Project TEENI - Turboshaft Engine Exhaust Noise Identification.

The project aims at tackling the broadband noise identification problem in order to increase the knowledge of the exhaust sound sources balance, allowing the maximization of the attenuation of the dominant engine noise source in flight, such that to comply to the ACARE SRA2 objectives.
The main objectives of the project are:

- To develop sensors for fluctuating quantities, adapted to harsh engine environment
- To develop noise breakdown methods
- To understand broadband noise generation and propagation through blade rows
- To discriminate engine exhaust noise sources

The project consortium consists of eleven partners, from ten EU member states:

- Turbomeca - France (project coordinator)
- Anotec Consulting - Spain
- Avio S.P.A. - Italy
- Bruel and Kjaer Sound and Vibration Measurement A/S - Denmark
- Institutul National de Cercetare - Dezvoltare Turbomotoare COMOTI - Romania
- Deutsches Zentrum fur Luft- und Raumfahrt DLR - Germany
- Ecole Polytechnique Federale de Lausanne - Switzerland
- Integrated Aerospace Sciences Corporation INASCO - Greece
- Microflown Technologies - The Netherlands
- Office national d'études et de recherches aérospatiales ONERA - France
- Trinity College of Dublin - Ireland

The Romanian research team of INCDT COMOTI was involved in two of the project activities:

- Perform the quality and safety testing for two of the newly developed sensors - the instantaneous velocity dielectric sensor and the acoustic pressure probe microphone;
- Design and manufacture the engine parts, new and adapted, needed to accommodate the instrumentation required for the full scale engine experimental campaign aimed at gathering the relevant data for exhaust noise source identification.

The research infrastructure involved in the project from the Romanian side consisted of the thermo-gas dynamic complex including a full scale combustion chamber, with variable exhaust temperature, coupled with a large tri-sonic wind tunnel, as well as the manufacturing capabilities of INCDT COMOTI, including a 5 axes precision milling machine, NC lathes, a high precision 3D measuring unit. Figure 1 presents the 3D model of the TEENI experimental section (left), and a picture taken during the testing program (right).

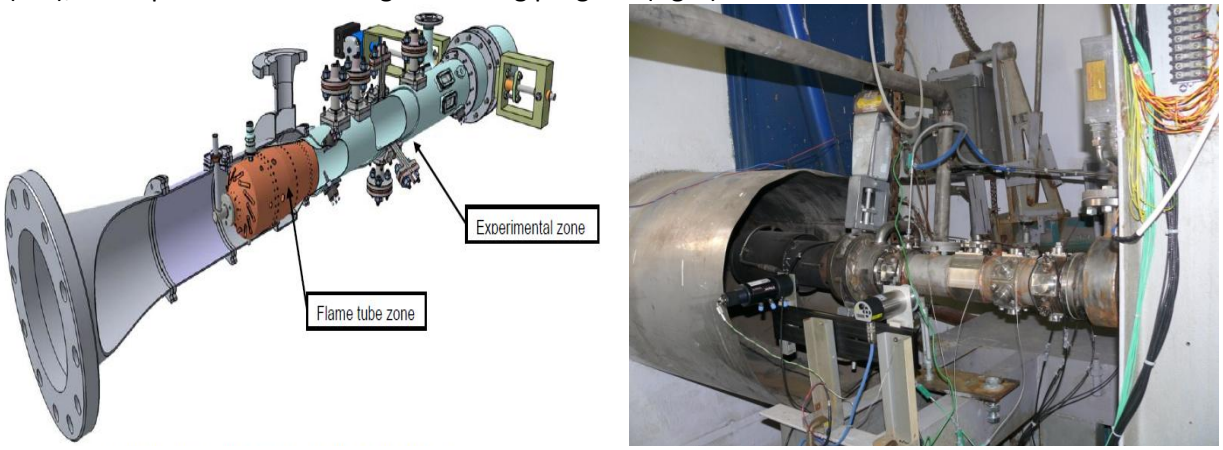

Figure 1

The participation of INCDT COMOTI in the project amounted to 251 person months, of which 2 pm for Management, 66 pm for sensor testing, and 183 pm for the design and manufacturing of the engine parts. The

research team consisted of 13 people over the entire duration of the project, including 5 experienced researchers, 1 PhD student and 7 technicians and workers.

The research efforts of the Romanian team resulted in the successful completion of the experimental campaign aimed the quality and safety of two of the newly developed sensors. As a result of the experimental campaign, the probe microphone (Figure 2- left) successfully demonstrated its capacity to satisfy the project requirement and was used for the large scale engine testing campaign. The dielectric sensor (Figure 2 - right) passed the safety testing, but failed the quality testing, due to the impossibility to achieve proper calibration of the measured signal, since the electric field used for the measurement was uncontrollably altered by the presence of the seeding particles used for the reference PIV measurements.

