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On the Investigation of the Possibility of Converting the Vintage Trent 1000 to Gas Turbine Power Plant with Electrical Integration

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ABSTRACT

Turning Vintage Trent 1000 engines into gas turbine power stations gives rise to a potentially productive approach for improving electricity generation efficiency and adapting aging aerospace technology. This work, which involved literature review, mathematical modeling, and CFD simulations, deals with the challenge of if the regenerative converter is feasible for conversion. After thorough investigation, two patents were selected, the first one dealing with structural modifications and the second one being about exergy analysis in order to determine the thermodynamic characteristics. At the beginning, the principles from CFM 56 engines were modified to generate a prototype for the Triple spool Trent 1000 engine, which we named the TRS 1000 engine. Followed by the adjustments, specific to the design of the engine. CFD analysis was performed to observe the influence of inlet airflow and engine performance on upstream generator configuration, the result of the analysis was a proof that this project is viable. The results demonstrate that the Trent 1000 is a larger and more powerful engine, making it a viable alternative to CFM 56 engines. The proposed TRS industrial gas turbine is feasible for use as a topping cycle in either a combined-cycle power plant or a unitary cycle power plant

Keywords: Rolls Royce Trent 1000, Gas Turbine, Power Plant, Sustainable Energy, Brayton Cycle, Renewable Energy Solutions, Aviation Assets

The terminologies used in this paper are

T	Temperature
P	Pressure
E	Exergy

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S	Entropy
R	Specific gas constant
W	Work
V	Volume
H	Enthalpy
F	Force
N	Rotational speed
L	Length
M	Mass
Q	Heat
U	Internal energy
p	Specific pressure
v	Specific volume
c	Specific heat value
u	Velocity (x – component)
ρ	Density
r	Torque
g	Gravitational constant
σ	Turbulence constant
ϕ	Exergy development potential
η	Efficiency
SFC	Specific fuel consumption
FHV	Fuel heating value
LHV	Low heating value
LPT	Low pressure turbine
LPC	Low pressure compressor
IPT	Intermediate pressure turbine
IPC	Intermediate pressure compressor
HPT	High pressure turbine
HPC	High pressure compressor

.industrial gas turbine are given as in Figure 1

INTRODUCTION

The replacement of Vintage Trent 1000 Engines by turbine Gas Power Station turns out to be a strategic way of meeting the current Responsible Energy issues. Nowadays, it is a well-known fact that climate and environment changes are one of the most important issues people are struggling with. Therefore, use of the current aerospace technology provides a direction towards cleaner and cheaper source of energy. These engines with their robust design and proven fitness to operate are, in fact, some of the factors that render them an appealing choice for conversions, indicating a chance to use decades of engineering experience in

.a newly set up environment

Among all, gas turbine power plants are marked by their combustion-based electricity generation and their unique set of advantages over the traditional fossil fuel-based methods. Through adoption of aerospace engines as stationary power generating sources, raw potential of engines in terms of their efficiency and reliability can be materialized while they are grounded. A comprehensive study that

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is centered on this kind of assessment shall be done to provide useful insights for the repurposing of the Trent 1000 engines into power generation and
.address any associated challenges

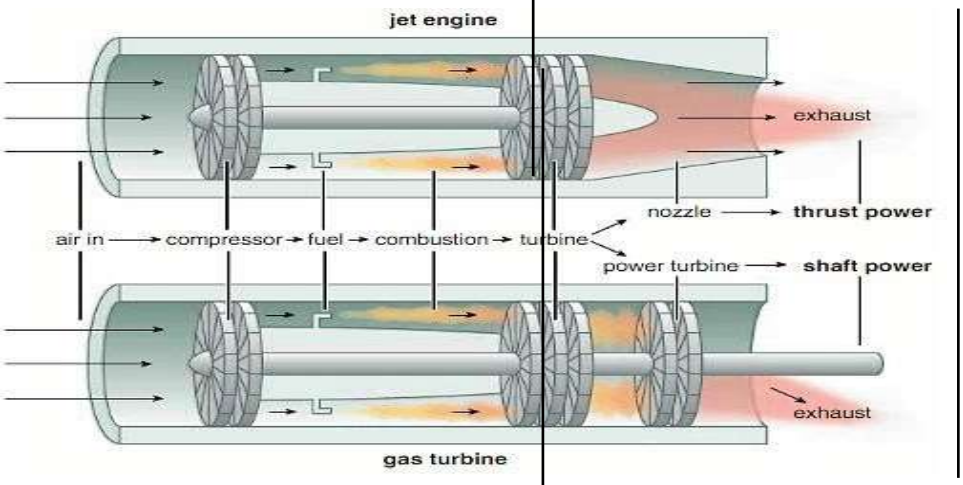

Fig. 1 Working model of Jet Engine Gas Turbine

In contrast, a combined-cycle gas turbine combines a gas turbine with a steam turbine. Steam is created from the exhaust heat of the gas turbine and drives a turbine to produce extra energy]6, 7[. Figure 2 displays the combined cycle power plant's operating schematic diagram. This integrated approach of utilizing both gas and steam turbines in tandem significantly enhances the overall fuel-to-power conversion efficiency of the plant, culminating in an impressive efficiency rate of

