

Computers in engineering

Student team simulates historic flight

A team of engineering students from the **Instituto Tecnológico de Aeronautica (ITA)** in Sao Jose dos Campos, Brazil, recently used **ANSYS ICEM CFD** and **ANSYS CFX** software to simulate what is considered the first public flight of a heavier-than-air machine in Europe 100 years ago.

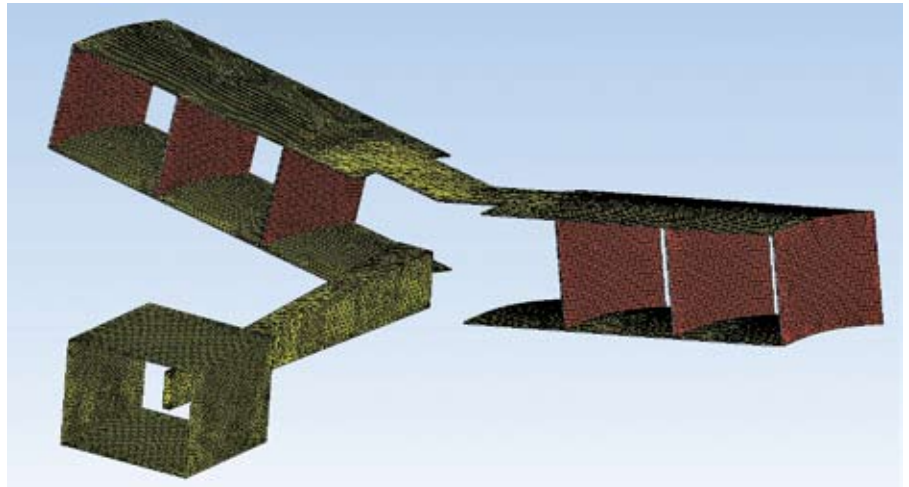
On October 23, 1906, Brazilian aircraft pioneer Alberto Santos-Dumont flew his aircraft, named 14-Bis, almost 61 m at Bagatelli Field in Paris, France. The flight, witnessed by officials from what would become the **Federation Aeronautique Internationale**, won Santos-Dumont the Deutsch-Archdeacon Prize of 3000 francs for surpassing 25 m and secured his place in aviation history as pilot of the first officially recognized airplane flight in Europe.

South American software distributor **Engineering Simulation and Scientific Software (ESSS)** sponsored the project to use modern engineering simulation to demonstrate the 14-Bis' ability to fly.

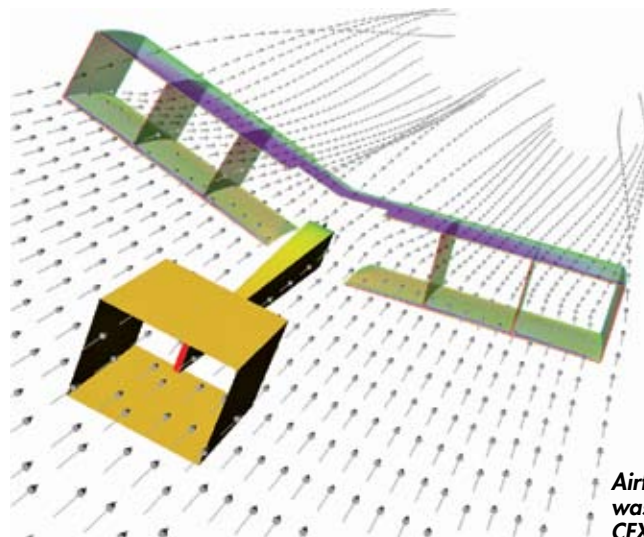
"We conduct a wide range of engineering simulation in fields such as oil and gas, aviation, and automation," said Marcus Reis, Director of Engineering, ESSS. "This project was an opportunity for us to use what we do best in support of a national project on the anniversary of the Santos-Dumont flight."

Unusual by today's standards, the 14-Bis consisted of a long neck at the front of the craft with wings in the rear, and the pilot maneuvered the plane from a standing position. After an initial failed attempt using 24-hp nominal power, Santos-Dumont increased the nominal power to 50 hp and was successful.

The model was developed using historic pictures, plans, and discussion. **ANSYS ICEM CFD** software was used to create high-quality surface and volumetric meshes of the plane's surfaces. Due to the model's complex geometry, the students meshed surfaces using hexahedral elements and represented volumes with a tetra/prism mesh. **ANSYS CFX**



*A CAD model of the 14-Bis was developed using historic pictures, plans, and discussion. **ANSYS ICEM CFD** software was used to create both high-quality surface and volumetric meshes.*



*Airflow around the 14-Bis was simulated using **ANSYS CFX**.*

CFD tools were used to simulate the airflow around the aircraft.

"The ease of use and accuracy of the software tools allowed our team to build the geometry and perform a series of studies in order to predict and understand the aerodynamic behavior of the 14-Bis airplane," said team leader Leonardo Bitencourt.

By analyzing drag, lift, and engine thrust, the students estimated possible

angle-of-attack and flight speed values to around 5° and 12 to 14 m/s.

Ground-related speed is generally quoted at 11 m/s. The discrepancy could be attributed to the presence of wind or ground effects during Santos-Dumont's flight, which were not taken into account in the simulation.

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