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Design and Analysis of the Combustion Chamber Gas Turbine

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ABSTARCT:

Design and analysis of combustion gas turbine room to combine theory based and experimental approach and design of the combustion chamber is less than exact science. This paper screens combustion chamber followed by three dimensional simulations to investigate The characteristics of speed, and concentration of species and the temperature distribution inside the room and fuel Consider methane (CH_4). computational approach is trying to strike a balance for Treat the competitive aspects of complex physical and chemical interactions of flow. Modelling It uses non-orthogonal coordinates, second degree individualize minutes, repeated curved TETRA network

Settlement procedures and SST turbulence model. Accordingly, in this study, it has been attempting to Through using ANSYS CFX CFD approach 12 to analyze the flow pattern with the combustion and by Holes to accept the air and the temperature distribution in the walls of the room, and is obtained in the quality of the outlet temperature of the combustion chamber

INTRODUCTION:

It has been the development of the gas turbine and aircraft engine plant for the generation of energy fast so difficult We estimate that by the 1950s there were very few people have heard of this form of payment on the aircraft. The The possibility of using an aircraft reaction is interested in aircraft designers for a long time, but on the principle of low speeds Aircraft early and is suitable for large piston engine to produce the high air flow speed necessary to "Aircraft" has provided many obstacles.

This evolution combustion gas turbine plant for aircraft and power room was so it was a gradual increase in the rapid development in the early years. . The challenges have not changed in the system design high-performance combustion dramatically in recent years, in the ceramic composite current materials (sic) used in the protective layer of gas components of the combustion

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turbine room aircraft and hypersonic technology products, where serious problems of the structure of high-temperature oxidizing environment protection today. Use of the material chamber combustion ceramic coating (sic) for the development of a small amount of momentum. The principles of the fundamental principle for the realization of the single plane Jet Propulsion slightly. Newton's third law of motion, spread along the simplest form states, "every action, there is a violent and equal reaction with him." What this means is, if you pay something will pay. In the same way the payment and formed'alheiih 'is in the air, causing the atmosphere to accelerate as it passes through the engine. The force required to give this acceleration has an impact on an equal footing in the opposite direction to work on the mechanism of acceleration of production. Production momentum of a similar configuration of the motor / fan jet engines so. Pay the entire aircraft and heavy weight pushing air to the rear and one in the air made great form at a relatively low speed, and the other as a jet of gas at very high speed. Combustion chamber combustion chamber (Figure 1) has the difficult task of burn large amounts of fuel, which is offered through the barrels of fuel spray with volume and width of the air supplied by the compressor and shootings in the form we are expanding the air and rushes to give a gentle stream gas heated uniformly in all the conditions of the turbines. This must be done to accomplish this task with minimal pressure loss and maximum fire the limited space available. The amount of added fuel to air depends on the height of the desired temperature. However, the maximum temperature is limited to within the range of 850-1700 ° C the material which causes the turbine blades and nozzles. There has already been a hot air was ssThe between 200 and 550 degrees Celsius. Before the work done by the pressure, allowing the state high temperature of between 650 and 1,150 degrees Celsius. Combustion process. Because the desired temperature in the gas turbine varies with the engine thrust, and in the case of engine turbo-propeller power required, as the combustion chamber to be able to maintain the stability and effectiveness a wide range of operating conditions of the combustion engine. combustion efficiency has become increasingly important due to the rapid increase in commercial aircraft movements and the consequent increase in air pollution, which is seen by the general public as exhaustsmoke

COMBUSTION CHAMBER

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Combustion chamber (Figure 3) has the difficult task to burn large amounts of fuel supplied Through the fuel spray nozzles, with air volumes and width, provided by the release of the compressor and heat So that the air expands and accelerates to give a uniform and smooth surface across the heating of the gas stream and so The conditions required by the turbines. It must be done to accomplish this task with minimal loss of pressure and The maximum heat release limited space available. The amount of fuel added to air depends on the

High temperature required. However, the maximum temperature is limited to within the range of 850-1700 Degrees. C. of the materials that comprise nozzles and turbine blades. It has already been heated to the air