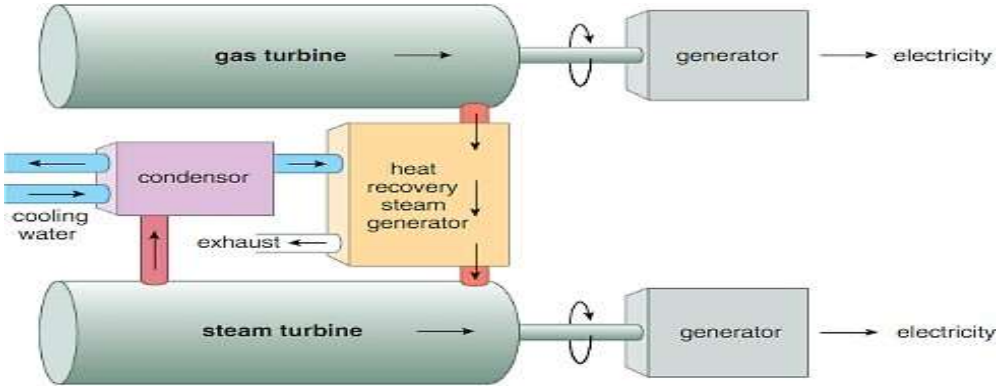

Fig. 2

Literature Review

There are several convincing reasons why jet engine conversion is so appealing. First off, jet engines frequently have energy conversion efficiency of over 40%, which is rather astounding. Second, there is a ready supply of prospective power sources due to the large number of retired engines produced annually by the worldwide aviation industry. Lastly, jet engines are perfect for peak power generation or integration with renewable energy sources due to their flexibility

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and quick
The GE90-115B, the biggest jet engine in the world, has been converted by GE into the potent LM9000 electrical generator. Its megawatt capacity allows it to reach maximum power in -65 about 10 minutes, which is enough to power about 6,500 houses The operation of a land-based gas turbine (bottom) and a jet .]2[

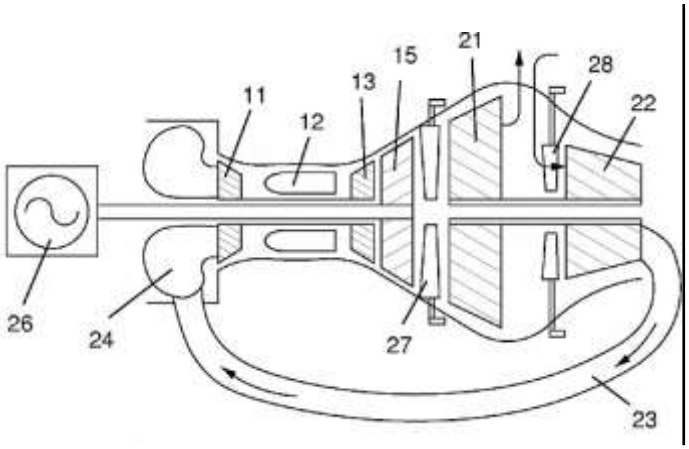

Fig. 2 Combined cycle power plant
Gas turbines are multi-functional installations broadly employed in facilities coverage including industry, generators, and aviation among others. Nevertheless, the simplest design, a gas turbine cycle system without a closed cycle is the least efficient one with thermal efficiency of just 33%]9[. Also, it must make sure about the problems like fuel wastage, environmental pollution, and that finite role of the atman power
engine (top) is identical, yet they produce distinct final outputs. To heat the air, fuel is supplied, compressed air is drawn in, and finally the fuel burns]3[. The schematics of jet engine and an
.and long-term energy resource generation

Seminal Patents
The US patent]10[is testifying the complex task of converting
the classic twin-spool aero gas turbine engine, the CFM 56 into an environmentally friendly turbine for power production is accomplished. In Figures 3 and 4, one can observe the original engine configuration vs. the modified option as portrayed. The key modifications are disclosed in the patent document and
.illustrated in Figure 3, 4

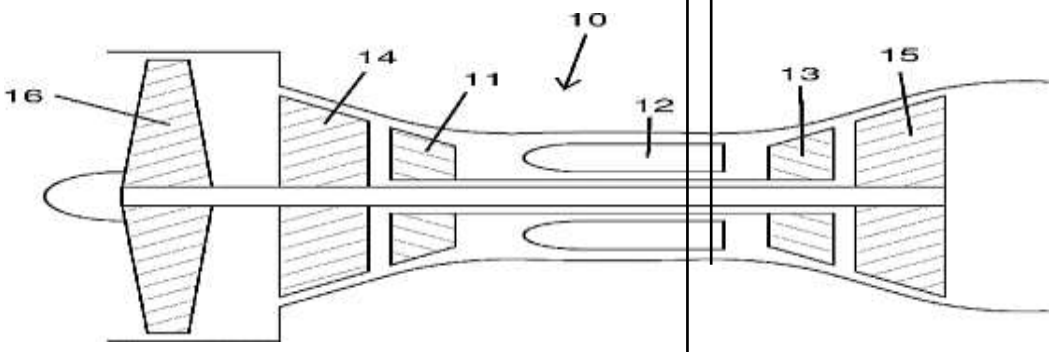

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Fig. 3 Pre-modified CFM 56 engine schematic

