



COMOTI
ROMANIAN RESEARCH & DEVELOPMENT INSTITUTE FOR GAS TURBINES



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COMOTI's experience in Clean Sky Programme

COMOTI short profile description:

Romanian National Research & Development Institute for Gas Turbines COMOTI is a public research organization with 300 employees, established in 1996 with NACE code – 7219 (Other research and experimental development on natural sciences and engineering). COMOTI is the only specialized Romanian company that integrates such activities as scientific research, design, manufacturing, testing, experimental activities, technologic transfer and innovation in the field of aircraft and industrial gas turbines and high speed bladed machinery.

During last 10 years COMOTI was involved in seven projects in the frame of Clean Sky Programmes (Clean Sky1 and Clean Sky2), as project coordinator or project partner. COMOTI was selected in these projects through open Calls for Proposals (CfPs) where the topics for each call are proposed by the Clean Sky Joint Undertaking. A short presentation of these projects is shown below.

Acronym: **AIRSEAL**

Title: Airflow characterization through rotating labyrinth seal

Project number: 831939

Topic addressed: JTI-CS2-2018-CfP08-ENG-01-34

Project Coordinator: COMOTI

Comoti Budget: 462,500 EUR

Status: on-going project

Summary: The main objective of this project is to test different labyrinth seal configurations to determine the pressure loss characteristics for different rotor speeds and different radial clearances at different temperature and different pressure ratios. The test rig, specifically developed in this project, will be able to test different seals configuration in a simplified environment. The project is based on the innovative techniques, and makes use also of the latest developments in the field of labyrinth seal testing. Various modern equipments and processing methods are used for the manufacturing of new type of labyrinths. One of the ground-breaking innovations that the project proposes is that the radial clearance measurements will be done during testing runs while the rotor (disk + labyrinth seal) is rotating. In this way, the real clearance value during testing could be used in optimizing the mathematical model of the sealing. Another ground breaking innovation is that by automatically controlling the test vehicle the testing time will be reduced. Another way to reduce the time is to reduce the number of operations done in order to prepare the test vehicle is to use the centre cone system which helps to centre the labyrinth on the rotor disk. Finally, the results of the tests will be compared with a prediction of numerical model in order to perform a gap analysis. It is expected that the experimental measurement to match the numerical results. If the experimental data does not match with the numerical results, then improvements must be made to the numerical model.

Member of:





Acronym: InnoSTAT

Title: Innovative low noise fan stator technologies for 2030+ powerplants

Project number: 865007

Topic addressed: JTI-CS2-2018-CfP09-LPA-01-60

Project Coordinator: Munich Aeroacoustics UG, Germany

Comoti Budget: 575,000 EUR

Status: on-going project

Summary: The proposed work of InnoSTAT consists in a systematic procedure, which has not been performed yet for considered Outlet Guide Vane (OGV) technologies. InnoSTAT will be the first project where the activities are focused on the above process with the only goal of bringing at least 3 OGV concepts to demonstrator level at TRL3 on full scale. This has not been achieved yet in any other programme for one OGV concept. The project's objectives are to define 5 novel low noise stator concept designs: to develop and test them on prototype level TRL2 to TRL3, to select and develop 3 novel stator concepts for further advanced design, characterisation and full 3D stator stage large scale testing to TRL4, to define, design and manufacture 2 demonstrator OGV at TRL3 on full scale.

The project's goal will be achieved in 3 major steps by: 1) testing and improving the technologies 5 concepts on small scale prototype level, 2) down selection of 3 technologies for further test on large scale, each as a fully equipped stator stage, and 3) finally 2 selected concept demonstrators to be manufactured and perform an integration study regarding engine environment. Its contribution to the noise reduction on Ultra-advanced Long-range and Ultra-advanced Short/Medium-range will be significant.

Acronym: OPA

Title: Aeroacoustic optimization of a jet pump demonstrator for ECS application

Project number: 325977

Topic addressed: JTI-CS-2012-2-SGO-02-050

Project Coordinator: COMOTI

Comoti Budget: 198,000 EUR

Status: closed project

Summary: New directions of research were opened for the COMOTI and partners, by OPA project implementation, such as jet mixing, secondary flows, and passive noise reduction methods, and the partnerships between the consortium partners was consolidated and further developed. These new research directions opened up by the project are provided and are expected to further provide new high skilled jobs. At COMOTI, the anechoic chamber used in the project was upgraded for the project. The project results were disseminated among the student body at KTH Royal Institute of Technology, Sweden and at the partner universities by COMOTI, as well as in public events attracting the young. This has increased the attractiveness of the field for the young researchers. The results of the project also provide new scientific information that was supported further research studies in the field. From the environmental point of view, an optimization of the jet pump directly led to a decrease of sound pollution. The reduction in the noise level of the fan is most important impact of this project. Since the jet pump that is the subject of this project is part of the air conditioning system of the aircraft, its location is required to be closed to the passenger and crew cabin, and therefore, the emitted noise can be expected to easily propagate there. Exposure to noise constitutes a health risk, and can induce hearing impairment, hypertension and ischemic heart disease, annoyance, sleep disturbance, and decreased mental





