BIRD IMITATING DRONES

These tiny aviators are more agile than any aircraft — but that may be about to change. Inspired by the aerial abilities of birds, bats and insects that are crafting a new generation of ultralight drones that lack propellers and are equipped, not with fixed wings, but with flapping ones.

Summary

Unmanned aerial vehicles, commonly called drones, are being increasingly used in ecological research, in particular to approach sensitive wildlife in inaccessible areas and for long term surveillance which includes the high altitude long endurance (HALE), medium altitude long endurance (MALE) and small altitude long endurance (SALE) surveillance.

Operation Capabilities

- It flies by flapping its wings as a means of lift and propulsion and it has the realistic appearance and weight of its living counterpart.
- The Drone Bird mimics nature by studying the motion and behaviour of birds, and combining technical expertise, engineers produced a true-to-nature robotic bird.
- The drone bird is realistic, covert, lightweight, and unobtrusive.
- The bird drone can be able to fly in HALE, MALE and SALE according to the operation requirement.
- This stealthy drone bird is primarily for surveillance and reconnaissance. It is a fixed-wing unit with various uses, such as border control and observation.

Features

Although multiple designs are there however the common features which includes from the Bird drones for long term surveillance are:

- Real-time telemetry link
- Standard IR and visible spectrum cameras
- Payload max. 500 grams.
- Endurance up to 1.5-2 hours.
- Operational ceiling 10,000 ft. AMSL
- Common temperature limits -10C to +40C
- Interchangeable sensor modules
- Automatic launch and landing
- Various autonomous modes

Advantages and Disadvantages

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Advantages	Disadvantages
The manoeuvrability is high.	Efficiency is low
An optimized flapping wing could require 27 percent less power than its optimal steady-flight counterpart at small scales.	The power requirement increases drastically at large scale
Wings that can vary their shapes as freely as birds' wings could have advantages for small aircraft in built environments.	Varying shapes of wings will become difficult for manufacturing and reduces efficiency
Stable in windy condition and able to land on	They cannot go at higher altitude like the fixed

improper surface	wing drones
Bird-like robots could assist in medical emergencies.	Their speed is generally low
They are good for surveillance and generally not detectable and used for military purposes.	The flapping causes a significant increase in the induced drag.

The top innovative Bird Drones market designs

- **THE EPFL DRONE**

(EPFL)

- Engineers in the EPFL Laboratory of Intelligent Systems have designed a new drone inspired by a raptor. When the researchers say raptor, they're not talking about a dinosaur or the Ford pickup. They're talking about a bird of prey. Specifically, the northern goshawk. A northern goshawk is a fast and powerful bird that's able to fly effortlessly through forests

Features and Capabilities

- The drone can change the shape of its wing and tail to change direction faster, fly slower without falling out of the sky, and to reduce air resistance when flying fast.
- It's clear in the images that the drone uses a propeller for thrust rather than flapping wings. Researchers say the propeller is more efficient.
- One big benefit of this design over a quadcopter is that the bird-inspired drone can fly for a long time while being almost as agile as a quadcopter. Researchers do note that flying the drone is complicated because of all the possible tail and wing configurations. They intend to integrate AI into the final design allowing the drone to fly semi-automatically.
- It moves its wings and tail in tandem to create the desired motion from rapid changes of direction when hunting in the forest to fast flight when chasing prey in open terrain. The bird is also able to efficiently glide to save energy. The drone's design extracts principles from agile avian flight, creating a drone approximating the flight performance of a raptor.

- ALBATROSS INSPIRED DRONES TO SURVEY THE OCEANS

- The albatross is one of the planet's largest birds, with a wingspan of around 11 feet,the longest wingspan of any living bird species. They can fly hundreds of miles in 1 day, while exerting little effort. Some individual albatrosses are known to circumnavigate the Southern Ocean three times (covering more than 120,000 km or 75,000 miles) in one year!