The engine structure consists of several key elements, such as a fan, a high-pressure compressor (HPC), a high-pressure turbine (HPT), combustion chamber, a low-pressure compressor (LPC), a diffusion fan, and a low-pressure turbine (LPT). Table 1 below lists all the parts as well as their numbers, as this Table is based .on the diagram in Figure 3

TABLE 1. COMPONENTS OF THE PRE-MODIFIED CFM 56 ENGINE

Part Number	Part Name
11	High Pressure Compressor
12	Combustion Chamber
13	High Pressure Turbine
14	Low Pressure Compressor
15	Low Pressure Turbine
16	Fan

Fig. 4 Post-modified CFM 56 schematic

The engine is rebuilt; removing the fan and replacing it with an electric generator. Turbine is added to the power to drive the unattached low-pressure compressor. The variable guide vanes which are located between the high-pressure turbine and the power turbine are designed to regulate and optimize the flow of steam. Besides, the low-pressure compressed air line is laid between the outlet of the low-pressure compressor and the tightening-up of the inlet where the high-pressure compressor is. As indicated in the Table 2, a full list of the parts and their .corresponding numbers is provided

TABLE 2. COMPONENTS OF THE POST-MODIFIED CFM 56 ENGINE

Part Number	Part Name
11	High Pressure Compressor
12	Combustion Chamber
13	High Pressure Turbine
15	Low Pressure Turbine
21	Power Turbine
22	Low Pressure Compressor
23	Air line
24	Air Bag
26	Electric Generator
28 ,27	Guide Vanes

This second patent]11[is based on in-depth exergy analysis of the CFM56 engine,

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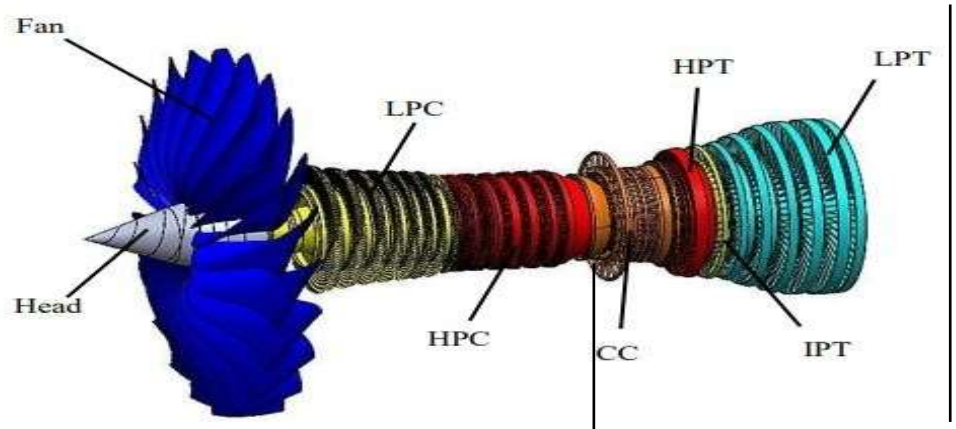
the Brayton cycle manifesting the thermal dynamic process is solved with advanced GasTurb® software. These ensure the principal foundation of thermodynamics provides the engine with its performance. After the considered Brayton cycle, the patent computes the exergy components within the engine. For this, we need the exergy value of destruction exergy, fuel exergy, and product exergy to be assessed or quantified. This way, the exergy losses are accounted
and the portion of exergy that goes into the engine efficiency is
.also known
Such patents, which were initially intended for the CFM 56 train, were used as basic references for understanding the manufacture of this train. Though the CFM 56 engine differs from the Trent 1000 one spool configuration, the basic knowledge about this engine will be retained. The central aspect is related to the design and specific arrangement of the rotating engine components, which will be modified properly by
.considering the specific Trent 1000 engine's unique features



METHODOLOGY AND MODELING

This study employs a structured, multistep approach. Initially, we conducted a comprehensive survey of patents and scientific
.structural elements
publications on converting jet engines into power stations,
focusing on the CFM 56 engine. We thoroughly reviewed and
.validated calculations from these sources
Next, we applied the validated mathematical models to the Rolls Royce Trent 1000 engine, assessing the transferability of techniques. Our methodology involved reviewing patents, solving mathematical equations, and performing computational fluid dynamics (CFD) simulations. These steps provided a deep understanding of the conversion process, guiding us toward an
.optimal solution

