Design, Analysis and Fabrication of Ducted Fan

Project Reference No.: *45S_BE_3732*

College ***:*** *Dayananda Sagar College of Engineering*
Branch ***:*** *Department of Mechanical Engineering*
Guide(s) ***:*** *Dr K.C Panda,*
Student(S) ***:*** *Mr Rahul Yankanchi*
Mr Poorvik V Prasad
Mr Neeraj Ramesh Naik
Mr Nikhil Yadav PN

Keywords:

Turbofan Engines**,** Ducted fans, CFD

Introduction:

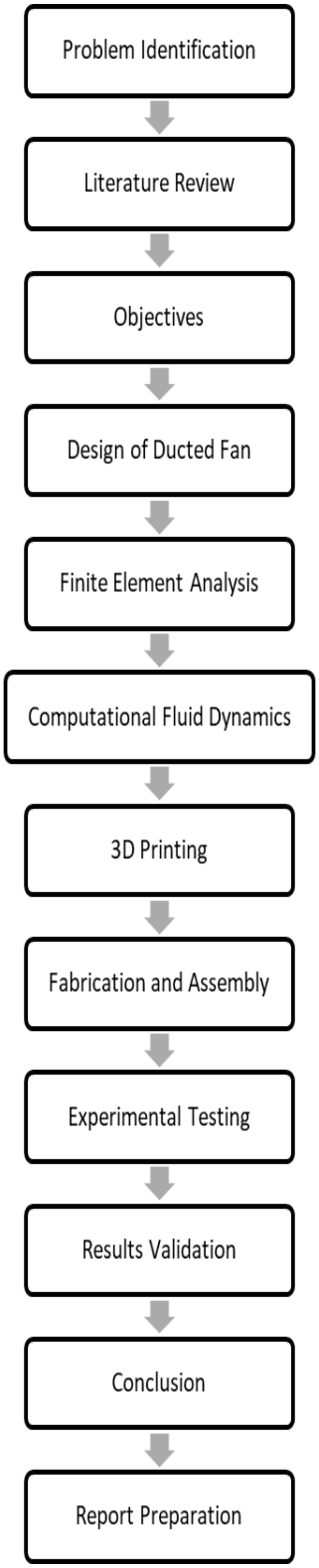
Ducted fans have an interest in the fields of commercial aircraft because they possess an ability to maximise payload capacity at minimizing vehicle size, they also have an ability to fly at high-speed having application in Commercial Flights and Turbofan Engines. The flow interactions between shroud, and rotor affect the design of optimal duct profile. Also, duct profile and tolerance of duct and blades, affect velocity-pressure variations and thrust. The project focuses on the design of a ducted fan followed by a finite element analysis and CFD on it, studying the effect on thrust and power requirement by changing the profile of the duct/ shroud. Validating the analysis data with the fabricated prototype model.

Objectives:

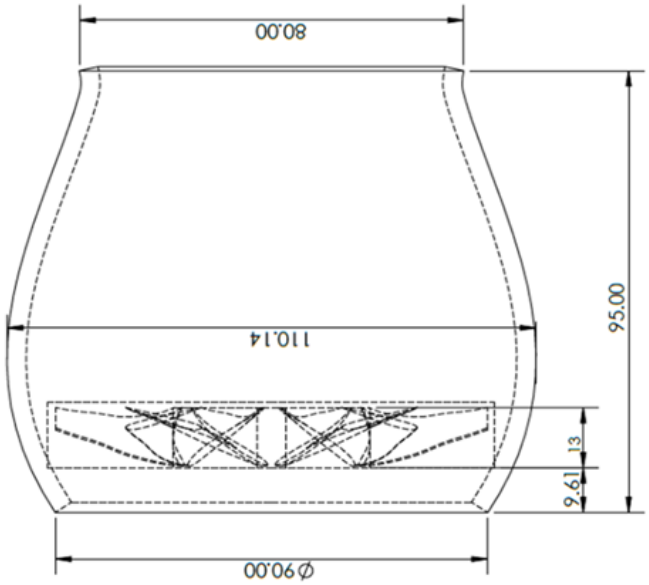
- Design of Ducted Fan
- Study the effects on the thrust and required power, by changing the profile and clearance of duct and blades
- Computational Fluid Dynamics (CFD) using SolidWorks.
- Fabricating the prototype.

