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## **NIA researchers work to make aircraft imitate flight of birds**

By Susana Acosta, Special to the Daily Press

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HAMPTON — Imagine an aircraft that so closely resembles a bird that actual birds are fooled by it.

Researchers at the National Institute of Aerospace have created a model in their lab that can do just that in the hopes of boosting the performance of small-aircraft designs.

Cornelia Altenbuchner, a Ph.D. candidate from the University of Maryland, is working with Langley Professor James Hubbard at the National Institute of Aerospace to make airplanes imitate the flight of birds.

Altenbuchner's research, for her thesis in aerospace engineering, focuses on "flexible multibody dynamic modeling" — wings that flap.

Numerical simulations are crucial to her work so that she can make improvements in all respects of airplane flight: scaling down or up, aerodynamics, range, handling, cost and power consumption. The simulations have been turned into flying models and tested by the Air Force Research Laboratory, the Air Force's research command.

Altenbuchner, Hubbard and Aimy Wissa, another of Hubbard's students, have programed the current model so that it can use its autonomy and bird-like appearance to accomplish specific tasks. In addition to being used for research, this new generation of airplane models will be able to scout areas for law enforcement officials, assist with land-use planning, and monitor fires.

People have been trying to imitate the flight of birds for centuries – going back to humankind's first attempts to get off the ground. Most of those attempts ended in crashes. Fixed-wing planes came to be the preferred approach because of the simpler aerodynamics and structures. Bird-like wings are tremendously complicated but far

more effective. However, advances in computer modeling and simulation have made them possible.

"Birds have evolved for a reason, and this bio-inspired flight design which mimics birds will allow us to have the same advantages they have with respect to handling, which you can't get with fixed flight," said Doug Stanley, president of the NIA. "This project is really making progress over state-of-the art in the aerodynamic field. These unmanned aerial vehicles are extremely difficult to model, but by numerically analyzing the design, it's possible to model multiple configurations rapidly."

At NIA, the first work on flapping-wing designs was done not by a scientist or engineer, but by an artist. NIA bought the model, which researchers have been refining ever since. Hubbard's team now has a fleet of ornithopters that share impeccable resemblance to the flight performance of real birds.

With this as the starting platform, Altenbuchner enhanced the design and investigates the flight physics and dynamics of flapping wing flyers.

Altenbuchner has been working on improving the model's performance by fine-tuning its wing motion so that it can smoothly dive, glide and perch. Smoothing out those motions will be a must before any flapping-wing design elements can be used on actual airplanes.

"We want the airplane to move in the same fashion as a fish," Altenbuchner said.

"You never see a fish speed up or slow down — you just see it moving forward with constant speed. This is one way to describe what we are trying to do with airplanes. We want to eliminate the bumps in its path, so to speak, and just have it fly smoothly".

Hubbard has created a company, Hubbard Innovative Systems, to market his ornithopters. One of the functions of the National Institute of Aerospace is to generate spinoff companies so that the technology gets into the market and the economy. Hubbard expects his clients initially to be hobbyists and then later perhaps government customers.

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