Approach

In the beginning, first the patents and the scientific publications on the transformation of jet engines into power stations were found. Attention was

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more particularly concentrated on the CFM 56 engine since it offered essential information for our project scope. Emphasized on the CFM 56 engine and consequently, in-depth reviews were performed on the patents and papers, specifically, to understand the fundamental principles and techniques used. This primarily

Fig. 5 Rolls Royce Trent 1000 CAD model

Below are the stepwise modifications suggested by the patent for
:the conversion of the Trent 1000 engine

i. Removal of the Fan and Nozzle: The first modification is that the fan and nozzle of Trent 1000 engine that is
.meant for airplane propulsion need to be taken off
involved an in-depth look into the computations and the
parameters presented in the write-ups. Further, we retraced these figures to make sure that they are correct. It was the key point of our research as it strongly influenced the quality of all the
.following stages

Once the validated calculations of the recreated codes are confirmed, we then use them in our engine, the Rolls Royce Trent Through the utilization of the proven mathematical models .1000 obtained under the CFM 56 engine patents of our colleagues we aimed to check the transference and usability of these techniques
.to the new engine platform

The recreation procedure has to be done with great caution and precision to match the alterations stated by the patent. Tasks such as removing fan and installing electrical generator, adding hydraulic penstock, inserting variable guide vanes and laying compressed air line will be executed precisely. In addition to this, the mockup skillfully replicates the gaseous flow dynamics, which are thoroughly outlined in the patent, to ensure feasibility and efficiency. Fig.5 depicts the CAD model of the Trent 1000 engine, presenting it on a 3D view of all its constituting parts and

Fig. 6 Removing Fan and Nozzle

Addition of Power Turbine: A power turbine is incorporated into the modified engine setup. In this setup, the turbine has to provide power to the disconnected low-pressure compressor that used to be
.part of the prime mover

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Fig. 7 Insert a Power turbine

ii. Relocation of Low-Pressure Compressor (LPC): The process of modification comprises of removing the LPC from its usual place and fixing it thoughtfully at the rear

.end of the electric generator

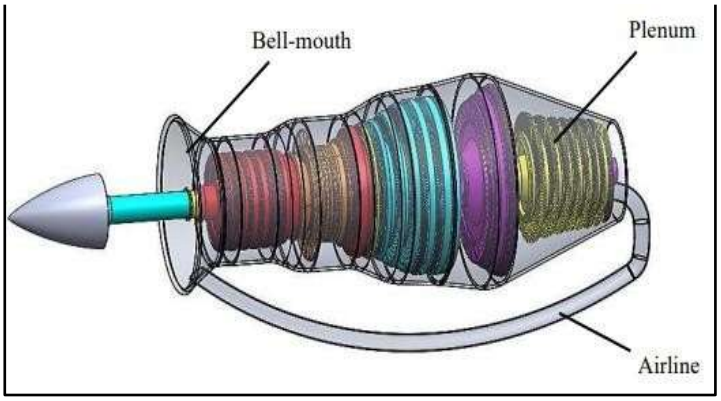

Fig. 8 Relocating the Low-pressure compressor

iii. Integration of an Electric Generator: The fan being replaced by an electric generator is the movement. This converter is there to change the mechanical energy .created by the engine into electrical energy

Fig. 10 Final Modified version of Trent 1000 engine

Important to be mentioned is that these modifications were made to the Trent 1000 engine as per the patent. The adaptations were tailored to match the particular traits and requirements of the Trent 1000 engine to guarantee the right fit and a high-

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.performing operation

Modeling

Heat being added to the system during the cycle denoted byqin is comprised of the integration of the specific heat capacitycP
over the temperature rangeT2to T3 ,Just like that .qoutis
obtained and, then is calculated from an initial temperature ofT1 toT4.

qin=T2T3cPTdt (1)
=cPT3-T2
qout=T1T4cPTdt(2)
=cPT4-T1

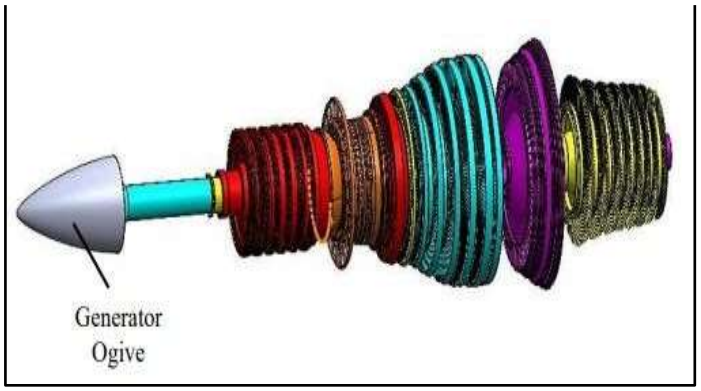

Fig. 9 Integrating the ogive generator

v. Connection of Low-Pressure Compressed Air Line: A low-pressure airline connected between the outlet of low-pressure compressor and inlet of high-pressure compressor is a line that carries compressed air at low pressure. This arrangement contributes to the maintenance of the system's optimal pressure levels.