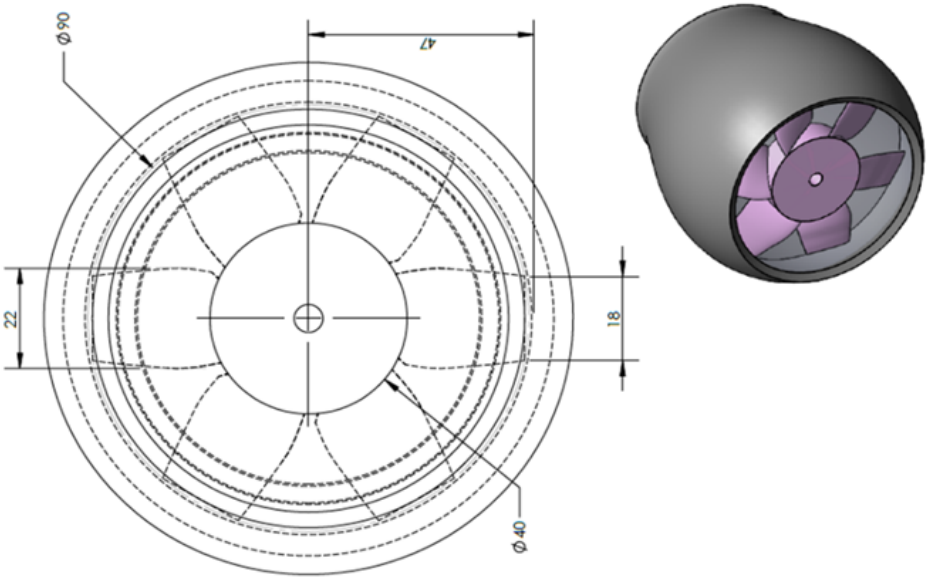
.

Methodology:

