

SPACE PROPULSION SYMPOSIUM (C4)
Propulsion System (1) (1)

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PRELIMINARY DESIGN STUDY OF STAGED COMBUSTION CYCLE ROCKET ENGINE FOR
SPACELINER HIGH-SPEED PASSENGER TRANSPORTATION CONCEPT**Abstract**

The revolutionary ultrafast passenger transportation system SpaceLiner is under investigation at DLR in the EU-funded study FAST20XX (Future high-Altitude high-Speed Transport 20XX). SpaceLiner is two staged reusable launch vehicle with liquid rocket engines. The main rocket engine SLME (SpaceLiner Main Engine) is similar in both stages for cost reduction and reliability enhancement, whereas they differ in the interface conditions and the nozzle expansion ratio for the optimum flight performance. SLME needs to have high performance for the total system to be set up, and also to be easy on the environment for frequent launches. Therefore we have accounted SC (staged combustion) cycle rocket engine with LH₂/LOX (Liquid Hydrogen and Liquid Oxygen) to be promising for SLME. This paper describes the engine cycle analysis and the component pre-design of SLME. That includes the trade-off study between full-flow SC cycle and fuel-rich SC cycle, the nozzle design by flow analysis, the consideration to regenerative cooling methods on the thrust chamber and the nozzle, the turbomachinery pre-sizing, the propellant feed line design, and the tank pressurization system design. These designs and analyses are mainly performed with the DLR developed code LRP (Liquid Rocket Propulsion), and also with the NASA developed TDK (Two-Dimensional Kinetic Thrust Chamber Analysis Computer Program) for the flow analysis in the thrust chamber and the nozzle.