Between 200 and550 degree. C. work done during compression, allowing the heated condition 650-1150 degrees. C. combustion process. Because the degree of heat required in the gas turbine varies with engine thrust, and in the case of turbo-propeller engine in the required power and the combustion chamber must also be able to maintain a stable and effective in a wide range of operating engine combustion Circumstances. combustion efficiency has become increasingly important due to the rapid increase in trade Aircraft movements and the consequent increase in air pollution

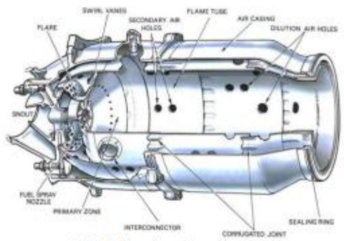

Fig.3 Combustion chamber

METHODOLOGY:

The operation of combustion air compressor motor enters the combustion chamber at a rate of up to 500 feet per second, but because of this speed air speed is too high for combustion, the first thing the room there to do is clear it, stop it and raise any constant pressure. Since the speed of burning kerosene in proportions of normal mixture are only a few feet per second, no illuminated fuel in a stream of circulated air, which now has a speed of about 80 feet per second, will be the wind. Thus a low speed in a central area in the room is created, so that the flame remains lit throughout the combustion chamber can vary between 45: 1 and 130: 1, however, kerosene only burns efficiently, or near, the ratio of 15: 1, so that the fuel should be burned with the only part of the air inside the room, in what is called the primary combustion zone. This is achieved through flame tube (liner combustion) containing a variety of devices for measuring the amount of air flow distribution of the length of the room.

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Taking nearly 20 percent of air mass flow by the Department of snout or input (fig.4) .Immediately downstream of the snout and spiral blades and perforated lighting system, passing through the air in the area primary combustion. Induces swirling air flow upstream from the center of the flame tube, and encourages recycling necessary. The air is not picked up by the muzzle is in the annular space between the flame tube and the atmosphere

Through the body wall of the flame tube adjacent the combustion zone, and a selected number of secondary holes through which 20 percent more than the main air flow passes in the core zone. The air of the spiral rotors and the secondary air orifices reacts and creates a low velocity zone recycling. This takes the form of toroidal vortex, similar to a smoke ring, which has an impact on the stability and consolidation of the flame (Fig. 5). And deployed gases re-accelerate burning drops fuel injection again quickly bringing the ignition temperature is arranged to spray fuel nozzle taper recycling spiral intersects in the middle. This work, together with the general turmoil in the base area, a great help to break the fuel and mixed with the incoming air. Temperature combustion gas of about 1,800 to 2,000 degrees. C., which is too hot to enter the nozzle guide vane turbine. Do not use air for combustion, amounting to about 60 percent of the total air flow, and thus progressively introduced into the flame tube. About a third of this is used to reduce the gas temperature in the area of mitigation before it enters the turbine and the rest is used to cool the walls of the flame tube. This is achieved by an air film flowing along the inner surface of the tube wall flame cooling, insulation from hot combustion gases. A recent development allows the cooling air to enter the network of corridors inside the wall of the flame tube before leaving to form the insulating film from the air, and this can reduce the wall of the flow of cooling air required up to 50 percent. You must complete the combustion air before facilitating the entry of the flame tube, otherwise the incoming air to quench the flame will be the result of incomplete combustion.

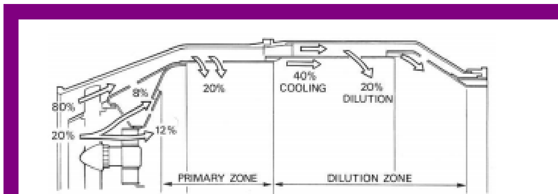

Fig.4 Airflow distribution along the chamber

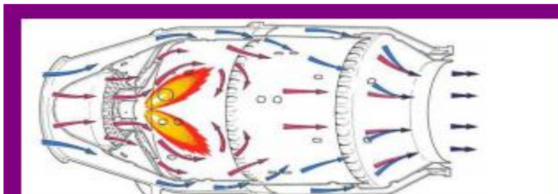
Fig.5 Smoke ring

RESULTS & DISCUSSION:

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Figure 8 shows pressure changes in the combustion chamber. The temperature inside the combustion Room is about 2500K. Figure 1 in the blue region refers to the air. According to the region of the red color Re made with molecules of air and fuel. The reaction of the fuel with air molecules and produce a large amount of heat. This heat is It occupies the overall combustion and salt in the port.

