

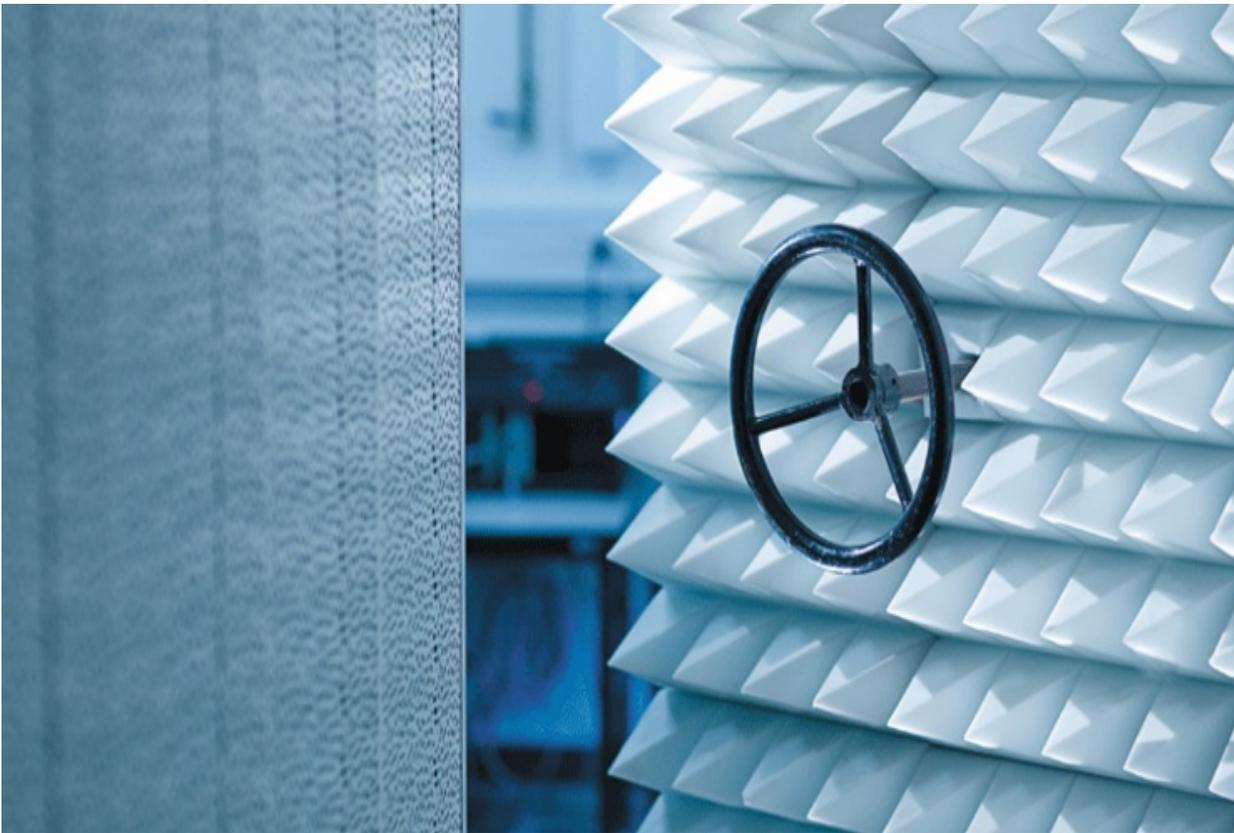
Interactions UTC

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40 years of acoustic and vibration courses/research at UTC

To celebrate its 40 years' "in business", the Industrial acoustics and vibrations specialty staff will be organizing two Special Days, March 10-11, 2016. This event will provide the occasion to make a status report with an update on progress and challenges in these fields allowing the department to "imagine the future" here. The research teams are seeking to characterize and model noises to make them more bearable (viz., acceptable) ... with of course commercial prospects and to possibility to gain a high reputation in this specialty.

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UTC's *Industrial acoustics and vibration* specialty was created in 1977, thus Spring 2016 will mark its fortieth anniversary. The training course is recognized as demanding, both from a theoretical and a practical standpoint of the training provided for the students who choose this specialty, which has a dozen or so lecturer research scientists. AVI (its acronym) counts over 800 graduates now and every year some 20-25 new students register for this specialist course.

Reducing and transforming noise

In engineering sciences, acoustics and vibrations impact the following sectors: transport, mechanical engineering, building trades, the environment and even telecommunications, urban areas and energy. "Our research focuses mainly on vibrations which propagate through structures, and those induced by air disturbances such as at the blade tips of wind turbines", explains Nicolas Dauchez, recently appointed to head this training specialty at UTC and a research scientist in the acoustics and vibrations

team. The main area of application and aim is to be able to control noise to provide an acceptable level of acoustic comfort. “The aim is to attenuate (or transform) noises to make them acceptable”, details Jean-Michel Ville, the former head of AVI who underscores how important is to understand how people perceive sounds and qualify them as “noise”. Psycho-acousticians are even thinking about sounds as a way to convey impressions about products. As an example, *“the “clunk” sound made by a car door closing and locking is unconsciously integrated to the way consumers make their choice of vehicle,”* explains Jean-Michel Ville.