.Also, the bell mouth and plenum are incorporated
Work done by the turbinewT and compressor wCis also
.calculated similarly

wT=T4T3cPTdt=(3)
cPT3-T4
wC=T1T2cPTdt (4)
= cPT2-T1

Isentropic compression (from state 1 to state 2) and expansion (from state 3 to state4) processes are investigated out where T2s/T1 and T3/T4sare determined using the polytropic
.process equation

T2sT1=P2sP1k- (5)
1k=rPk-1k
T3T4s=P3P4sk- (6)
1k=rPk-1k

Efficiency of the compressor is the ratio between the real work done (e.g. work of real adiabatic compressor) and ideal isentropic work (e.g. work of isentropic adiabatic compressor). Similarly, efficiency of turbine is between the real work done and the ideal
.isentropic work
.by exergy development potential

ηc=wc,swc=cPT (7)
2s-T1cPT2-
T1=T2rPk-1k-
1T2-T1

ϕ=ED1-ψ (18)

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,Similarly

$$\eta T=T3-T4T31- \quad (8)$$
$$1rPk-1k$$

,Work energy by cyclewnetis determined by deducing the ,
.energy performed by the compressor from that done by turbine

Exergy analysis acts as a vital engine for our project to develop an in-depth analysis of energy input and output within our system. It functions as a tutor, by probing into where energy is being squandered, inefficiencies, and where innovations can be made. Therefore, this method is not only helpful in the sense that it increases the feasibility and efficiency of our project, but it also gives us an honest insight into the complicated process of energy
.conversion

I. RESULTS AND RESULTS

$$wnet=wT-wC=\eta TwT,S-wC,S\eta C \quad (9)$$

A.

Brayton Cycle

The qlossis the maximal quantity of heat passing from the system to the surroundings, which equals to the difference
.between the actual and the ideal enthalpies at states 2 and 4

$$qloss=qloss,T+qloss,C \quad (10)$$

The overall efficiencyηoverallof the Brayton Cycle, however, is based on the relation between the net work done to the energy
.supplied

$$\eta overall=1-T4-T1T3-T2 \quad (11)$$

The exergy balance equations show how the exergy of a system changes during its evolution. Eq. 12 shows the exergy change between the statesE2 and E1 after the heat transfer δQ was introduced, and workW.has been done by the system

CFM 56 and Trent 1000 engines were studied, the Brayton Cycle analysis for which yielded the following findings as
.presented in Table 3

	CFM 56		Trent 1000	
State	**Pressure (kPa)**	**Temp (K)**	**Pressure (kPa)**	**Temp (K)**
1	101.32	298	101.32	298
2	2026.5	753.10	1317.22	628.24
3	1766.75	1389.67	1240	1381.44
4	105	609.53	105	758.13

TABLE 3 CYCLIC PARAMETERS FOR PRE-MODIFIED ENGINES

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E2-E1=12δQ-W (12)

,In the eq. 13, the change in entropyS2-S1where the heat ,
,transfer at the boundary temperatureTband irreversibility, σ ,
.are taken into the account

S2-S1=12δQTb+σ (13)

The cyclic parameters which we have calculated give the basic information to help us in the process of evaluating the engine's performance characteristics. The power specifications for the engines have been comprehensively calculated and Table 4
When looking at air from ambient and exhaust as an ideal gas as well as assuming specific heat is constant, the jet fuel exergy can
.be determined

Ef=Ephy,f+Echm (14)
,f

This portion deals with the LPT exergy balance, where m45 andm5which are the before and after turbine mass flow rates
.are considered

m45-m5=0 (15)

The work that the LPTWLPTdoes and the exergy change of the fluid are the sources of exergy that are consumed by the exergy
.destruction and the product exergy

WLPT+m45h45 (16)
-m5h5=0

Exergy efficiency inψis defined as the fuel exergy divided by product exergy. It is a measure of how efficiently the exergy of
.fuel is changed into useful work

ψ=EPEF (17)

The remaining exergy that is accessible for workϕis represented thereafter provides the specifications on the prescribed .parameters

Parameter	CFM 56	Trent 1000
Heat Supplied)kJ/kg)	639.12	756.21
Heat Loss(kJ/kg)	312.77	461.97
Turbine Work (kJ/kg)	783.26	627.79
Compressor Work (kJ/kg)	456.92	331.56
Net Work(kJ/kg)	326.34	294.24
Compressor Efficiency	0.90	0.90
Turbine Efficiency	0.986	0.987

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Thermal Efficiency	0.3894	0.4109
SFC(kg/kWh)	0.2229	0.2359
Power(kW)	30104.57	22943.98

