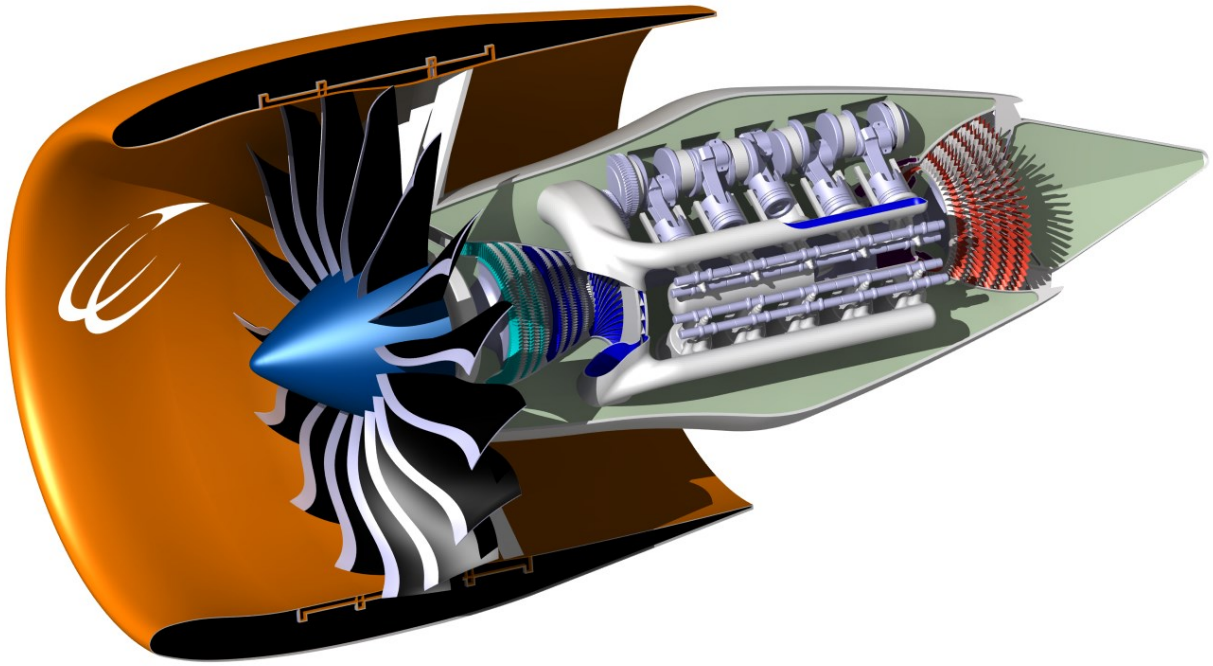
“Composite Cycle Engine” concept
Technical data sheet

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Mock-up illustration



Description

The Composite Cycle Engine (CCE) concept incorporates piston engines into the core of an aircraft turbo engine. The piston engines increase thermal efficiency by using non-stationary isochoric-isobaric combustion, which enables higher peak pressures and temperatures within the core engine. In the current design, the piston engine is connected with the high pressure spool and powers the axial-radial high pressure compressor (dark blue). The low pressure system is similar to a conventional geared turbofan (GTF) architecture. This way, the outstanding power to weight ratio of low pressure turbines can be fully utilized and an ultra-high bypass ratio is realized. Assuming an entry into service in 2050, fuel burn improvements up to 50% relative to year 2000 turbofan technology (11% relative to year 2050 advanced GTF technology respectively) can be reached.

Engine Design

Operating conditions	M0.82 / ISA+10 / FL350
Thrust (@TOC-MCL)	49.7 kN (11.2 klbf)
TSFC (@Cruise)	11.5 g/kN/s (0.406 lb/lbf/hr)
BPR	33.7
Burner exit temp. (@TOC-MCL)	1700 K
OPR (conventional)	38
Peak pressure (@Take-Off)	30 MPa
Overall efficiency	48.2 %
Intake mass flow rate	1100 kg/s

Geometry and Weights

Fan diameter	2.87 m
Engine length	5.88 m
Engine weight	7.27 t
Piston engine weight	2.45 t
Stage count	1-3-3-1-5
Number of Fan blades	16
Gear Ratio (Fan)	5.3
Number of pistons	20
Gear Ratio (Piston)	3.3
Piston bore	0.2 m
Piston stroke	0.2 m
Piston v_{mean}	18 m/s
Piston Compression Ratio	7.3

System Details

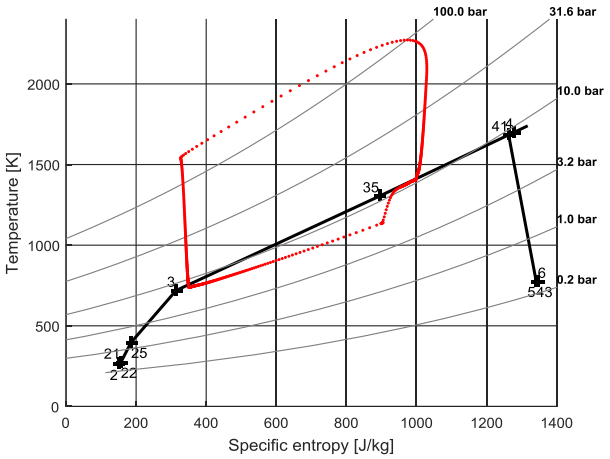
- Ultra-high bypass ratio Composite Cycle Engine technology
- Piston engine powers high pressure shaft
- No High Pressure Turbine
- No power- and bleed-offtakes
- Slim line nacelle design
- Buffering volumes to reduce interaction of stationary operating turbo components and non-stationary piston engine

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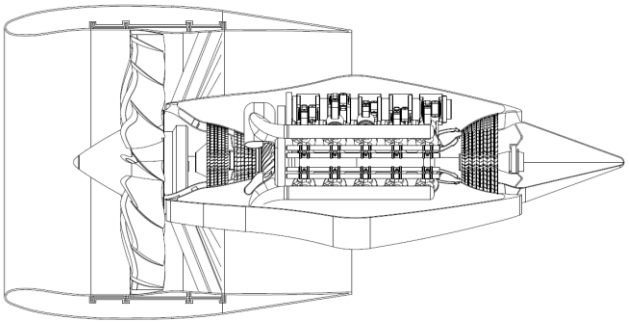
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T-s-Diagram



The T-s diagram of the CCE - thermodynamic cycle illustrates the high peak pressure and peak temperature that can be realized with a CCE. The red dotted line represents the non-stationary thermodynamic cycle of the piston engine which takes place between the thermodynamic station 3 and 35 of the total CCE cycle representation (black line with typical station nomenclature).

General Assembly Drawing



Funding / Acknowledgement

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Simplified General Arrangement Sketch

The sketch below shows the general arrangement of the CCE is shown in contrast to a Reference Geared Turbofan. The piston engine affects only slight enlargement of the engine length. At the right hand side of the figure, the V-arrangement of the two piston engine banks around the main engine centre line is illustrated.

