

Autonomous Robird is one step closer

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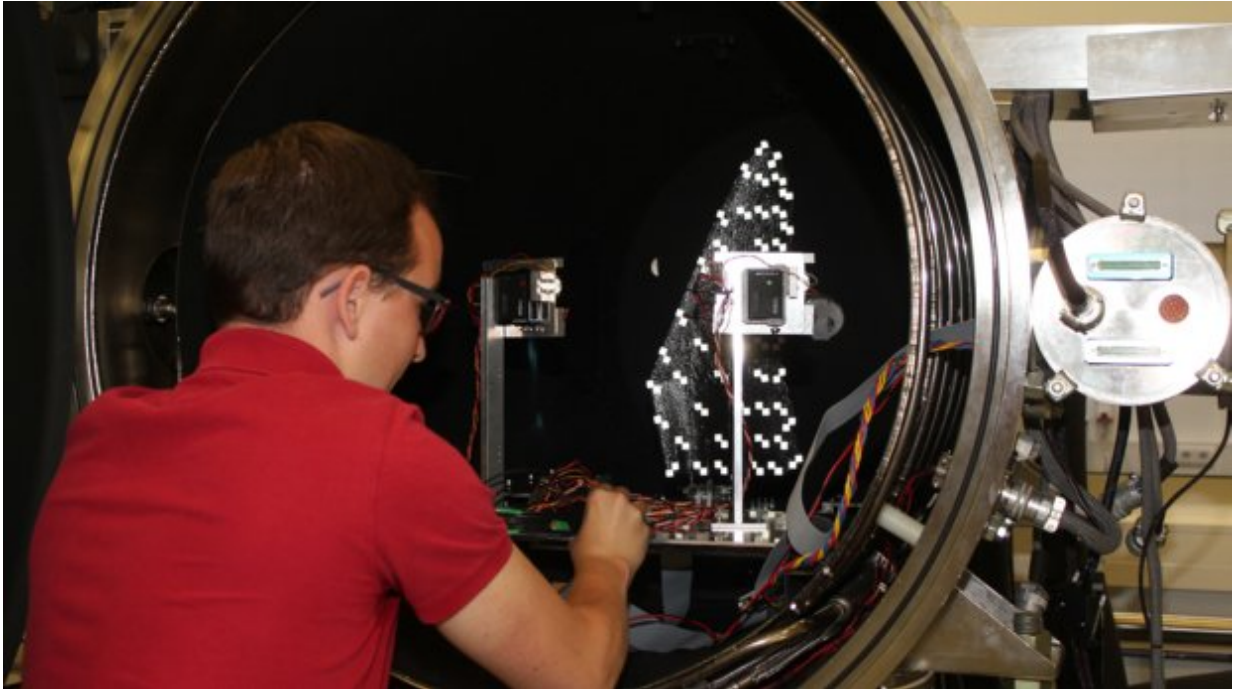
With the assistance of the European Space Agency ESA, robotics researchers at the University of Twente have taken an essential step toward the Robird's completely autonomous flight. This lifelike, robotic peregrine falcon from spin-off company Clear Flight Solutions will be used to chase away birds at airports and waste-processing sites. The Robird is now operated manually, but must ultimately be able to fly and dispel birds autonomously.

The researchers were successful in modelling the complete dynamics and mechanics of a flapping wing in a computer simulation - this, in order to steer the Robird more effectively and accurately with the electronics. To date, during the transition from manual steering to complete autonomy, only subsystems in the Robird were able to be modelled, and not a complete, moving wing. The combination of the model used, along with measurements in a [wind tunnel](#) and in a vacuum chamber, is unique in science.

"An autonomous Robird is a huge step forward," said master's student Berend van der Grinten, "but it's extremely difficult to visualise the play of forces in the wings. The standard models for 3-D aerodynamics (FEM) require considerable computing power and can't be applied to the electronics or to command and control".

Stroboscope, wind tunnel and vacuum chamber

To combine everything into a single model, Van der Grinten set about working with PhD candidate Geert Folkertsma in a revolutionary way. The robotic bird's 'actual' wing behaviour was measured in 3-D using two cameras and a stroboscope for delaying the motion. "A clever approach. This allowed us to film much more rapidly with relatively cheap cameras."



The wing motion was measured in the Technical Track faculty's wind tunnel at the University of Twente and in the vacuum chamber at ESA's ESTEC facility in Noordwijk. "There is no air in the vacuum chamber, so there are no aerodynamic forces, either. By measuring the flapping wing in both the wind tunnel and the vacuum chamber, the motion attributable to aerodynamics can be calculated precisely by means of subtraction. This is an essential fact. Measuring in the vacuum chamber was not easy. The sublimation of materials is a problem: this can contaminate the vacuum chamber. Special glue, tape and gaskets had to be used. There was also the risk that the cameras or motors would heat up and therefore fail. Since there is no air in a [vacuum chamber](#), the most important cooling had to be done by means of conduction from the material. Fortunately, we found solutions to everything and encountered no problems with the measurements.

Berend van der Grinten graduates on 28 August from prof. Stefano Stramigioli's Robotics and Mechatronics department (at the CTIT research institute). Earlier this year, Stramigioli was appointed Vice President of Research at the leading institute euRobotics. Stramigioli is also the chairman of RoboNED and of the LEO Centre for Service Robotics. Van der Grinten hopes to have the wing simulation model ready in time for his graduation. Geert Folkertsma will then complete the model of the entire bird.

About the Robird

The Robird is the flagship product of Clear Flight Solution, a robotics and drones spin-off from the University of Twente. The company recently received an investment of 1.6 million euro from the Cottonwood Euro Technology Fund. With this investment, Clear Flight Solutions wishes to grow into the position of the world's largest bird-threat regulation company. The damage caused by [birds](#) at airports worldwide - material damage and otherwise - is estimated to be in the billions. The nuisance caused by birds also occasionally results in fatal accidents. Furthermore, birds cause billions of damage worldwide in the agricultural sector, in the waste-processing sector, in harbours and in the oil and gas industry. One known problem is that birds are intelligent and get used to existing solutions to bird-threat management: they simply fly around them. The Robird, which realistically simulates the flight of a peregrine falcon, is a new, high-tech solution. The flight behaviour of the "Robird" is so realistic that birds believe that their natural enemy is present in the vicinity. This approach plays on a bird's fears, so habituation is no longer a problem.

Provided by University of Twente

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