Introduction:

1.1 Gas turbine:-

Aircraft gas turbine cycle differ from shaft power cycles that the useful power output is in the form of thrust the whole of the turbo jet is generated in propelling nozzle. A second distinguishing feature is the need to consider the effect of forward speed and altitude on the performance. The designer of aircraft engines must recognize differing requirement for take-off, climb, cruse and maneuvering. Evidently the selection of design condition is much more complex than for a land-based unit. As examples (design point) calculation will be shown for take-off and cruse condition.[1]

1.2 Jet Engine

Turbojet is the earliest and simplest form of jet engines; Jet Engine is the gas turbine application for aircraft propulsion. Basic principle in a jet engine is to accelerate a mass of fluid in the direction opposite to motion and thereby propelling the aircraft forward by the thrust generated and produce thrust by greatly accelerating a small mass of fluid. [2]

1.3 W1 whittles engine history:

Sir Frank Whittle's jet aircraft engine was patented in 1932, and Power Jets, Ltd. was formed in 1936. The Whittle Unit bench test engine first ran on April 12, 1937. In 1939, the British Air Ministry placed a contract for the W.1 engine, for flight test on the new Gloster E.28/39 aircraft. During taxiing tests, the W.1X non-airworthy engine unofficially

became the first British turbojet to be airborne when the E.28/39 made short, straight hops. The W.1 flew officially in the E.28/39 on May 15, 1941. [wep]

