

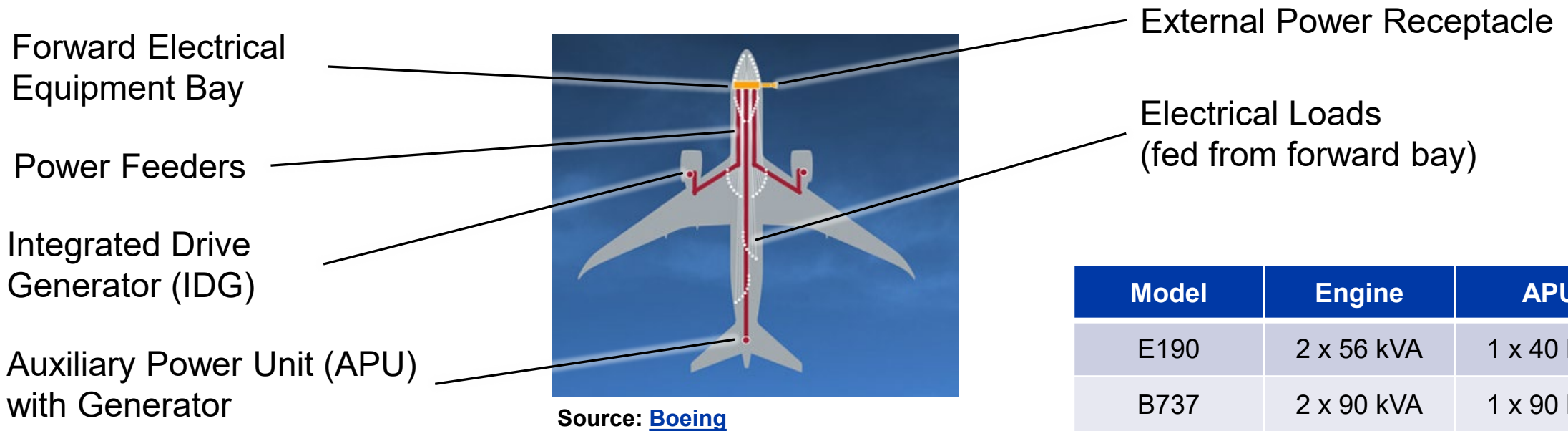
sCO₂ Power Cycles - Applications and End Users