TABLE 4 DESIGN PARAMETERS FOR PRE-MODIFIED ENGINES

modified CFM 56 engine, it is noticeable that the pressure at state
and state 3 is decreased while temperature at state 2 is only 2
slightly increased. On the contrary, the Trent 1000 engine after the modification shows an increase in both pressure and temperature at state 2 and state 3 which is the sign of the increased energy levels in the system. These changes are likely to lead to the possibility of the CFM 56 engine being less efficient due to decreased pressure, while the Trent 1000 engine might actually be more effective with the higher pressure and
.temperature

The validation cycle became more complicated through the execution of a Brayton cycle via the use of GasTurb® software. The computer-based powerful tool was used only to validate the calculated figures done on paper. The figure given below, Figure is the state diagram for CFM 56 engines. It clearly labels all ,5.1
.the states with notations for easy comprehension and reference The figure given below, Figure 11, is the state diagram for CFM
engines. It clearly labels all the states with notations for easy 56
.comprehension and reference

This kind of modeling allows us to get a perfect picture of the base thermodynamic processes that are typical for the Brayton Cycle and then can carry out a holistic assessment of the

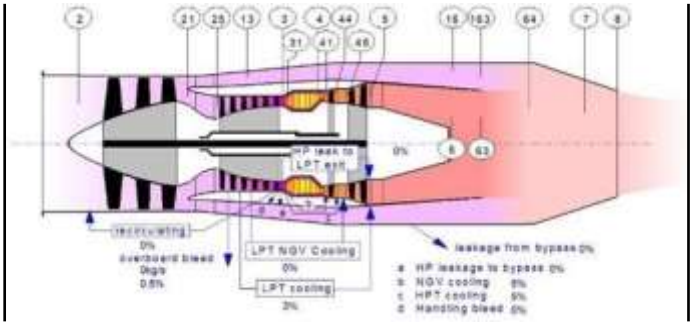

Fig. 11 State diagram for CFM 56 Engine (obtained from GasTurb®)

performance of both turbines – CFM 56 and Trent 1000.
The outcome of the cycle analysis is shown in Figure 12 with all states
Similarly the Brayton cycle solution was carried out for modified
.version of the engines, results represented in Table 5
.being named for their respective numbers

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Table 5 CYCLIC PARAMETERS FOR POST-MODIFIED ENGINES

	Modified CFM 56		Modified Trent 1000	
State	**Pressur e (kPa)**	**Temp (K)**	**Pressur e (kPa)**	**Temp (K)**
1	101.325	288.15	101.325	288.15
2	1304.05 3	612.19	1246.97 6	706.51
3	1264.93 1	1450	1095.23	1295.00
4	104.365	830.67	106.391	770.47

After analyzing the thermodynamic parameters of both the original and the modified versions of the CFM 56 and the Trent

Station	W kg/s	T K	P kPa
amb		288.15	101.325
1	49.500	288.15	101.325
2	49.500	288.15	100.312
13	24.750	400.81	300.935
21	24.750	379.61	250.779
25	24.750	379.61	248.272
3	24.007	669.07	1737.901
31	21.409	669.07	1737.901
4	21.996	1600.00	1685.764
41	23.234	1555.05	1685.764
43	23.234	1302.69	719.454
44	24.471	1273.25	719.454
45	24.471	1273.25	705.065
49	24.471	1102.94	361.322
5	25.214	1088.11	361.322
6	25.214	1088.11	354.095
16	24.750	400.81	291.907
64	49.964	765.77	311.000
8	49.964	765.77	311.000
Bleed	0.124	669.07	1737.902

Fig. 12 State results for CFM 56 engine (obtained from GasTurb®)

Figures 13, 14 demonstrate two diagrams, the Temperature- entropy plot as well as the Pressure- volume diagram for the engine (obtained from GasTurb®). These plots thus provide viewers visual diagrams that illustrate the key thermodynamic parameters throughout the engine cycle with axis values clearly .written on them

engines, we can see some of the differences. In the 1000

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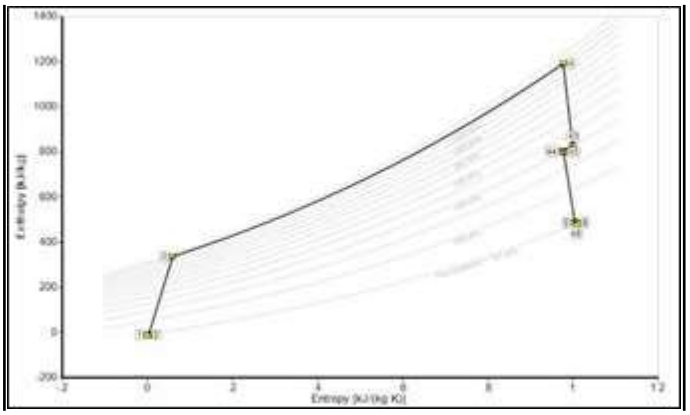

