Intercooled Recuperative Core Concept

One potential core engine configuration to achieve ACARE 2020 objectives is the concept of the Intercooled Recuperative Aero-Engine IRA. The proposed IRA cycle, already established in EEFAE CLEAN, will use significant benefits from a further increase in propulsive and thermal efficiency with a potential of up to 20% fuel consumption / CO_2-emission reduction.

The significantly lower OPR of a typical IRA cycle compared to a conventional approach for a highly efficient high OPR engine cycle will by itself support ultra low NO_x combustor conditions: highly efficient IRA-cycles with OPR<30 may enable the additional application of ultra low NO_x combustor technologies, not applicable to high OPR engines.

Fig. 1 shows a functional scheme of NEWAC IRA and Fig. 2 a potential scheme of IRA integration in a conventional nacelle and underwing configuration.

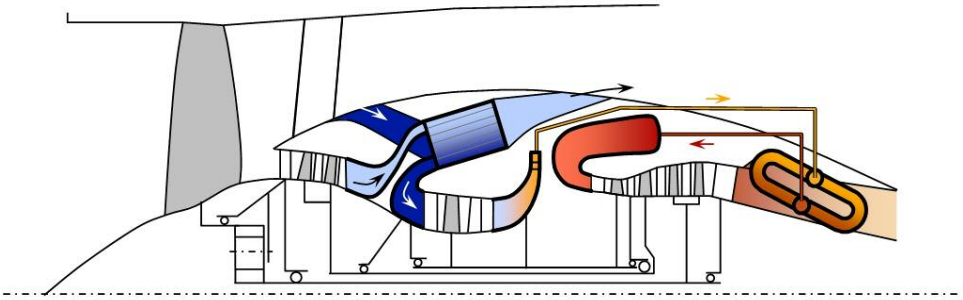

Fig. 1: Functional scheme of Intercooled Recuperative Core Concept for IRA

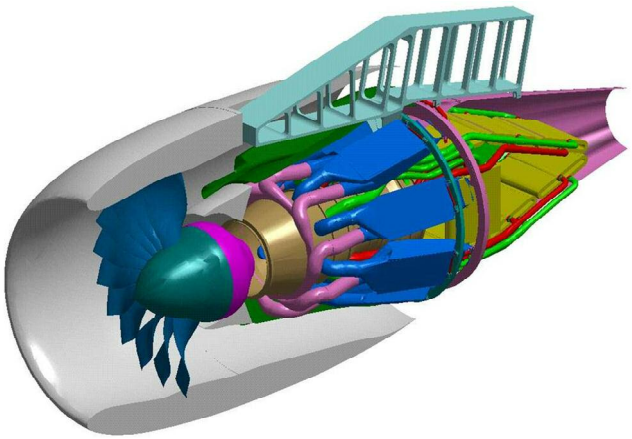

Fig. 2: IRA integrated in conventional nacelle and underwing configuration

Based on the results of EEFAE CLEAN and AEROHEX, NEWAC will investigate key components of the IRA core concept in more detail: Firstly, the recuperator and its optimal arrangement in the exit duct (the intercooler will be investigated in the Sub-Program Intercooled Core Configuration). Secondly, the centrifugal compressor is

identified as most suitable to support the overall concept transferring the flow to the piping system. As the specification of the IRA HPC is outside of today's experience, a centrifugal HPC complying with the requirements of the IRA engine application will be investigated and validated. Finally, the advanced LPP combustor, which is well suited for the low OPR IRA cycle, will support further NO_X reduction of this concept and will be validated within the innovative combustor work.

The objective is to demonstrate an improvement of 0.8 % efficiency and 10 % lower weight of the compressor and 15 % lower pressure losses in the recuperator.

To fully meet the environmental goals and the market requirements and to address potential shortfalls of the main core concepts under investigation in NEWAC, additional effort on selected "more innovative core configurations" is planned to allow and initiate a discussion to even further challenge engine-targets beyond the ACARE 2020 objectives.

The system studies will cover:

- variable core cycles
- innovative combustion
- contra rotating core
- unconventional heat management system