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performance. It must be noted that the project was finalized by designing, manufacturing new air jet pump optimized solutions and experimentally demonstrated a noise reduction of 2.5 dB provided by one of the new solution.

Acronym: ELTESTSYS

Title: Electrical test bench drive systems: mechanical interfaces

Project number: 270584

Topic addressed: JTI-CS-2010-1-ECO-02- 004

Project Coordinator: SC STRAERO SA

Comoti Budget: 475,200 EUR

Status: closed project

Summary: The main project final result is the ELTESTSYS Test Bench which is actually installed and used at SAFRAN's COPPER Bird® bench in Colombes, France. The test bench consists of four complete and identical Driving Systems which can function simultaneously or not, independently and/or interdependently, locally or remote controlled. Each Driving System drives one single generator or starter/generator and is able to simulate electrical start of the aircraft engine, as well as electrical generation. Any two of the four Driving Systems have the possibility to be synchronized in speed and position. The maximum torque is 100 Nm and the maximum speed is 22000 RPM, in four quadrants functioning. Each Driving System consists of one Control Cabinet , one Power Electronics Cabinet and one Drive . The Driving Systems are assisted by one Control and Storage Computer. For controlling the four systems, in a local and a remote manner, as well for data acquisition, each Control Cabinet has an industrial Panel PC equipped with a high-speed control and data acquisition board. Specialized control software has been developed in LabView. The Control System works with preloaded Torque (Speed) and Speed (Time) characteristics. These characteristics have to be provided, before any test, by the operator directly at the Panel PC or trough Ethernet. The synchronization in position of any two drives is done trough a special application board for the Converter (a board with dedicated function - Electric Line Shaft). For data storage purposes, one PC for all four drives is used. The commissioning phase for the ELTESTSYS Test Bench has been closed on September 2013 and the COMOTI provided technical support to the end user up to end of the project and after that.

Acronym: ANCORA

Title: Tuning of simplified rotorcraft noise models: preliminary acoustic test campaign

Project number: 287094

Topic addressed: JTI-CS-2010-5-GRC-05-004

Project Coordinator: ANOTEC CONSULTING SL

Comoti Budget: 58,100 EUR

Status: closed project

Summary: The main objective of ANCORA was to determine the transfer function between the noise measured on-board the helicopter, close to the noise sources, and the noise received on the ground by a grid of microphones, during a flight test campaign. ANCORA has investigated the application of surface microphones on the helicopter fuselage and has subsequently used this knowledge for the flight test campaign. ANCORA delivered a robust and reliable mobile noise measurement system, easily scalable and optimised for minimum deployment time and cost. During the test campaign a large number of steady-state conditions and manoeuvres have been flown over a grid consisting of 31 microphones.

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ANCORA developed an advanced method for the determination of the transfer functions between on-board and ground microphones. All results from the flight tests and data analysis have been made available through a data repository.

Acronym: HEXENOR

Title: Development of Quiet exhaust noise attenuation technologies

Project number: 296551

Topic addressed: JTI-CS-2011-1-SAGE-05-015

Project Coordinator: UNIVERSITE DE TECHNOLOGIE DE COMPIEGNE

Comoti Budget: 229,142 EUR

Status: closed project

Summary: To reach the objective of the project the work was split into two main parts: 1) An “academic” part which was mainly carried out during this first 15 months period and which is in charge of: defining the characteristics of the liner made of a perforated plate with cavity behind, studying the characteristics of two materials (K44X steel and TiAl alloy). 2) A design and manufacturing part of the three items on the basis of the specifications deduced from the works done in the first part. The goal was to determine the characteristics of the liner (hole diameter, plate thickness and hole ratio, number and height of the cavities) in actual aero-acoustics conditions of the engine but satisfying the weight and cost specifications. Experiments were therefore conducted on lined barrels specifically design to measure: the liner impedance of samples with an impedance tube in order to determine the suitable impedance model to be used for analytical development, the scattering matrix of the liner duct section with the DUCAT flow duct facility for higher order mode propagation conditions, the Transmission Loss (TL) and Global transmission Loss (GTL) without flow and the attenuation of the muffler for flow conditions with a flow acoustic intensity probe made of a microphone and a hot wire. An analytical calculation of [S] was carried out and validated with a FE model: to calculate without or with flow the scattering matrix, the TL and GTL of the academic mufflers, to conduct a parametric study to determine the “best liner configuration”.