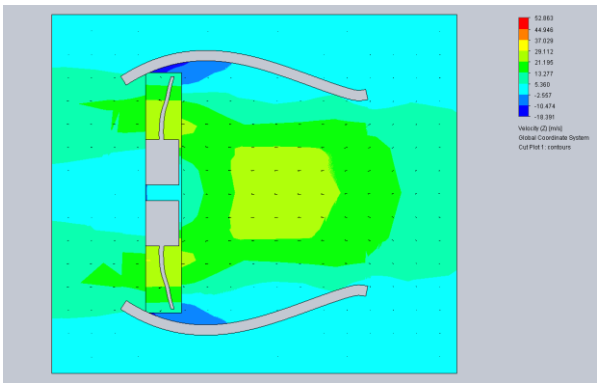


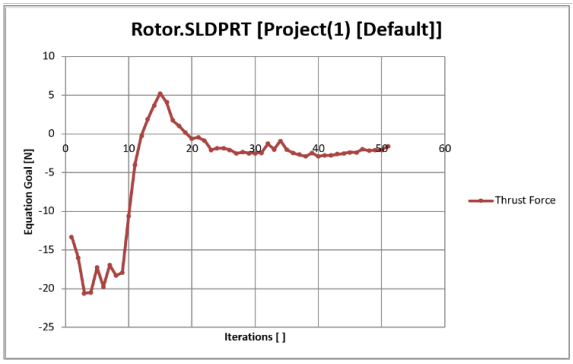
Design

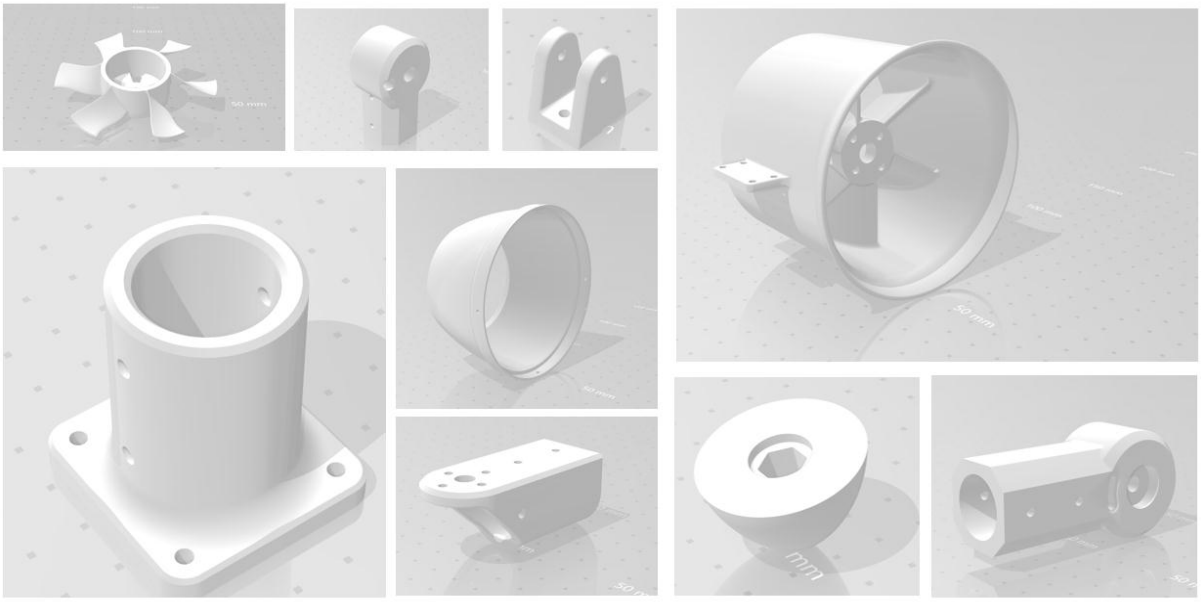


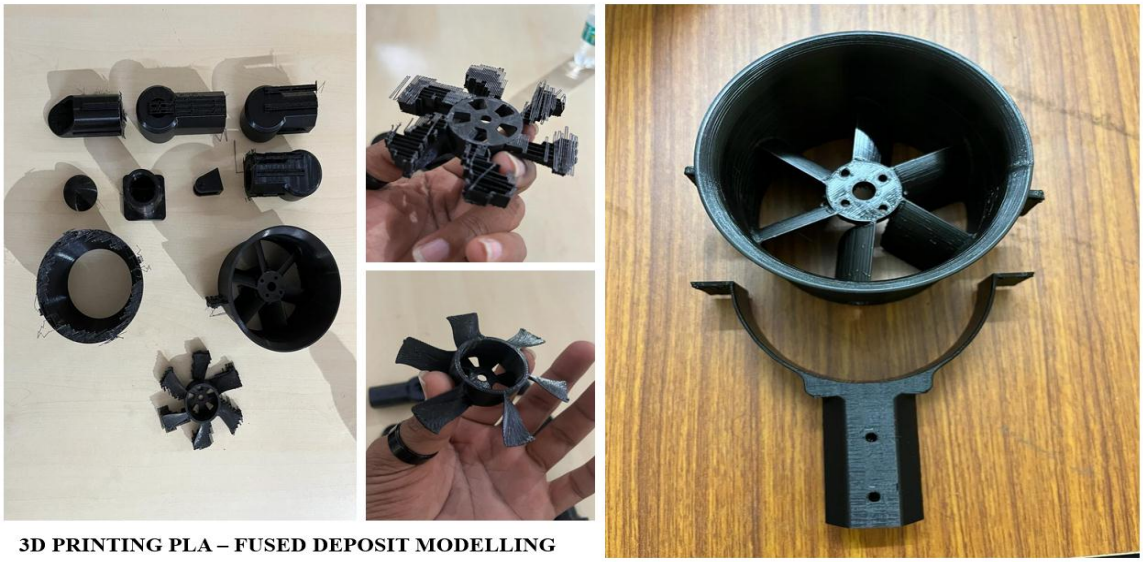


Results & Conclusion:









3D PRINTING PLA – FUSED DEPOSIT MODELLING

Name	Unit	Value	Progress	Criteria	Delta	Use in convergence
SG Minimum Static Pressure 1	MPa	0.10	100	0.00355148413	0.00067739308	On
SG Maximum Static Pressure 2	MPa	0.10	100	0.00456924026	0.000467136755	On
SG Minimum Total Pressure 3	MPa	0.10	100	0.00373482952	0.000305273898	On
SG Maximum Total Pressure 4	MPa	0.12	100	0.00336024005	0.0013642258	On
SG Maximum Dynamic Pressure 5	MPa	0.02	100	0.000601223044	0.000221104985	On
SG Mass Flow Rate 6	kg/s	0	1000	1e-08	0	On
SG Volume Flow Rate 7	m^3/s	0	1000	1e-08	0	On
SG Average Velocity (Z) 8	m/s	0	100	0	0	On
SG Force (Z) 9	N	-3.526	100	3.29777152	0.729899252	On
SG Force (Z) 10	N	1.919	100	0.956857183	0.879555958	On
Thrust Force	N	-1.607	100	3.87383372	2.00079911	On

Scope for future work:

Ducted fans are used for direct movement or lifting on a wide range of vehicles including aircraft, airplanes, hovercraft, and VTOL lift aircraft. High-bypass turbofan engines used in many modern aircraft are an example of the successful and popular use of fan design. The duct increases thrust efficiency by up to 90% in some cases, compared to a propeller equivalent in size in free air. Ducted fans are a little quieter, and offer great opportunities for vectoring thrust. The shroud provides good protection for ground workers from accidentally touching the spinning blades, as well as protecting the blades themselves from external debris or objects. By alternating the cross section of the duct, the designer can profitably affect the speed and pressure of the air flow according to Bernoulli's principle