DESIGN TO MIMIC BIRDS IN FLIGHT

Leonardo's michanical dawings

A book published by Leonardo da Vinci in 1505 included a series of manuscripts on the flight of birds. Leonardo was fascinated by the idea of flight and produced several plans for flying machines that would mimic the flapping of bird wings.

Leonardo's wing designs were the inspiration for many scientists and inventers through the ages that attempted to achieve flight that eventually resulted in a fixed wing, engine propelled machine credited to the Wright Brothers with their first controlled powered airplane flight at Kitty Hawk, North Carolina on December 17, 1903.

The creation of a machine that could mimic the flight of a bird was never achieved until a Dutch student by the name of Nico Nijenhuis at the Technical University of Twente was challenge by an advisor to choose an experimental project for his Masters thesis based on a crude prototype of a mechanical bird that his advisor provided and said, "Figure out how this works, and how to make it better."

The advancement of fixed wing flight was through scientific studies, calculated forces and testing but to mimic a bird in flight is more complex and the flapping-wing flight of a bird is still not understood. Nico had to begin as Leonardo did by studying birds. Based on early success, Nico formed a company called Clear Flight Solutions and chose as his prototype models, birds of prey and named them Robirds, a Robird Peregrine Falcon as well as a Robird Eagle.

The engineering team at Clear Flight Solutions created the Robirds out of 3D printed glass fiber and nylon composite material, printed to look as real as possible. The 3D printed body is formed and comes out of the machine with full colors of the bird. The realism took on real meaning in the challenges faced in making the Robirds to mimic the wing movement of a real bird. Nico had to figure out which parts of flapping-wing flight could be simulated to give the realistic appearance and performance of a bird in flight.

Instead of flapping from a single joint, bird wings deform across the entire length as the bird moves through the air. Nico designed the wing giving a pitching motion on the tips of the wing that will deform the wing with an upward and downward movement. On-board sensors and stabilization software gives the prototype a convincing approximation of a bird in flight.

Nico's Robird, Peregrine Falcon

The greatest challenge in engineering was to generate lift and propulsion from the flapping-wing flight that has eluded other scientists and inventers. Nico approached the problem using a lithium polymer battery for power to provide the robotic wing action and simplified the complex wing motion so each foam wing flexes to different degrees across its length and attached the wing using a double hinge at the root.

ADVANCEMENT IN SCIENCE AND INDUSTRY

Nico's Master's Degree project not only advanced the science of flight but it created a new industry. Test flights at waste management sites showed that the realistic flight of the predator raptor Robirds reduced bird populations by over 75 percent over time. Those are significant numbers when looking at other areas of concern in reducing bird populations at sensitive locations.

Bird collisions at airports in the United States are suggested to be over 11,000 per year. The predator looking Robirds success is based on their flight performances that mimic a real bird. Drones and small helicopters are not effective in scaring birds and sound devices only work a few times until birds become accustomed to them. Studies at airports are being conducted to define these early successes of the Robirds as a long term solution for moving bird populations away from airport sites.