Fig. 13 Temperature-entropy plot for CFM 56 engine

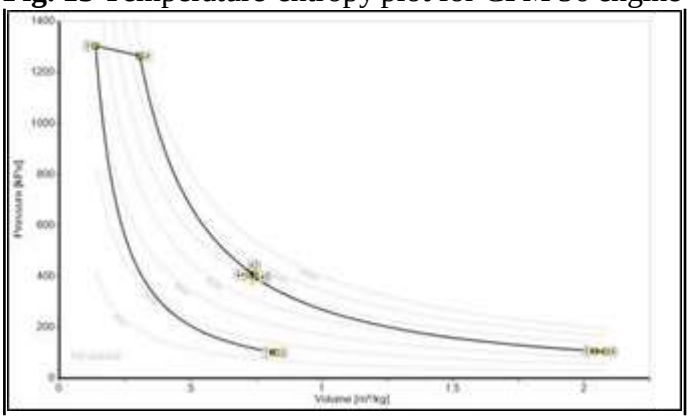

Fig. 14 Pressure-volume plot for CFM 56 engine

TABLE 6 HAND CALCULATIONS VS GASTURB® FOR CFM 56

	Hand Calculation		**®GasTurb Software**	
Stages	**P (kPa)**	**T (K)**	**P (kPa)**	**T (K)**
Inlet	101.32	298	101.325	288.157
After HPC	2026.5	753.10	2000	730
Before HPT	1766.75	1389.67	1860	1315.14
Exhaust	105	609.53	108.56	623.81

TABLE 7 HAND CALCULATIONS VS GASTURB® FOR TRENT 1000

	Hand Calculation		**®GasTurb Software**	
Stages	**P (kPa)**	**T (K)**	**P (kPa)**	**T (K)**

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Inlet	101.32	298	101.325	288.157
After HPC	1317.22	628.24	1304.05	626.17
Before HPT	1240	1381.44	1264.95	1349.99
Exhaust	105	758.13	106.495	756.65

The errors are shown to be belonging to the range between
These tables, 6 and 7 present a contrastive analysis between hand calculations and GasTurb® results for the CFM 56 and Trent respectively. The tables provide a summary of the main ,1000 outcomes, or the points of disagreements in the technical details,
.which are helping to validate the analytical modeling
and 5.66%, which is a decent range. Therefore, the %0.005 performance of analytical analysis of Brayton cycles will give accurate and reliable results. The agreement between the hands- on calculations and the GasTurb® software results provide evidence that the research method used is an analytical modeling approach. Hence, the analysis reveals that under the specific study conditions the equations for the Brayton cycle
.are correct and true

Exergy Analysis

The exergy analysis results for the CFM 56 engine are presented in Table 8 below, and they include our findings and those presented as a patent at the same time (for a comparison
.(purpose

TABLE 8 EXERGY ANALYSIS RESULTS FOR CFM 56 ENGINE
.boundary conditions

Parameter	Our Analysis	Patent Results
Destruction Exergy	W 315025.18	W 310871.2
Fuel Exergy	W 19849867.29	W 19949752.4
Product Exergy	W 1953842.1	W 1963881.3
Exergy Efficiency	%98.41	% 98.45
Development Potential	W 5008.900	W 4818.5

The 3.97% margin of error suggests a very small deviation between our results and the documented ones. Such a conclusion offers evidence of the mathematical

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modeling which is truly applicable and dependable to the CFM 56 engine. Therefore, we followed this model application to the

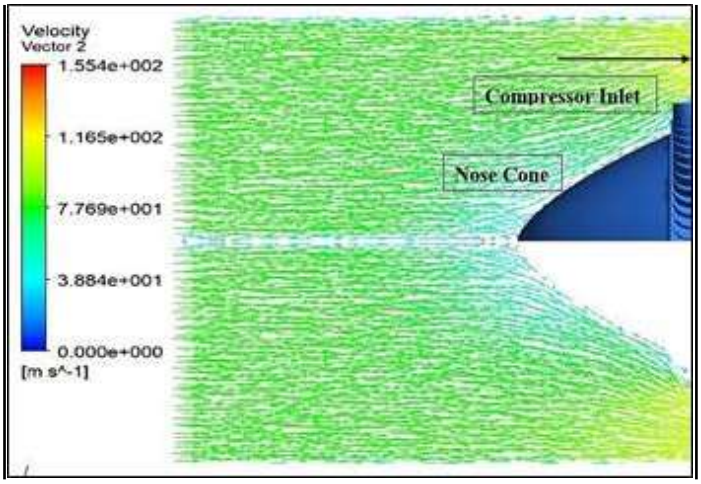

Fig. 15 Velocity vector flow over the compressor inlet

Steady State Flow Simulation of the Modified Engine with Integrated Generator

Trent 1000 engine, then we ran a test on it. Table 9 summarizes the exergy analysis data for the Trent 1000 engine which is

