Abstract of the REDNOISE project. Objectives and results.

Romania's following industrial development policy aims the conversion of the industrial economy into an economy based on sustainable development and performance according with the country's medium and long term objectives, having as major target the integration into the structures of the European Union. It is promoted nowadays in Romania an industrial policy based on the principles of concurrence, with a view to growing the capacity of accommodation of the Romanian economy to the more and more sophisticated demands of the market, in the conditions of an economical globalization trend, whose undeclared yet real purpose is the market.

The noise produced by the equipment used in open air, especially from construction and public works, is an important part of the community's noise, also known like the environment noise, residential noise or intern noise. Others sources of exterior noise are represented by the road transport, railroad, industries and surrounding noising areas, and also existing the internal noise.

In the UE approximate 40% from population is exposing to road transport noise lo a pressure level exceeding 55 dBA during the day and 20% to levels exceeding 65 dBA (Lambert and Vallet/1994). In Romania this percentage is reduced by reason of a lower intensity during the night and by the fact that a big percentage from population (45%) lives in rural zones where the road traffic is very reduced.

The main objective of the REDNOISE project was to design experimental models of the noise absorbent structures, made from different materials, with different absorption coefficient, which will reduce noise level for different types of industrial application and not only.

All noise control systems contained at least one of the following measures:

-screens;
-noise absorbent materials: polyamides foams, fibrous resin, blankets made from fiber materials;
-vibration isolators – isolation panels used for openings, mountings for engine;
-attenuation materials – composite materials based on elastomer, adhesive pellicle.

The first two categories are more used in case of the aerodynamic noise, which is predominating in atmosphere. The last two measures are more used for the structural noise or for vibration, which appear after the aerodynamic noise is transmitted through structure, if is not isolated or damped. It is important to notice the fact that noise is a type of mechanical energy and always finds ways to propagate from the source in entire building.

The noise control processes involves blocking this ways and eliminate the sound energy, anywhere it is possible. In realizing the noise absorbent structure we took into account the variation of the absorption characteristics with spectral field of the noise. The quality of noise absorbent materials involved the knowing of the apparent density, mechanical resistance, humidity behavior, the possibility of painting and disinfection.

The porous absorbents fixed on the rigid frame are composed from materials which have non-deflecting pores under the continuous action of the sound waves; examples of this kind are porous paintings, mineral wool, vegetal fibers or minerals stiffened with a binder.

The fragility of these absorbents requires coverage with protection materials which will not influence the frequencies characteristics of absorption. We use textile materials, wire net or fiber glass permeable to air. Using perforated panels from metal, plastics mass or wood plates we modify the absorbent characteristics of the noise absorbent structures, obtaining a resonant character, which will depend on the mass of the screen and the quantity of the holes. The assembly formed from porous material and perforated screen work like an oscillatory system, with the weight concentrated in the screen and the elasticity and friction are concentrated in the porous material. The rigid protection screen of a noise absorbent materials influence the increasing of the absorption capacity at low frequencies and has a resonant behavior at the medium frequencies (500 Hz). The unprotected structures present absorption values which are relative constant for f > 500 Hz. Mounting the materials on rigid frames, with a space between frame and materials, improves absorption for low frequencies.

We **realized 12 new phonoabsorbent structures based on differed combinations of materials.**

We assume that each material has a specific characteristic with good results for some frequency, and we combine all in a specific geometry to obtain high attenuation for bigger domains of frequency. The combination was made in the same time to reach high attenuation for differed noise sources but especially for industry noise.

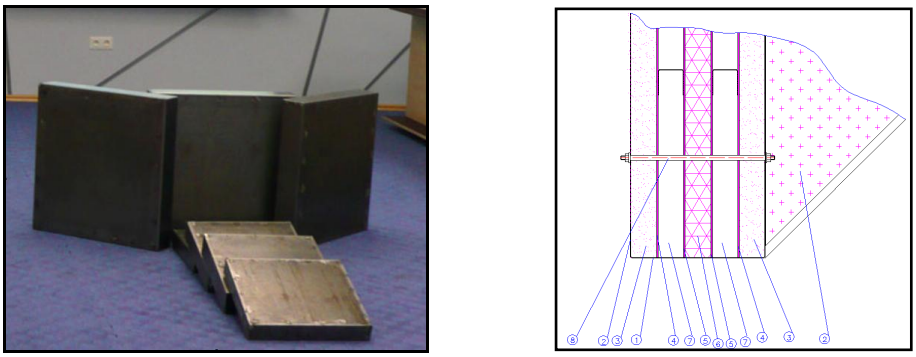

Fig.1 Example of realized phonoabsorbent structures

The new structures were tested to identify the acoustic characteristics. In the following figure is presented the acoustic chain for measurement and the results for one structure.

