

In this project, we tend to design a turbofan engine, which can compete with PW1900G (Figure 1). This engine was selected by Embraer, a Brazilian multinational aerospace manufacturer, to power the E-Jets E2 (Figure 2), with entry into service in 2018. The PurePower PW1900G engine offered significant economic and environmental savings over existing engines in that time, bringing exceptional performance to the E-Jets E2.

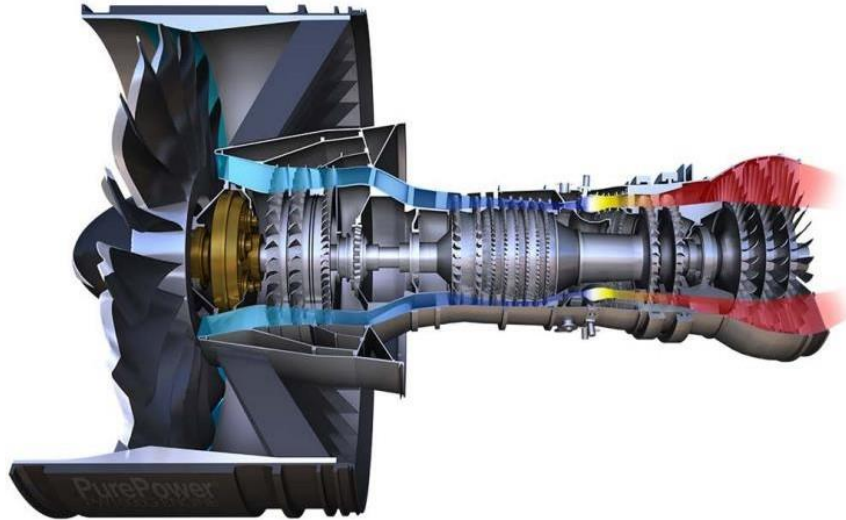


Figure 1 PW1900G configuration



Figure 2 An E190-E2 from E-jet E2 family

PW1900G specifications are listed in Table 1.

Table 1 PW1900G Specification

Fan diameter	73 in/1.85 m, 18 blades
BPR	12:1
Takeoff thrust	20,860 lbf / 92.79 kN
Compressor	3 stage LPC, 8 stage HPC
OPR	22
Turbine	Axial flow, 2-stage HP, 3-stage LP
Application	E-Jet E2
Service entry	24 April 2018
Length	125.4 in / 3.184 m
Fan case diameter	79.0 in / 2.006 m
Weight	4800 lb / 2177 kg

Part 1:

You need to study the market as your 1st step towards this design; to complete this task, you need to gather a database of all the engines in this thrust range with respect to airplane dimensions. Each team must add at least three different engines to the engine database.

Part 2:

The purpose of this project is to minimize the specific fuel consumption and maximize the turbine inlet temperature and overall pressure ratio and you need to make the changes necessary to achieve these objectives and after this optimization you need to implement ideal and real cycles with MATLAB. The following needs to be done in order to complete the phase one of the project (note that this is a civil design, and you also need to select the type of your fuel).

1. From the database you already have, you need to prepare a table to show the ranges of CPR, BPR, FPR, TIT, Net Thrust and SFC.
2. Implement the ideal cycle at SLS and take-off phase in MATLAB and introduce the best engine in this condition.
3. Implement the real cycle at SLS and take-off phase in MATLAB and introduce the best engine in this condition.
4. Do the real cycle at SLS and take-off phase with engine software (such as Gasturb) and compare your results with task 2.

5. If tasks 3 and 4 are not alike, you need to discuss why the results are different. (The difference should be the least possible; else, you should do the cycle again to achieve the best one.)

Part 3: (Bonus)

Perform a parametric study of your design point for the following conditions:

$$0.1 < M_0 < 0.8 \text{ and } 0 < Alt < 35000ft$$

Draw the parameters T , SFC , EGT , $\dot{m}_{air,tot}$, $\dot{m}_{fuel,tot}$, $T/\dot{m}_{air,tot}$ as a function of the flight Mach number and altitude. Discuss your results.

Note that you should justify all the assumptions that you make in your calculations/analysis. Provide all the information that you have used to develop your best design.