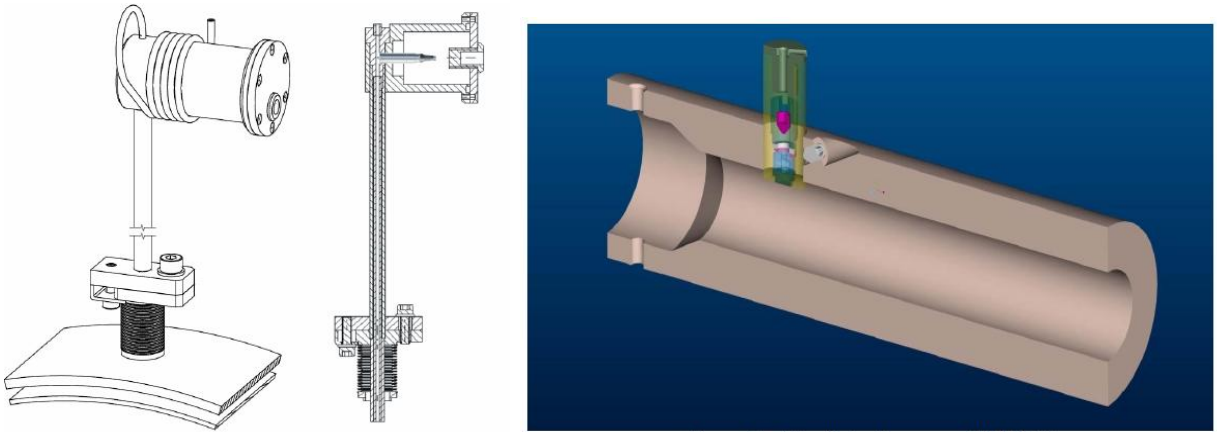

Figure 2

Figure 3 presents some of the new engine parts designed and manufactured by COMOTI for the project.

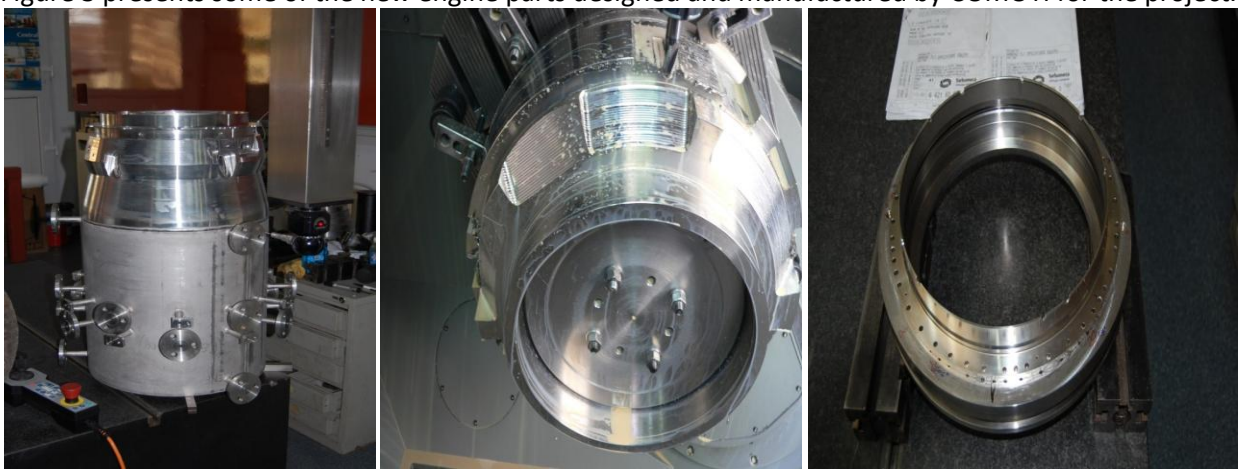

Figure 3

The experimental measurements carried out in the project by means of temperature and pressure probes, and Particle Image Velocimetry, and the database resulting from these experimental measurements forms a highly valuable foreground generated from the TEENI project. This database has already been used by two of COMOTI's doctoral students for validation of their numerical works, in their respective theses, and is expected to be further used for CFD subroutines to be developed at COMOTI, also as validation data. Two national research grant proposals on this subject are currently under evaluation. The foreground generated by COMOTI in the design and manufacturing processes in the project will be used in the optimization of its manufacturing technologies, taking into account the high complexity of the parts. The knowledge gained by COMOTI in this activity will be further used for attracting and carrying out new design and manufacturing contracts, either economic, or in research grants.