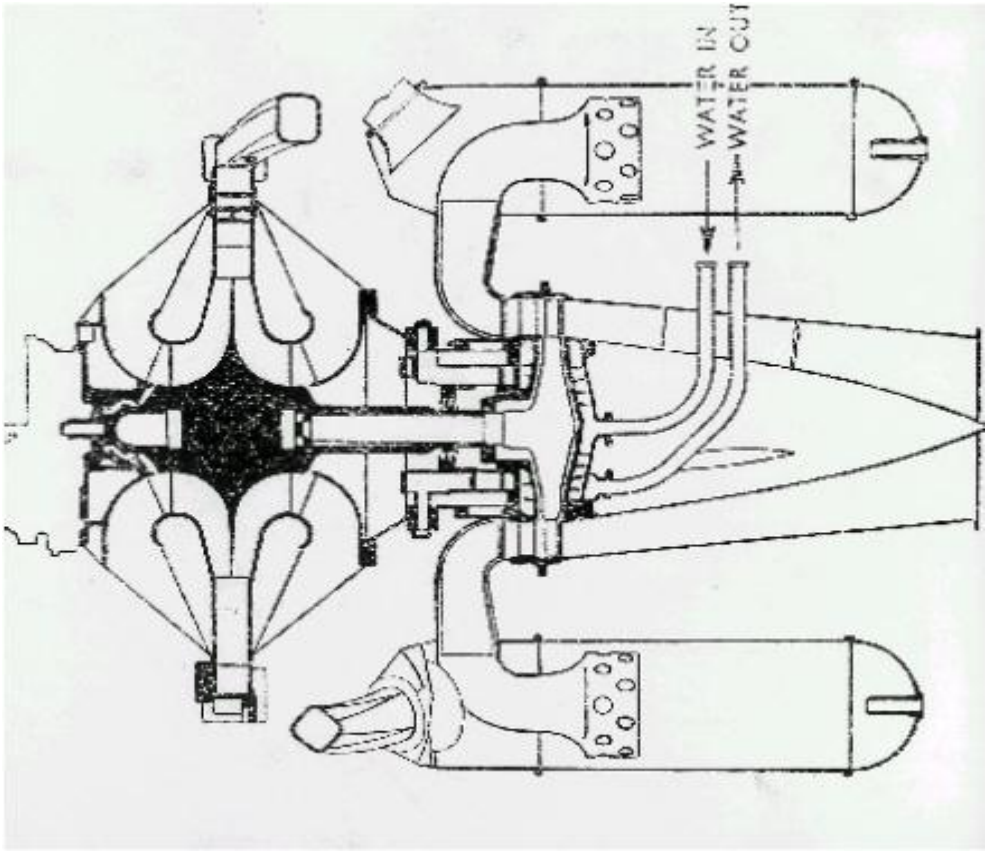

Fig (1.1): W1 whittle engine

1.4 Global Optimization:

Individual engine performance modeling consider as optimization task to look or the global optimum by different optimization research method including in the simulation tool that was used for this project.in general , the optimization task dependence on the case that determine the problem .the problem can frequently be modeled by a set of linear or non-linear equations. For each case we are interested in global optimization ,

which in simple words can be defined as the task finding the absolutely best set of parameters to optimize an objective function on our case we are interested in minimizing the distance between our measured data and modeled data for off-design point to achieve optimal matching. This relation can be expressed mathematically be the list squire method.

In linear optimization the best solution should be bounded and for the non-linear case the solution maybe bounded or unbounded for which many method can be used such as gradient, zero order and gradient free method. In non-linear multi-model functions there are solutions that are locally optimal but globally optimal. Consequently, global optimization problems are typically quite difficult to solve exactly.

Methods for global optimization problems can be categorized based on the properties of the problem that is studied and the type of the guarantees that the methods provide for final solution. A Non –Linear Programming (NL P) problem has the form:

Minimize f(x)

Subject to $g_i(x) = 0$ for i=1,….., m_i where $m_1>=0$

hj(x)>=0 for j=mj+1,….., m where $m>=m_1$

Where f is a function of a vector of real's x that is subject to equality and inequality constrains. Some of the most important classes of global optimization problems are differential convex optimization, complementary problem, minimax problems, bilinear and biconvex programming, continuous global optimization and quadratic programming.

Specific optimization methods have been developed for many classes of global optimization problems. Additionally, general techniques have been developed that appear to have applicability to a wide range of problems.

General unconstrained problems have a nonlinear function over real that is unconstrained (or which have simple bound constraints). A variety of partitioning strategies have been proposed to solve this problem exactly. These methods typically rely on priori knowledge of how rapidly the function can vary, or the availability of an analytic formulation of the objective function (e.g. interval methods). Statistical methods also use partitioning of decompose the search space, but they use the priori information (or assumptions) about how the objective function can be modeled. A wide variety of other methods have been proposed for solving these problems inexactly, including simulated annealing, genetic algorithms and clustering methods, which first transform the potential function into smoother function with fewer local minimizers, and then uses a local minimization procedure to trace the minimizers back to the original function (e.g. More and Wu).

These types of problems have not received as much attention as have general unconstrained problems. However, many of the methods for unconstrained problems have been adapted to handle constraints.[3]

1.5 Objective:

The aim of this project work to develop a working model of the individual performance whittle gas turbine engine that have the same behavior as the real engine and also sufficient agreement with measured data according to the variation of engine speed to find various parameters as :

-Exhaust temperature.

-Thrust

1.6 Research Outline:

In chapter one we made an introduction to the general gas turbine engine and defined it main component and the global optimization of the engine and collocating the data for the whittle engine.

In chapter two we made a literature review about the turbo-jet engine, design and off design performance.

In chapter three we calculate the thermodynamic design (off-design) in one point by using MATLAP program to analyze performance off-design point and perform the measured data with off-design performance. We used the measured data to estimate the optimal set of parameter. The tool develop this model is the program (GESTPAN),General Stationary and Transient Propulsion Analysis, which is a program for simulation of gas turbines. This parameter is achieved by optimization technique. The tool to achieve this uses a non-linear steady stat, generic gas turbine model. The

program includes many optimization methods for solving this problem by using the simulation tool.

In chapter four we made a performance modeling of W1 TJE by using performance simulation and estimation technique.

Chapter five deals with the result of the performance technique and the value of the performance parameters and represents this result in curves to show the relation between the real values and the calculated one by different types of optimization method. Beyond this, what we recommends to be done in future.