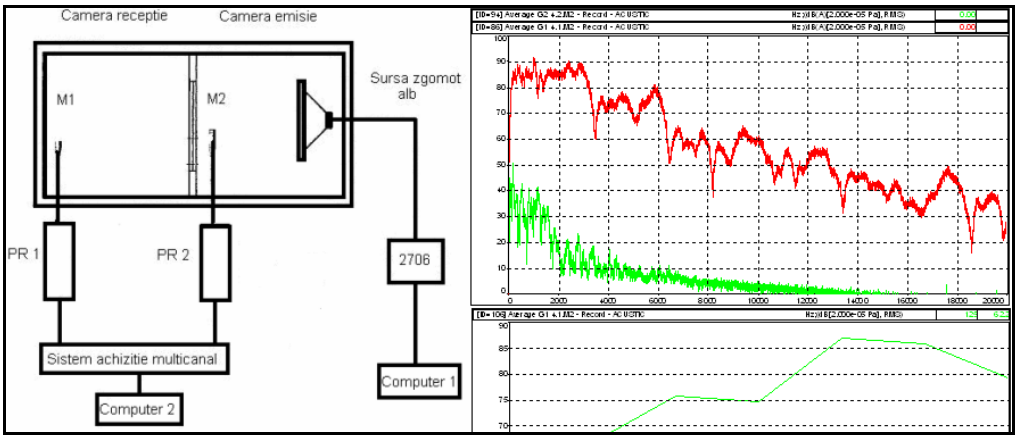

Fig. 2 The acoustic chain for measurement and the results for one structure

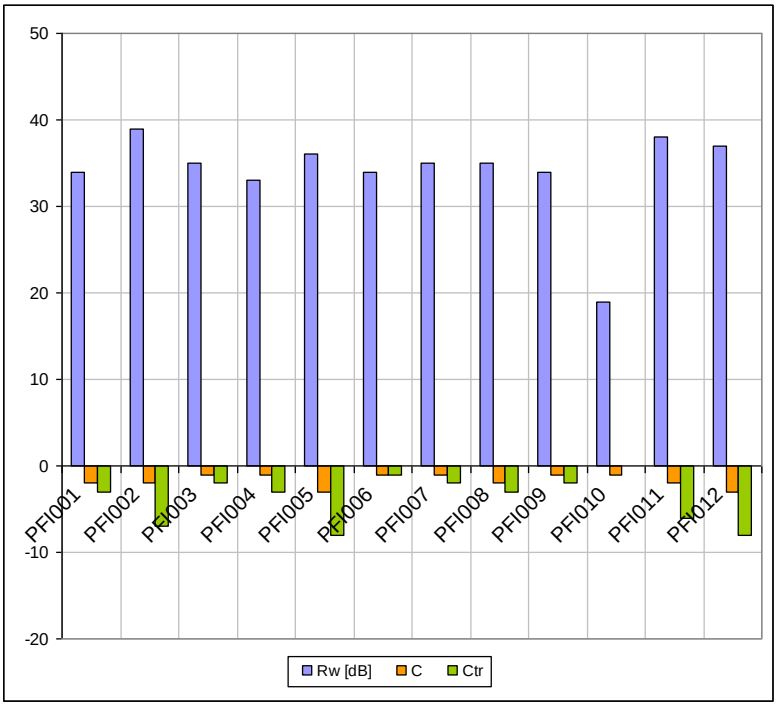

Fig. 3 Comparation of all structures using the noise attenuation Rw[dB] and corrections C, Ctr, in accordance with SR EN ISO 140-3: 2005

In order to evaluate the performances of our phonoabsorbent structure, we measured the noise footprint of an industrial turboengine and we estimated the noise reduction for this application using the spectral curves of attenuation.

