

## *Biggest fan turns to biggest fan manufacturer*



Fläkt Woods has completed refurbishment work on what is believed to be the world's largest fan, part of the giant S1MA, the largest transonic wind tunnel in the world, located at the ONERA facility in Modane, France.

### ■ FACTS

**Customer:**

ONERA facility in Modane, France.

**Need:**

A major upgrade of the fan system for flight testing in ONERAS giant S1MA wind tunnel.

**Solution:**

Replacing the two giant counter-rotating fans, 15 meter in diameter, weighing 58 tons per impeller.



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When an aircraft moves through calm air, its aerodynamic behavior is the same as if it was immobile and the air was rushing past it. A wind tunnel is a test facility used to generate a flow of air past a scaled model of an aircraft. It provides various measurements to determine aerodynamic behavior and performance. In that respect a wind tunnel can be seen as an aerodynamic flight simulator.

Wind tunnel testing can be performed at an early stage in an aircraft development programme without having to wait for the first prototype. Over the last 50 years aerospace testing has been so extensive at the ONERA research agency, that even though the giant S1MA wind tunnel has been continuously maintained and modernised, an upgrade was required.

The bulk of the work involved replacing the two giant counter-rotating fans, (15m in diameter, weighing 58 tons per impeller and requiring 88 MW power), the fans comprise 12 blades upstream and 10 blades downstream respectively.

In order to verify the state of the impellers, aerodynamic calculation of the flow field through the blades was necessary, and this was difficult to achieve, requiring millions of mesh points for Navier-Stokes computation.

For this application, ONERA used CFD analysis. Once a report on their state was complete, ONERA invited tenders for their replacement.

However, because of the history of using metal and the cost implications of composites, the decision was taken to replace the existing steel fabricated blades with a new steel blade design, optimised to reduce peak stress level to half the previous level and using high strength steel in the blades construction, with double the original strength.

After nearly 4 years of extensive work, the project is now complete, with the supply and the installation of new impellers. As a major benefit, energy savings above 10% are obtained. One company stood out to win the contract with a proven track record of constructing and refurbishing the largest fans in the world, Fläkt Woods. The contract to replace impellers was awarded to the Company after engineers demonstrated detailed solutions to overcome the problems of wear and tear of the blades.

One suggestion included use of composites substitutes, which Fläkt Woods, a leader in this field, calculated would offer significant advantages to metals due to the flexibility of selecting various combinations of glass, Kevlar, carbon reinforcement and resin matrix. It was demonstrated that weight savings of over 27% could be made using these products.



## **ONERA**

(Office National d'Etudes et de Recherches Aérospatiales) is the French aerospace research agency, operating under the auspices of the Ministry of Defence. Its prime mission is to direct and oversee aerospace research, and transfer this research to industry

## **Fläkt Woods Group**

Fläkt Woods is a global company providing solutions for ventilation and air treatment for buildings as well as fan solutions for Industry and Infrastructure applications.

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