(Albatross)

Features and Capabilities

- An Albatross relies upon gliding and soaring flight, to fly long distances. These manners of flight are unpowered — instead so that they can ride the breeze of flapping to remain aloft, their wings are merely extended by the birds away from their body. +
- The MIT researchers developed a new model to simulate dynamic soaring and have used it to identify the optimal flight pattern that an albatross should take in order to harvest the most wind and energy. They found that as an albatross banks or turns to dive down and soar up, it should do so in shallow arcs, keeping almost to a straight, forward trajectory.
- The engineering potentialities of dynamic soaring are tantalizing: a robotic albatross could survey the oceans (or ride the wind shear of jet streams), and collect oceanic and atmospheric data, travelling at over 40 knots with a virtually infinite range.
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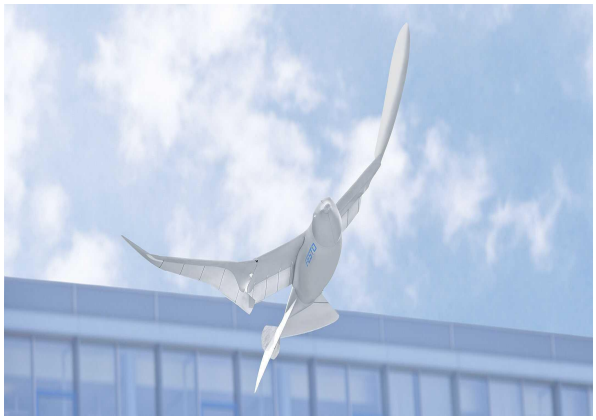
- **SMARTBIRD FESTO**
- For the SmartBird, Festo was inspired by the herring gull. The ultralight flying model impresses with its outstanding aerodynamics and maximum agility and is able to take off, fly and land without an additional drive.



(SmartBird Festo)

Features and Capabilities

- Its wings not only beat up and down, but twist in a specific manner. This is done using an active articulated torsion drive, which provides both lift and propulsion. With this functional integration, Festo has technically deciphered bird flight.
- Bird flight decrypted: technical adaptation of the natural model.
- Ultralight flying object: outstanding aerodynamics and maximum agility.
- Active torsion: targeted contortion of the beating wing.
- Intelligent functional integration: Uplift and propulsion in one movement.
- Scientific forerunner: measuring the aerodynamic

- **RUSSIA'S SNOWY OWL**

- An Owl-Inspired Russian Spy Drone.

(Snowy Owl)

Features and Capabilities

- Russia has unveiled its newly developed a combat surveillance Drone disguised as a bird of prey-in this case a snowy owl, at an annual military Expo in Moscow
- The unmanned aerial vehicle (UAV) is designed to be difficult to detect, can track any assets and is equipped with a laser that gives it the ability to direct Russian fire to specific positions.
- Weighing only 5 kilograms, it can be carried and launched by one person.
- The company has also developed a falcon drone. It is said to be able to fly for up to 40 minutes and cover distances up to 20 kilometres.

- **METABIRD**

- The MetaBird is the latest evolution of the original Bionic Bird.

- Its range of 150m is perfect for wide open spaces. The feeling of freedom of a flying animal is impressive thanks to the realism of its movement. The control with a smartphone via an application is particularly intuitive so that you can quickly become one with your MetaBird.