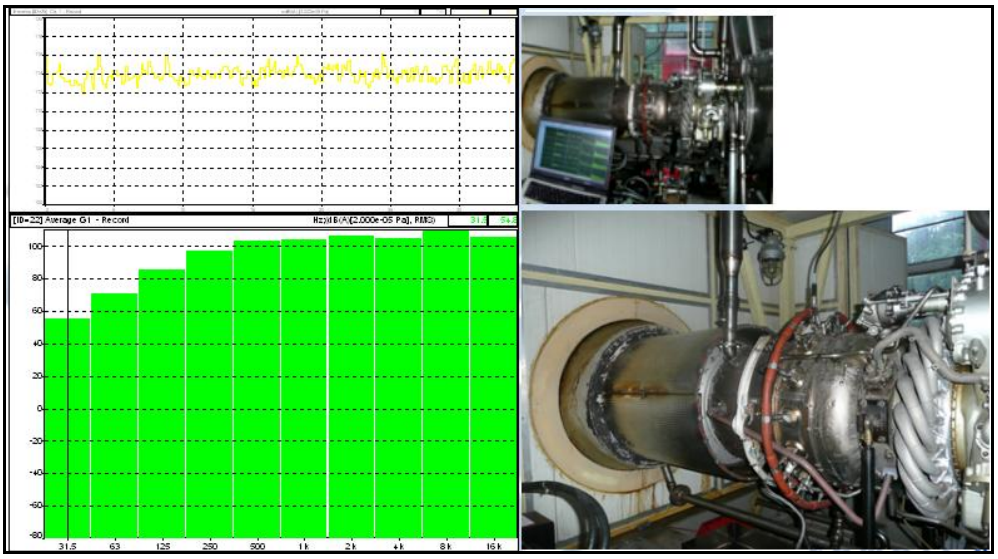

Fig. 4 Results of noise measurements in situ

The results of simulation were very good because we predict that the noise source produced by a turboengine used in industry is attenuated under the admissible Cz70 noise curve.

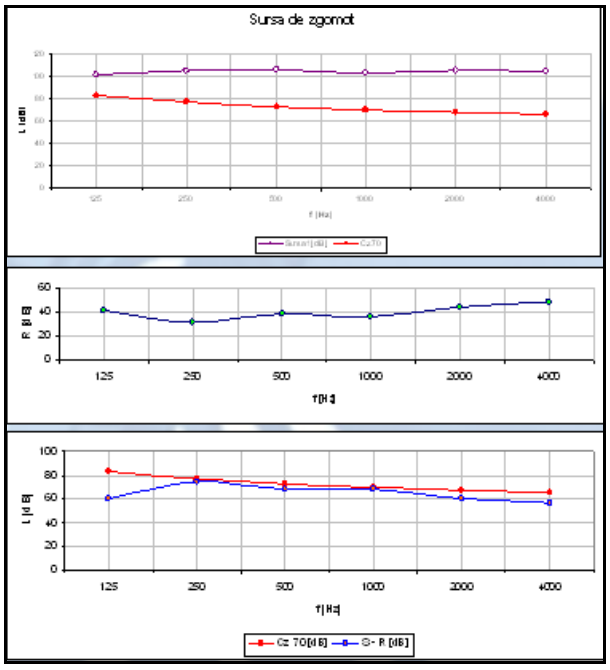

Fig. 5. Results of prediction using noise source, attenuation of structures and Cz70 curve.

The best and the inexpensive method to control noise are obtained by focusing the attention on noise and vibration emitting sources. That means to use the attenuation treatments on a large scale for vibration; for the aerodynamic sound the glass fiber, polyamide, and other absorbent materials are used to reduce reverberation. When we use these kinds of materials we have to take into account the average life-time of these materials and the way in which these materials degrade. The main solutions to combat noise at source and on the propagation ways consist in mounting the noise source on vibro-insulating elements. This measure assures an attenuation of the noise level between 75 – 1200 Hz, especially on the low frequency component of the acoustic oscillation.

In case it is necessary to decrease the noise level in a specific point, a sound absorbent and sound isolating panel is interpositioned. By placing such panel, a reduction of noise level is obtained almost on all frequency range, the highest attenuation being obtained for frequencies over 2400Hz. When mounting the panel we should be careful so that the panel is not disturbing the technological process and to permit equipment supervise and access at the command elements.

The present project represents a new research direction in order to achieve strategically objectives in science and technology development. This will permit to reduce noise pending the proved limits of noise pollution.