

## Possible Unification of Engines for Advanced Small and Medium Supersonic Civil Aeroplanes

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By hypothesis of advanced supersonic civil transport (SCT) development concept, supersonic civil aeroplane SCA2030 will come into service by 2030 and be based on 4-engined supersonic medium jet SSMJ2030 with 100-120 pax and twin engine supersonic business jet (SSBJ) SSBJ2030 with 8 pax.

The activity is dedicated to capability of unification of engines for advanced small and medium supersonic aeroplanes, providing required mission, noise margins and emission level.

Propulsion system (PS) with unified engine (UE) for SSBJ2030 and SSMJ2030 is based on using of unaugmented mixed turbofan with variable supersonic nozzle, moderate bypass ratio (BPR) and overall pressure ratio (OPR).

The turbofan, optimized for SSSBJ, i.e. satisfying requirements with minimal margins is considered in the paper. Generated requirements to SSBJ2030 and its Propulsion System (PS) corresponding to the SCA2030 concept are presented in Table 1.

Table 1. Generated requirements to SSBJ2030 and its Propulsion System (PS) corresponding to the SCA2030

Requirement	Value
Range by supersonic flight profile, km	> 7400
Range by subsonic flight profile, km	> 7400
Aircraft takeoff mass, t	< 55
Field length, m	< 2000
Noise (margin relative to Chapter 4), EPNdB	> 10
Cruise NO <sub>x</sub> emission, g/kg fuel	< 10
Subsonic cruise conditions	M = 0.95; H = 12km
Altitude of transonic acceleration, km	> 8
Supersonic cruise conditions	M = 1.8; H ≤ 17km
Number of engine	2
Passenger capacity, pax	≥ 8
Fuel efficiency, g/pax-km	< 380

Cycle parameters (turbine entry temperature TET and overall pressure ratio, OPR), engine components efficiencies, cooling air flow rates corresponds expected level for SCT engines entering into service in 2020-2030 time period.

Obtained required maximal levels of SFC, providing together with assumed advanced level of aerodynamic and mass efficiencies of airframe of SCA2030, required range by supersonic and subsonic flight profiles. In the case, takeoff mass of SSBJ2030 and SSMJ203 may account about 45 and 106 t accordingly.

In case of accounting only jet noise (taking into account additional noise margin for fan noise by 2 – 3 dB) noise requirements for SCA2030 with UE may be meet by using special low noise takeoff thrust management schedules with early start of engine throttling at initial climb.