What's new in MetaBird

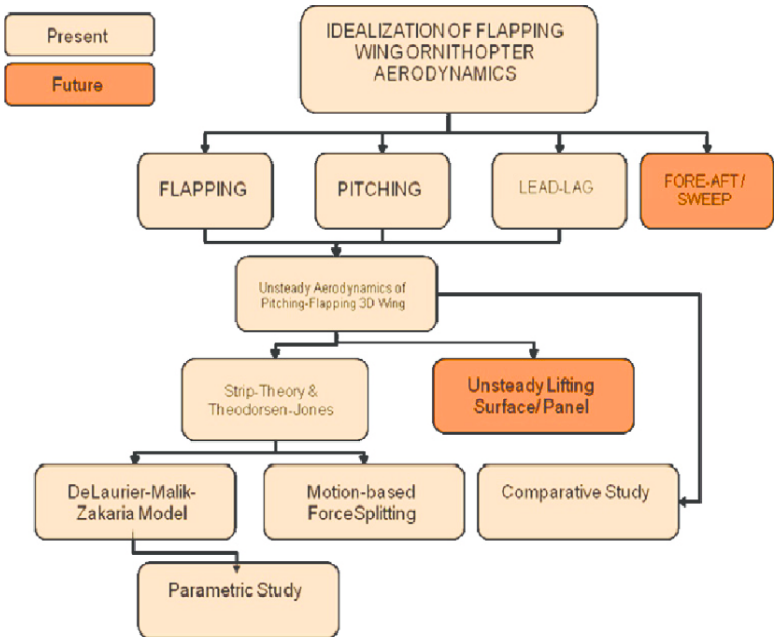
• A more powerful and robust engine makes the MetaBird even more dynamic and spectacular during hundreds of hours of flight.
• Its new 60 mAh Lipo battery weighing just 1.7 grams guarantees 10 minutes of gliding, turning and aerobatics.
• It's a very compact and light box (barely 130 grams) and is easy to take along.
• The MetaBird's wing balancing is simplified with the sliding ballast system.

(Metabird)

Features and Capabilities

- Take control by simply using your smartphone. Fly the closest drone to a bird by its realistic design.
- Precise control by dedicated 2.4 GHz joystick.
- Autonomous recharging outdoors more than 15 times.
- Advanced technology -Light and miniaturized like a dragonfly. Propeller-less – Safe.
- Additional steering appendix – manoeuvre in the living room, around furniture!
- Take off from the ground thanks to its insect legs and shorter wings.
- Adjustable long tail – 4 flight speeds.
- Front and rear bumpers, elastic wings and tail.
- Range of 100 meters – Speed 18km/hour – 8 minutes flight time for 12 minutes charge.

- **FLOWCHART FOR DESIGNING**



- **How to Design & Build Ornithopters**

- **Power Systems:** Choosing the right motor and battery are both essential for building a successful ornithopter. Here, I will explain some of the different options and how to choose the right power system.
- **Gear Design:** Unless you use a rubber band for power, you'll probably need to gear down the motor, to give it enough torque to flap the wings. The gearbox can be one of the most challenging parts of your ornithopter to build. The information here will make it much easier.
- **The Flapping Mechanism:** Here is where we convert the rotary motion of your motor into an oscillating wing motion. This is what makes your device an ornithopter instead of an airplane or helicopter! Several different mechanisms and construction techniques are described. The Ornithopter Zone web site also has a software program that can help you design your own flapping
- **Wings:** When building ornithopters, an efficient wing design can make the difference between failure and success. There are several general types of ornithopter wing. In this section, I'll describe the advantages and disadvantages of each type, and I'll tell you how to build them. This is where we talk about aerodynamics, in case you've been wondering where the lift comes from.
- **Stability and Control:** It's pretty easy to stabilize a free-flight ornithopter, but when you add radio control, some surprising things happen. Often the ornithopter refuses to come out of a turn! Just as there are several ways to steer an ornithopter, there are also some things you can do to avoid these problems.

- ## CHALLENGES IN BUILDING

- In order to better study the control of flapping wing flight one has to develop a large scale bird imitating drones. It is capable of carrying a heavy computer and sensor package and is designed especially for the application of controls research. The design takes special care to optimize payload capacity, crash survivability, and field repair abilities. This thesis covers the design process of both the mechanical and electrical systems of the bird drones and initial control experiments.
- The unsteady fluid dynamics of flapping wings are poorly understood and it’s difficult to get an ornithopter to maneuver as desired.

- These small flying machines have struck the imaginations of many as ideal platforms for a variety of tasks including systems monitoring and surveillance where a swarm of tiny agents would be 9 unobtrusive and have better access to confined areas than larger flying vehicles.