



CASE STUDY /

Ansys + Turbotech

Turbotech Develops Efficient Aeronautical Propulsion Solutions Using Ansys' Simulation

"Ansys' simulation and the Ansys Startup Program helps us to save time and money because some years ago, people would have needed dozens and dozens of prototypes, but we have been able to have our products running efficiently and smoothly after just a few prototypes," Malet says. "Without Ansys' simulation tools, if we had to design test rigs for every component, it would take up to 10 years to be able to run this kind of engine efficiently and smoothly."

Guillaume Malet
Design Engineer / Turbotech

Established in 2017, Turbotech is a French-based company providing efficient and sustainable flight solutions with high-powered, low-consumption propulsion systems to the light aircraft industry. Light aircraft includes small planes or helicopters with a maximum takeoff weight of 12,500 lbs. To power the eco-friendly propulsion systems, Turbotech first incorporated Ansys simulation in optimizing heat exchanger technology and continues to integrate Ansys' tools to power their pioneering regenerative turbines and subsequent products. This includes the first low fuel burn turboprop, the first turbogenerators for hybrid-electric aircraft, and forthcoming hydrogen-powered turbomachinery.

Turbotech's signature microtube heat exchanger is much lighter and more compact than traditional heat exchangers while still being able to recover the heat normally wasted in exhaust gases and reinject it into the combustion chamber, which leads to dramatic fuel burn reduction. As a result, Turbotech's regenerative turbine has all the advantages of a turbine engine but operates with very low fuel consumption, making it a much cleaner choice. Further, Turbotech is the first company in the world to introduce regenerative turbines for aeronautical applications.

/ CHALLENGES

As a startup company, Turbotech had limited resources and needed access to simulation tools at a low cost. Additionally, they sought tools that were user-friendly, capable, and accurate. Coupled with structural analyses, Turbotech engineers needed competent tools to observe the aerodynamics of the turbine, including its behavior and vibration.

/ TECHNOLOGY USED

- Ansys Mechanical
- Ansys Fluent
- Ansys CFX

/ ENGINEERING SOLUTION

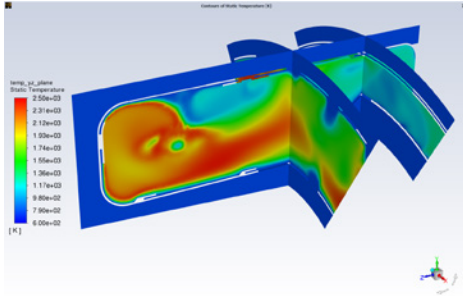
With access to Ansys' structures and fluids products package through the Ansys Academic Program, Turbotech integrated Ansys Mechanical, Ansys Fluent, and Ansys CFX into their workflow at an affordable cost. Ansys' multiphysics simulation enabled them to develop efficient propulsion systems at an accelerated pace, such as the first regenerative turboprop with the TP-R90 model (capable of up to 130 horsepower) and the first turbogenerators equipped for hybrid-electric aircraft with the TG-R55 and TG-R90 models for 55-kilowatt and 90-kilowatt continuous running power, respectively. Turbotech is also developing hydrogen-powered turbomachinery to offer customers greater energy efficiency. Turbotech's turboprops are suitable for small planes, helicopters, and unmanned aerial vehicles (commonly known as drones), while the turbogenerators are fit for hybrid planes and hybrid electric vertical takeoff and landing (eVTOL) aircraft.

/ BENEFITS

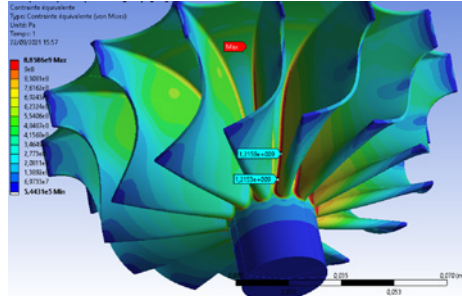
- Ansys simulation accelerated Turbotech's development by five times, enabling them to complete each product's prototype in two years instead of an expected 10-year period, which resulted in parallel cost savings.
- Turbotech used Mechanical, Fluent, and CFX to analyze and measure thermal and strain deformation, vibration, pressure losses, combustion, and fluid flow.
- Ansys simulation helped Turbotech determine the number of cycles — i.e., each shutdown and start-up of the engine — it could manage in its lifetime. Turbotech's turboprop and turbogenerator both have an impressive time of 3,000 hours between overhauls.
- Turbotech is currently using Ansys' tools to develop hydrogen-powered turbines that will support on-board cryogenic storage and contribute even more to sustainable aviation.

COMPANY DESCRIPTION

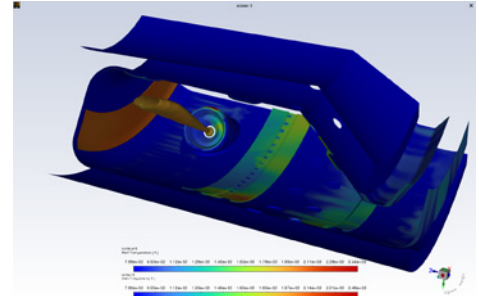
Turbotech is a global leader in high-technology aeronautical propulsion solutions for hybrid-electric and conventional light aircraft. Turbotech provides the light aircraft industry with next-generation high-powered turbine engines, enabling long range hybrid-electric flights with specifically designed high-efficiency turbogenerators and turboprops. Turbotech is currently developing hydrogen-powered turbine products that will enhance efficiency further.



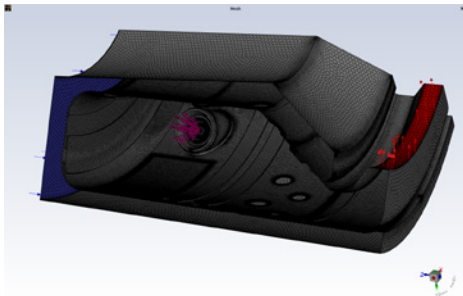
Fluid temperature contours are analyzed in Ansys Fluent using kerosene-air combustion models.



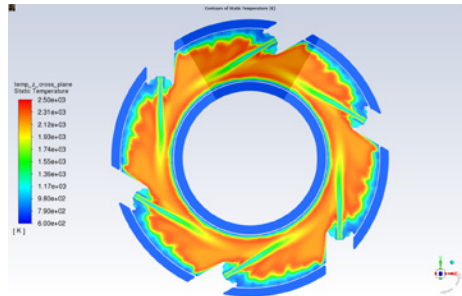
Static structural analysis in Ansys Mechanical illustrates equivalent stress on the turbine wheel rotating at full speed.



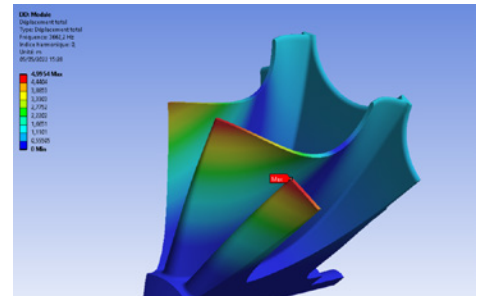
Ansys Fluent is used to visualize thermodynamics such as adiabatic wall model temperature plots inside the combustion chamber.



Mosaic poly-hexcore mesh of the combustion chamber and discrete phase modeling (DPM) of kerosene injection simulated using Ansys Fluent



Fluid temperature contour plot on the kerosene injection plane simulated in Ansys Fluent



Total displacement plot from modal analysis on a sector of the turbine wheel shown in Ansys Mechanical

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