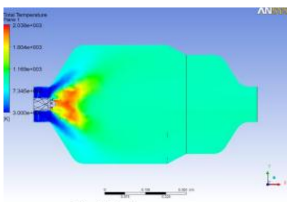

Fig.8 Total temperature

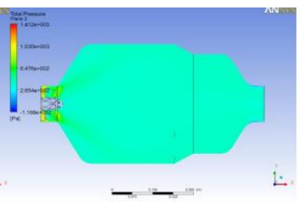

Fig.9 Total pressure

Fig.9 difference indicates the total pressure in the combustion chamber. According to this figure and total pressure In all parts of the combustion chamber is equal to the combustion chamber is in a stable condition. Pressure on The combustion chamber sets limits. So there will be no significant impact on the combustion chamber Fig.10 indicates the severity of the radiation through the combustion chamber. radiation intensity The constant in the walls of the combustion chamber increase. And the intensity of radiation from one end to the other end. the The density of the air molecules in a collision and the fuel is low and incremented for this purpose. At the end of the room The maximum density. Indicate the red radiation intensity.Fig.11 region indicates the mass fraction of oxygen. The introduction of oxygen from the air inlets. In air 21% oxygen

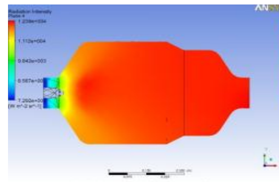

Fig.10 Radiation intensity

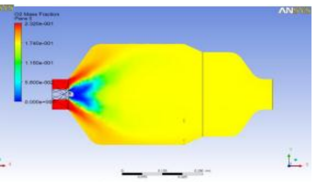

Fig.11 Mass fraction

Found This oxygen reacts with fuel that comes from the fuel inlets. the combustion process takes Places because of this oxygen. Red and indicate the oxygen concentration region. the color blue Region decreased concentration. Due to air-fuel combustion process. Fig.12 shows the mass of water in the air portion. And decreasing the ratio of water mass gradually in the combustion chamber due to the combustion process. Blue is the color area region refers to water in the air. This H2O comes from the air inlets with air. And decreasing concentration of water molecules to produce a lot of heat during the combustion process until evaporation of water molecules easily.

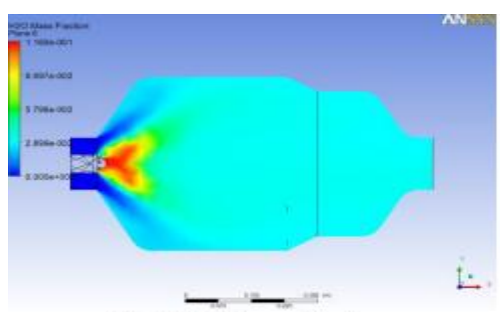

Fig.12 H_2O mass fraction

And the increase of the gas temperature to about 2500 K, which can lead to the combustion process. pattern factor is between 0.025 to 0.3 and the pressure loss should be less than 8% for good combustion process

CONCLUSION:

The above analysis leads to the following conclusions below:

 constant temperature is very high in areas instead of combustion and remains low

Toward the exit. The maximum temperature reached 2500 K, indicating that it is not efficiency

The combustion process.

 concerned high density in the immediate vicinity of the slope indicating upper injector air and fuel

Mix. In order to 60.000% from the turbulent intensity in the door. Embarrassed very high

According to the intensity of the mixture of air and fuel higher. Serving high value of the block formed NO indicates the presence of process efficient combustion.

 sudden temperature increase was observed near the injector tip relates to the generation of shocks

Which aids in the mixture of air and fuel higher. Upper air-fuel mixture, thereby improving combustion quality

And therefore improve performance. As expected, the results of this study show in the air and improved fuel

mixing and combustion sound, which can be attributed to the ramp injector geometry considered

This studio.

However, to be in the process of port temperature

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