The SNCF sound image

The SNCF (French national railway operator) is highly interested in noises on board its trains and other sounds/noises coming from the equipment. “The railroad company is trying to build a recognizable acoustic signature, agreeable to the client-passengers”, explains Jean-Michel Ville. This sound identity will be declined and blended to other sounds - doors opening/closing, commercial jingles, *etc.* Making sounds and studying how they are perceived is an independent expert domain. A company like Genesis, who are partners to the CEVAS research programme (*cf.* below) employ psycho-acousticians to test various sounds on juries in order to analyse the way the sounds are “received and appreciated (or otherwise). We can even wonder – will the day (and sounds) come that make you want to travel?

CEVAS, quiet air-conditioning

In order to satisfy customers’ needs for comfortable travel conditions, the equipment makers must comply with the automobile constructors’ specifications more rapidly (and for a continuously lower cost). VALEO, a world leader in automobile air-conditioning units have a set of partners – including the UTC acoustics research

team - in a programme called CEVAS (acronym in French for Silent Design Air-conditioning and Ventilation units), with the CETIM, ESI-Group and GENESIS, to develop silent ventilation air-flows that are judged satisfactory by potential customers. “The UTC-AVI research team therefore developed some test gear and some unique digital models to characterize airborne sound (fan, distribution ducts, thermal feeds, filters, louvers) separately and in combinations. The data acquired are fed into the design tool finalized by the CETIM in a collaboration with GENESIS.

dBET or silent electric power units

Whereas the CEVAS programme aims at mastery of the air-conditioning system on board a road vehicle, the dBET programme is fundamentally more focused on acoustic emissions of sound by the electric transformers for propulsion units in trains. The project is financed by ADEME and involves two UTC laboratories (UTC-LEC and UTC-Roberval), plus the Electric Power systems lab at the École Centrale, Lille as well as several industrialists such as Arcelor , Mittal, Transrail Boig & Vignal, Alstom Transport who supervise and coordinate the project and the ESI Group who manage the project on behalf of ADEME. *“Modelling transformer vibrations is a highly complex affair”*, says Mohamed Ali Hamdi, UTC Professor and Scientific Executive Director for the ESI Group, and he underscores the importance of bringing together specialist laboratories to better understand the multiphysics issues involved. He also points to the key role played by software package editors who have the tools and the know-how to integrate the various approaches developed by the research scientists and engineers who work on this project. The final objective of dBET is to reduce noise from this omnipresent piece of equipment used in the propulsion systems for trains and which can prove to be a nuisance to passengers and to those who live near the tracks.

ECOBEX, 'no-nuisance' cars in tomorrow's cities!

Another project supervised by Nicolas Dauchez at UTC is ECOBEX (acronym in French for External noise abatement using optimised screens), the aim of which is to reduce noises as car pass by, by using a ousting screens round the propulsion unit. The consortium led by Vibrattec has major groups as partners, *e.g.*, the Renault Group or Saint-Gobain ISOVER, Mecacorps and various service companies such as ESI Group, the M2a Critt, Matelys, RJP, MicrodB ... the finance being provided by two Regions Nord-Pas-de-Calais and Rhône-Alpes, plus Bpifrance and the DGCIS government bank and agency and by two competitiveness clusters *i-Trans* and LUTB. The three main sources of noise in a moving vehicle are the engine, the exhaust system and the tyres. "It turns out to be quite a difficult task to improve on engine noise whereas tyres and exhaust noises are perfectly "under control"", says Nicolas Dauchez who adds that the target decrease of 6 decibels set by the EU for horizon 2024 will be achieved by acting on the propulsion unit sound emissions. The objective of ECOBEX is to optimize absorbing screens placed in the engine compartment. *"Various experimental and mock-up experiments have been conducted as well as acoustics modelling to identify new paths forward"*, explains Nicolas Dauchez. The modelling has allowed is to isolate the sound emissions with an accuracy down to a few centimetres and they also take into account the other constraints of the automobile industry- thermal, pollution, costs, *etc.* Some twenty different materials are being tested and there is a PhD working specifically on the effects of shaping technologies by thermo-compression on the acoustic characteristics of the screens. The ECOBEX project, which started in July 2014, is planned to terminate in July 2017.

To celebrate its 40th year « in business », so to speak, UTC-ME-AVI are organizing two Special Days (March 10-11, 2016) at UTC so that future engineers can get a good insight to the specific of this specialty. *"Today we see industrialists making numerous demands that relate to comfort in terms of acoustics and*

vibrations”, explains Mohamed Ali Hamdi. In a world that where ICTs are pervasive, sound is becoming an increasingly important factor, and this is obvious in the context of a coming event “Be the future of sound” launched by LUTECH (Technology Transfer Accelerator) in which UTC is an active partner. UTC-ME-AVI will consequently continue to train engineers capable of designing “silent ways and means” and able to adapt to new challenges by implementing their numerous skills, tools and knowledge in the field. Not only will the 40th year events open up new prospects for future AVI engineers, but it serves to celebrate Jean-Michel Ville’s handing over the department keys to Nicolas Dauchez, a year ago - after numerous years in charge of the specialty.