AIRCRAFT COMFORT WITH DISTRIBUTED PROPULSION SYSTEM

V. Baklanov*, A. Mirzoyan**
* «Tupolev», 105005, Moscow, Embankment Tupolev 17, baklanov@tupolev.ru
**CIAM, 111116, Moscow, Aviamotornaya Str. 2, mirzoyan@ciam.ru

Significant increasing of fuel efficiency has become a requirement for new generation engines in crisis and high oil prices maintenance.

Today we are on the next stage of engines development– the transition to super high bypass ratio engines (BPR = 10 - 15). It makes turbofan engine similar to turboprop, especially in case of gearbox scheme application and concept of “open rotor”.

Modern airplane configurations (especially aimed for long routes) lead to the “flying wing” where the propulsion system (PS) either located above the wing, or embedded into the construction with engine diameter limitation.

Integrated PS will allow at reduction of engine and remote fans diameters to have system with BPR up to 30 and thrust efficiency over 95 % which may provide essential decrease of fuel consumption and CO_2 emission.

The distributed PS has the big future in aviation progress and in transition to the "electric airplane". The engine core can become the high power generator, and the fan can drive -by electromotors. Power of such generator will allow to abrupt increase power supply of airplane.

The distributed PS may also provide lower noise using shielding by the wing.

But in the same time a factor of vibration impact of multishaft systems of the distributed PS (core and driving fans) which will transfer through attachment points (bearing contacts) of intake, engine cases (cores), fan cases and exhaust system structures, is now appear.

The distributed fans can be used to realize advantages of boundary layer injection from a wing, taking into account the fan work in strongly disturbed flow. Impact of the disturbed flow on fan efficiency and stability will be strongly depend on integration of PS and airframe.

The concept of new vibroinsulation mounting is necessary to decide a problem to reduce the low-frequency vibration impact.

Necessity of development of new engine mounting is caused by extension of a vibration spectrum of modern engines in a low-frequency part, insufficient efficiency existing vibroprotection, especially in the low-frequency area developed using of out-of-date models; change of dynamic characteristics of airframes and, in particularly, engine cases.

Our researches allow to essentially improve the models of modern aviation structures and engine cases in a range of frequencies for engine rotary speed.

Essential decrease of vibration impact of PS, whose vibroactivity increases due to convergence of low-frequency components of gas flow and fan rotary speed with natural frequencies of airframe, is necessary to provide working conditions for crew, decrease psychophysical load at long distance flights.