:given below

TABLE 9 EXERGY ANALYSIS RESULTS FOR Trent 1000 ENGINE

Parameter	Analysis Results
Destruction Exergy	W 209548.26
Fuel Exergy	W 16445457.92
Product Exergy	W 16235909.66
Exergy Efficiency	% 98.72
Exergy Development Potential	W 2670.0669

The project has gone above and beyond by providing all the necessary mathematical analyses such as this Brayton cycle and

.exergy analysis, which have been clearly and precisely presented

CFD Analysis

Analysis of the flow intersection and its influence on the engine performance was done through a CFD flow simulation to address

Next, the study was extended by the analysis of the alternative fuel system, which comprised the integrated generator in the upstream location of the main engine. This comprised working around a moving engine with the generator component, which introduced additional dynamics. Therefore, the target was to determine whether there was any deviation, or wake flow

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.disruption, and evaluate its impact on the engine output

Figures 16 and 17 are the ones that show the velocity vector and the velocity streamline of the flow over the assembly. It is obvious from these figures that the flow is consistent at the

.compressor inlet, and there are no flow behavior disturbances

the objections related to the inlet flow disruptions and the upstream generator configuration. The analysis in question was

:composed of the following two components

i. Steady State Flow Simulation of the Modified Engine without Integrated Generator

The flow simulation on the compressor inlet was performed using Ansys Fluent to check the flow behavior at the inlet of the compressor by applying appropriate mesh and by using specified

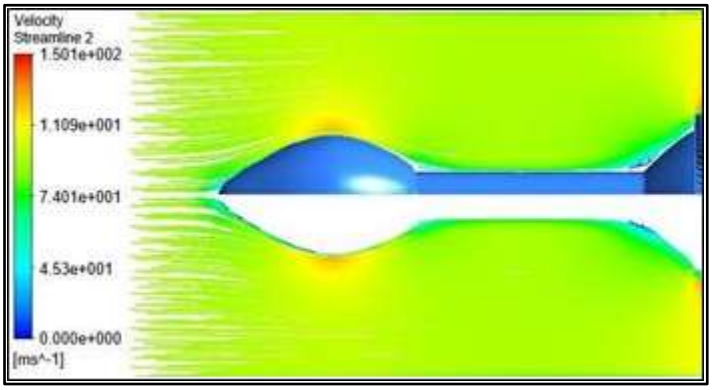

Fig. 16 Velocity vector flow over the generator ogive

Fig. 17 Streamline of the flow over the generator ogive

The finding of the CFD flow analysis for both the configurations is the same. In both situations, the airflow keeps its streamlined shape as it gets to the compressor inlet,

technical parameters of the generator as well as the relevant

with no turbulence or distortion after the installation of

generator ogive up stream. The ogive's shape and the scaling were precisely created to make sure the airflow behavior of the compressor inlet is not disturbed. The airflow on both sides of the engine is compromise, therefore the function of

.the axial compressor of the engine remains the same

CONCLUSIONS

This study has been intricate research on the feasibility of Vintage Trent1000 engine conversion to a gas turbine power plant. The literature review was thorough and entailed going through a myriad of research papers and patents, which laid the foundation for the selection of two patents for further and in-depth analysis. The first patent described a complete process not only for the air jet engine conversion into a power station but also brought to attention all the minuscule but very essential details in the issue of component removal, relocation, and upgrading needed for the conversion. The second patent presented a thorough exergy analysis framework tailored particularly for the type of CFM 56 engine, which significantly aided in the checking of certain

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.exergy parameters like efficiency and development further

Despite the existence of engine architecture differences between CFM 56 and Trent 1000 engines — especially in the spool configuration—we efficiently addressed the patent insights by means of adapting them to the triple-spool configuration of the Trent 1000 engine. Specific amendments encapsulated in the new Trent 1000 engine design were dedicated to the distinctive features of this aircraft while remaining in line with the original principles as described in the patents. Similarly, to achieve the goal of calculating the influence of the inlet air flow changes on the engine operation and performance, the comprehensive CFD analysis was developed. These results, however, both endorsed the project's presumptions and stressed that the designed

.conversion procedure had a broad spectrum

Summing up, this project has not only brought us to the advanced gas turbine power plants understanding but also developed our analytical capabilities and the capacity to

.solve problems in aeronautical engineering field

FUTURE RECOMENDATIONS

Regarding the future, many roads await that may be explored and perfected. Firstly, the required size and

configuration should be established using the detailed power calculations of the converted Trent 1000 gas turbine power plant. These estimations have to be undertaken in a cautious manner for taking into account load requirements, efficiency metrics, and operational parameters in order to achieve the maximum output. Along with this, the design and scheduled implementation of the electric circuit system of the actual converted system need meticulous attention. This means conducting an all-round examination of safety regulations, voltage regulations and the measures that protect both equipment and crew. The other side of this is that the results obtained should be widely communicated by means of patent publication. Aside from contributing to the present knowledge base on the topic, such documentation will also provide a foundational reference for future efforts in the gas

.turbine conversion domain

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