Acronym: STARTGENSYS

Title: Adaptation kit design & manufacturing: APU Driving System

Project number: 298147

Topic addressed: JTI-CS-2011-2-GRC-03-009

Project Coordinator: COMOTI

Comoti Budget: 275,000 EUR

Status: closed project

Summary: The main project final result is the STARTGENSYS Test Bench which was delivered at SAFRAN’s COPPER Bird® bench in Colombes, France. The project was completed in December 2015. The STARTGENSYS Test Bench consists in a Control Cabinet, Power Electronics Cabinets and the Driving System. The Control Cabinet is based on a Panel PC equipped with a high-speed control and data acquisition board. The Power Electronics Cabinets contain the converter and the active front end and power the electric motor and regenerate energy back into the lines when the electric motor works as generator. The Driving System is composed of Supporting Frame, Electric Motor, Gearbox (Speed multiplier), Lubrication and Cooling Group for Gearbox, Motor Cooling System, Low Speed Coupling, High Speed Coupling with Torque Meter, EUT (Equipment Under Test) mounting

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interfaces and a Bursting Shield. The Driving System drives one single generator or starter/generator and is able to simulate electrical start of the aircraft engine, as well as electrical generation. The test bench can be locally or remote controlled and is integrated with ancillaries and central control system available at place of use. A complete measurement channel deserves the entire test bench. The STARTGENSYS Test Bench is used at SAFRAN's COPPER Bird® bench in Colombes, France, in the frame of Clean Sky programme, for testing generators and/or starter-generators in order to validate the integration of electrical systems and equipment, the quality of the energy produced, as well as demonstrating the maturity of technologies and systems for more electric aircraft.

In the last two years COMOTI submitted, as project coordinator or project partner, a number of 13 other proposals in the frame of Clean Sky 2 Programme, putted on the reserve list or pending to be evaluated. The ID proposal, acronym, topic identification code and topic title are shown below.

785458, **INNOPump**, JTI-CS2-2017-CFP06-SYS-02-30, Innovative stage-over-stage oil pump for cooling electrical machines;
785298, **ECAD**, JTI-CS2-2017-CFP06-ENG-01-22, Advanced Instrumented Engine Cradle Demonstrator;
785497, **MEPIV**, JTI-CS2-2017-CfP06-LPA-01-33, Multi-physics modelling of elementary physical phenomena applied to an innovative high temperature engine valve;
785460, **INNOVATION**, JTI-CS2-2017-CfP06-AIR-01-26, Development of innovative and optimized stiffeners run-out for overall panel weight saving of composite wing;
785456, **ADINA**, JTI-CS2-2017-CFP06-ENG-04-07, Advanced Investigation of Ultra Compact RQL Reverse Flow Combustor;
821223, **EMBASYS**, JTI-CS2-2016-CfP07-SYS-03-13, Electro-Mechanical Brake actuation for Small Aircraft;
821241, **ROSWEL**, JTI-CS2-2017-CfP07-ENG-01-30, Numerical and experimental study of high speed radial flow compressors;
821430, **ODESSA**, JTI-CS2-2017-CfP07-ENG-01-27, Composite process modelling and net-shape, complex geometry RTM tool design;
831902, **NEOTICS**, JTI-CS2-2017-CfP07-ENG-01-30, Numerical and Experimental Optimization of the Turbine Impingement Cooling System;
831947, **NORA**, JTI-CS2-2018-CFP08-THT-01, Innovative NOx Reduction Technologies;
864502, **TTBLADE**, JTI-CS2-2018-CfP09-ENG-01-39, Measurement of rotor vibration using tip-timing for high speed booster and evaluation of associated uncertainties;
864942, **CHARM**, JTI-CS2-2018-CfP09-ENG-01-40, Turbulence modelling of heat exchangers and roughness impact;
864545, **NERVA**, JTI-CS2-2018-CfP09-ENG-01-41, Ground vortex characterization method applicable for engine testing;

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