**Noise Reduction Using Optimal Takeoff Thrust Management for Supersonic Business Jet**

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Optimization of thrust management (TM) at initial climb may give an important reserve to improve noise performance of Supersonic Business Jet (SSBJ). A variable engine nozzle with a variable throat and exhaust area is often used as a component of supersonic propulsion system. Optimization of nozzle throat variation for jet noise reduction may significantly increase the environmental friendliness of SSBJ. Such optimal (low noise) variation of nozzle throat area at engine throttling provides fixed air flow and corresponding additional reduction of engine exhaust jet velocity.

The efficiency of variation of different TM variables is evaluated at main takeoff and initial climb flight conditions. The considered TM variables include nozzle throat area, the altitude of TM start and rate of TM at initial climb.

According to the noise certification procedure for subsonic aircraft, lateral noise level should be estimated at the full engine power and flyover noise level should be defined taking into account the impact of the engine throttling after reaching minimal acceptable flight altitude of engine cutback (300m for twin-engine airplanes, 260m for triple-engine airplanes).

Considered SSBJ engines are mixed turbofan of conventional architecture with variable supersonic nozzle (without using any acoustic nozzle).

Altitudes of start of TM both higher and less than minimal altitude are considered in the studies. The lateral noise is predicted taking into account the impact of TM at initial climb. Such approach to the certification noise prediction extends the understanding of the efficiency of earlier engine TM for supersonic civil transport. It may result in necessity of making changes in the current noise certification procedure for SSBJ taking into account flight safety. Moreover, low noise TM may be realized as one of the embedding engine schedule controls automatically providing required control of engine fuel flow and nozzle throat area.

Use of smoother thrust throttling, that allows reaching of minimal engine power at the altitudes close to 300m, may keep the flight safety level at the low flight altitudes. For this reason, the optimization of rate of TM at initial climb has been conducted in the studies.

Reference (blue lines) and optimal low noise (pink lines) TM at takeoff and initial climb are shown on the Fig.1 in the view of dependences of throttle ratio TR (left plot) and relative nozzle throat area A8rel (right plot) on the distance from brake release.

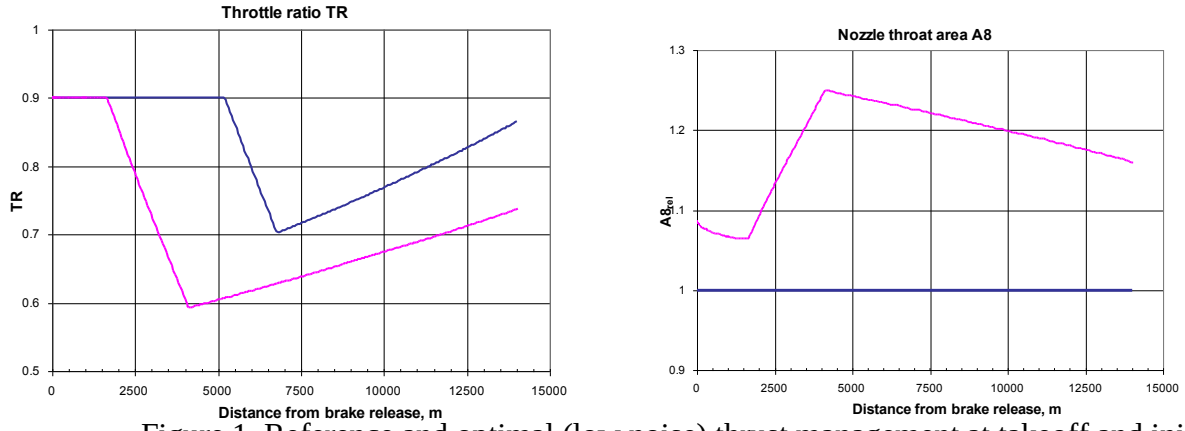


Figure 1. Reference and optimal (low noise) thrust management at takeoff and initial climb.

As showed investigations, application of optimal low noise TM could reduce total noise in lateral and sideline certification points by 5-8 EPNdB.