

# European Research Council grant for new simulation methods for predicting performance of the next generation of aircraft

*BSC researcher Xevi Roca has been awarded with an ERC Starting Grant to study the integration of time into simulation geometry.*

*The objective is to create new simulation tools for companies looking to revolutionise aircraft design.*

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BSC researcher Xevi Roca will receive a European Research Council Starting Grant, one of the European Union's most prestigious research grants, for a project to create new simulation methods to respond to the aviation industry's most pressing challenges. Roca, who has been working on geometry for aeronautical simulation since 2004, is proposing to integrate time as a dimension into the geometries of simulations. The aim is to improve the efficiency, accuracy and robustness of the aerodynamic performance simulations carried out on supercomputers such as BSC's MareNostrum.

## **The challenge**

The International Air Transport Association (IATA) forecasts that demand for transportation of passengers and goods will increase threefold in the next 30 years. Coupled with the restrictions imposed by the need for sustainable growth, this forecast is forcing the aviation industry to turn efforts to creating the next generation of aircraft. Such vehicles will be capable of carrying greater loads without using more fuel or emitting more CO<sub>2</sub>, and might even be able to reduce consumption and emissions.

Initial proposals for groundbreaking new designs from research centres and companies are reined in by the current inability to carry out simulations which show accurately and in detail both aerodynamic performance and the complex interactions between the engines and fuselage of future aircraft.

At present, the proof of concept tests carried out in the aviation sector are still highly reliant on making full-scale prototypes to be tested in wind tunnels. This method is expensive and offers little flexibility for changes in design or flight conditions. The fundamental problem is that the air surrounding an aircraft is perturbed in a wide range of spatial and temporal scales. It is therefore extremely difficult to recreate aircraft performance over time at a level of detail great enough to make the simulation results reliable.

## **The proposal**

Roca has proposed to the ERC a disruptive methodology which will substitute existing simulations, which are 3D in terms of space and 1D in terms of time, with 4D simulations in which the dimension of time will also be part of the simulation geometry. He argues that this new method has the potential to increase the capability and reliability of simulations, particularly those in relation to moving parts, without the need for increased computational resource.

Roca's proposal also includes exchanging the current flat-sided representations of simulation geometry for representations which naturally incorporate the curvature of different

aerodynamic components. This concept has already been proven viable in preliminary studies carried out by the researcher and his collaborators over the last five years.

The research work funded by the ERC Starting Grant is expected to take five years and will take the project name TESSERACT, which is the Greek word for a four dimensional cube.

### **Xevi Roca**

Xevi Roca has a PhD in Applied Mathematics from UPC-BarcelonaTech and worked for four years as a postdoctoral researcher at the Massachusetts Institute of Technology (MIT), where he took part in competitive projects on aerodynamic simulation. His experience in simulations for the aviation industry began with collaborations with industry leaders such as Pratt & Whitney and The Boeing Co. He has also provided scientific consultancy to the U.S. Air Force Office of Scientific Research. Since April 2015, he has been working at BSC on ways to improve geometrical methods for simulation as a basis for aircraft design.

See the full list [here](#).

ERC Press release [here](#).