초청강연

AEROPROPULSION PROGRAMS AND RESEARCH

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The Fluid Dynamics Research at the von Karman Institute, in relation to Aero- propulsion,is covered in this presentation with the relation to the European programs from 1995 till todayas a guideline. The development of total propulsion systems, combustion, noise and advanced manufacturing processes are not covered. A few high-speed related studies will be discussed. Compressor and Turbine flow problems will be shown.

On the compressor side we encounter the need of shock wave control in the fan. The mitigation of the shock losses and increase in stability margin lead to the complex shapes observed today. The radial flow distribution poses a major aerodynamic challenge for the booster stage. These stages have a low compression ratio per stage and a difficult radial load distribution. Careful design of these stages and of the interconnecting duct is required for a high quality flow into the HP compressor.

The HP turbine is an excellent example to illustrate the heat transfer problems and the different cooling methods. Additional aerodynamic problems occur due to the nozzle trailing edge shock waves sweeping over the following rotor blade causing an unsteady heat transfer. The LP turbine, rotating at fan speed, has many stages with the effect of "clocking"on the aerodynamic and heat transfer performance.

The continuous search for less weight, less volume, less noise, less fuel consumption …. lead to the requirement of less stages and blades or a higher loading in the compressors and turbines. How far can we go before seriously compromising the overall performance?Do we have new configuration to cope with that problem?

The high speed propulsion will be covered by two studies in which we participated. One is an air collection and liquefaction study for a TSTO and the other one is a more recent study of a Helium loop in a high speed propulsion system.

These aspects will be illustrated and ideas of optimization studies shown in some 55 views of the Powerpoint presentation.