It's All about the Heat Exchangers

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Aircraft Power Systems

Conventional Aircraft Power Systems

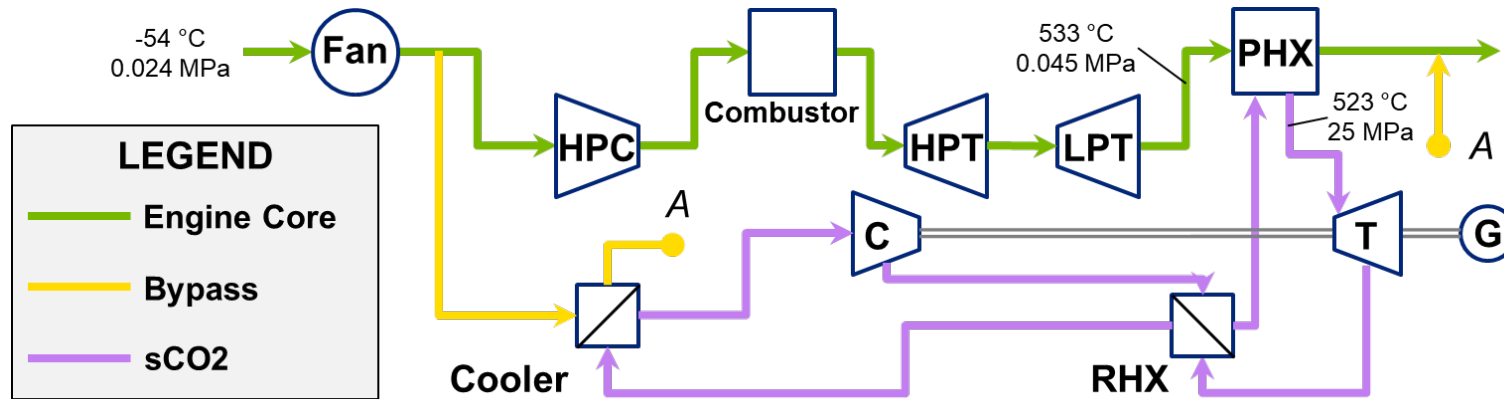


Model	Engine	APU
E190	2 x 56 kVA	1 x 40 kVA
B737	2 x 90 kVA	1 x 90 kVA
B777	2 x 120 kVA	1 x 120 kVA
B787	4 x 250 kVA	2 x 225 kVA

Sources: [Boeing](#), [EASA 1 2 3 4](#), [Pratt & Whitney](#)

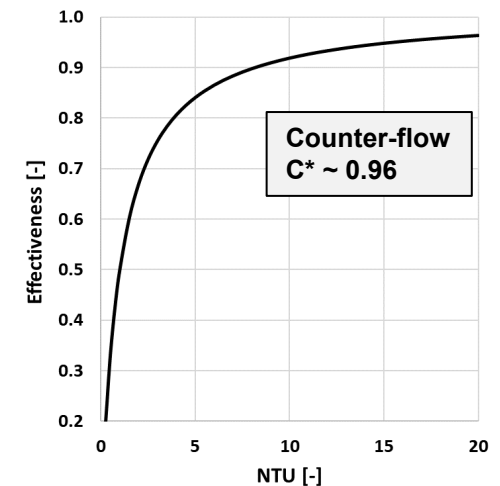
Waste heat recovery from aircraft engines should target comparable power levels

Potential for Aircraft Engine Waste Heat Recovery (WHR)



Cases	1	9	10	18
Alt [km]	0	900	1000	10,668
Mach	0.15	0.17	0.50	0.74
Q in [kW]	592	599	600	246
Q out [kW]	408	410	410	246
Net Power [kW]	184	189	592	326
RHX Eff [-]	90%	90%	90%	90%
Cycle Eff [-]	31.1%	31.5%	31.7%	33.5%

