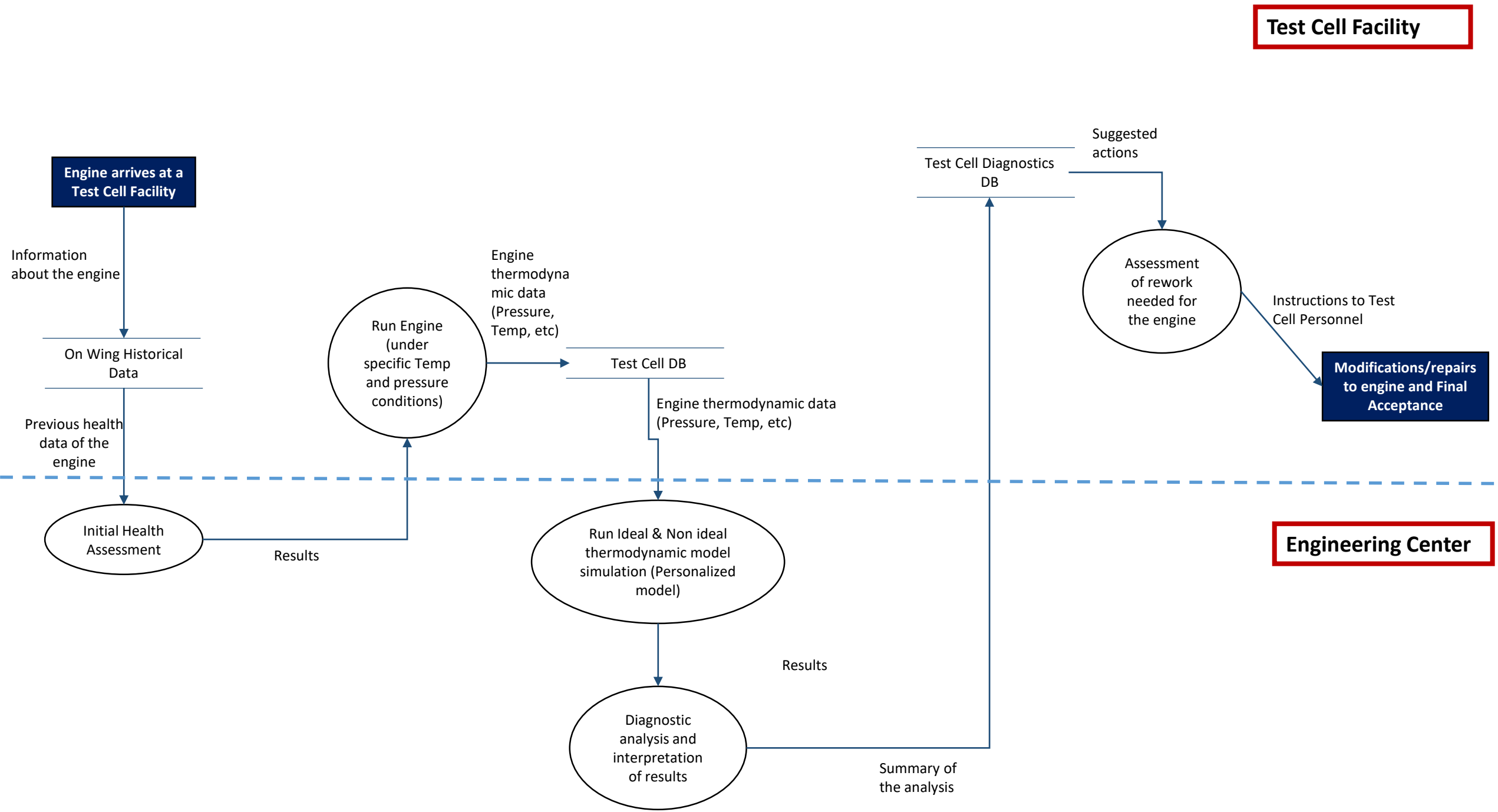
Predicting the health of a commercial engine.

For the aerospace industry, especially for the commercial airplane business measuring the health of their engines is a vital task. This is driven by many factors, the most important is the safety of the passengers followed by saving money to the company by ensuring efficient engines (savings given by reduction in maintenance and fuel consumption). Even though the health of the engine can be divided into many fields in this particular example we will focus on the thermodynamic part of it.

The turbofan/turbojet engine follows a thermodynamic cycle called Joule-Bryton. This cycle states that the systems are interconnected one to another. By this assumption and by having data from certain sections of the engine it is possible to infer the status on all the other components, and with all this information and some models (and experts looking at this) an assessment on the thermodynamic health of the engine can be provided. This assessment leads to repairs and/or certification of the engine to go back to service again.

This process is costly and time consuming given that every analysis is done by an expert in thermodynamics, plus the many unique tools that this can be using. I would like to provide a data flow structure to diagnose and certify a commercial engine:


Test Cell Facility
Engine arrives at a Test Cell Facility
Information about the engine
On Wing Historical Data
Previous health data of the engine
Initial Health Assessment
Results
Run Engine (under specific Temp and pressure conditions)
Engine thermodynamic data (Pressure, Temp, etc)
Test Cell DB
Engine thermodynamic data (Pressure, Temp, etc)
Run Ideal & Non ideal thermodynamic model simulation (Personalized model)
Results
Diagnostic analysis and interpretation of results
Summary of the analysis
Test Cell Diagnostics DB
Suggested actions
Assessment of rework needed for the engine
Instructions to Test Cell Personnel
Modifications/repairs to engine and Final Acceptance
Engineering Center