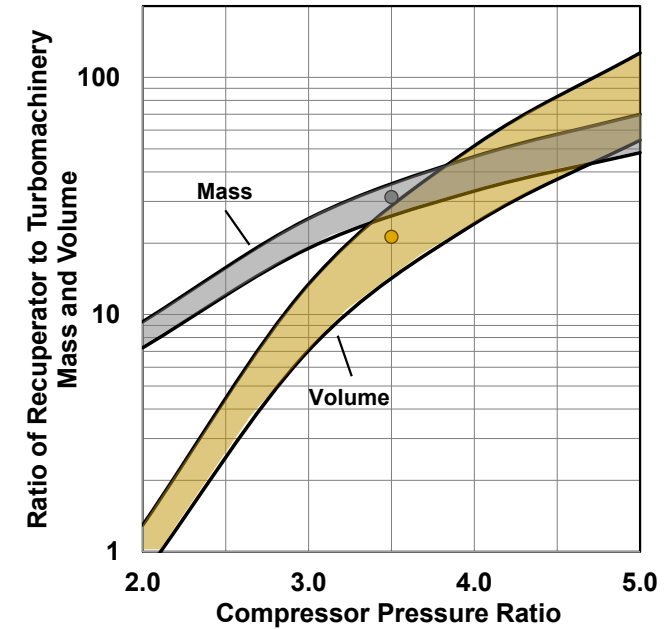
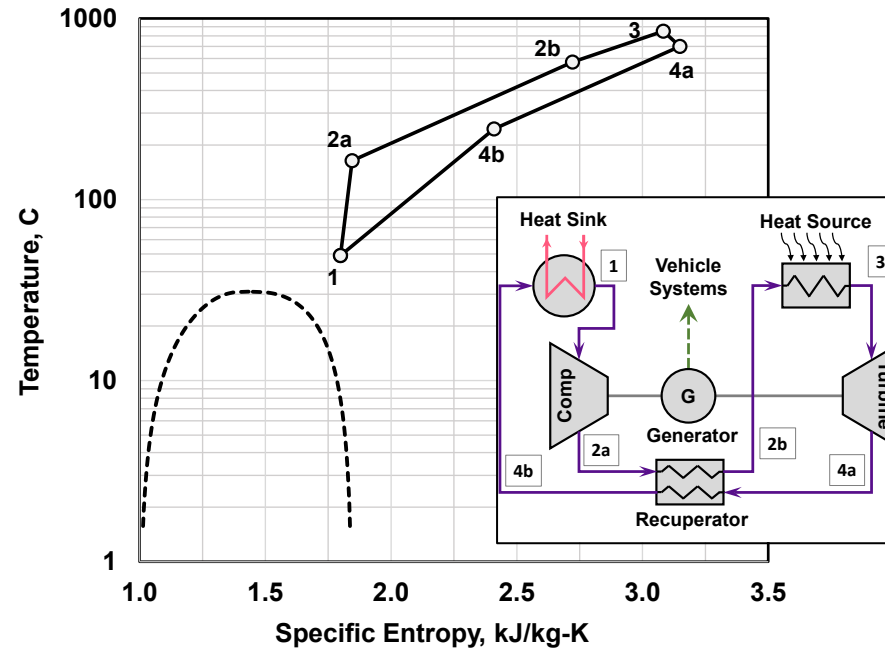
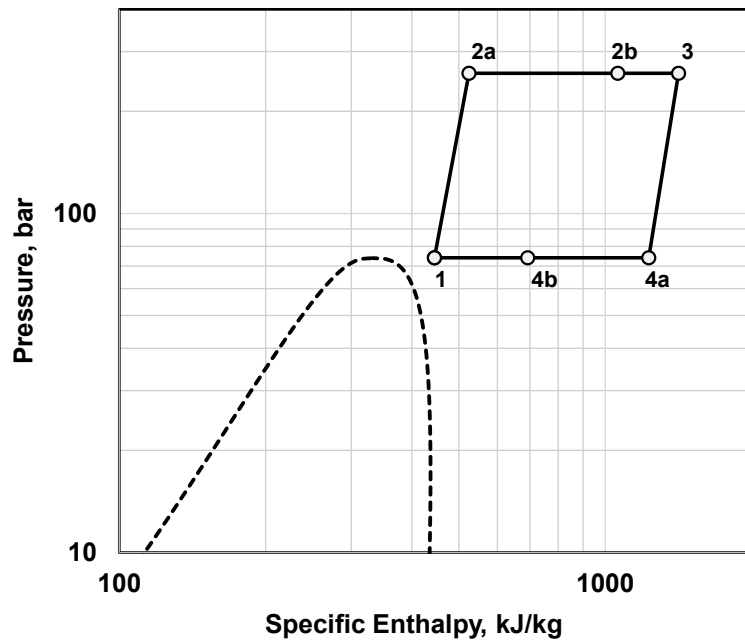
- WHR study for mixed flow turbofan engine used in small aircraft
- Key Outcomes
 - sCO₂ WHR can improve engine SFC by up to 5%, but...
 - System-level impact (SFC) is very sensitive to PHX and Cooler losses
 - RHX is recommended to minimize PHX and Cooler loads, but...
 - RHX sizing (NTU) can become unwieldy due to balanced flow condition



It's all about the heat exchangers.... says the thermal person, but it really is!

High Mach Flight Vehicles

sCO2 Power Cycles for High Mach Platforms



- Brayton cycle provides two key functions: heat pump and heat engine
- Heat exchangers will dominate power density metrics

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