Additional technical information on RoboSwift

Technical details

Span	50 cm
Length	25 cm
Weight	100 grams
Range	1 km
Endurance	up to 20 minutes

RoboSwift, no cameras mounted on the wing. Source: Team RoboSwift.

Morphing

Aerial birds flap their wings up and down to gain speed or height. Less obviously, they also adjust their wing geometry while flapping or gliding. One of nature's most aerial and efficient flyers, the common swift, inspired the shape shifting of the wings on RoboSwift. Research performed at Wageningen University by David Lentink, in cooperation with other universities, showed that the swift is able to fly 60% longer and up to 100% further using the morphing capacity of its wings. Also, the turns that a swift can make are up to three times tighter because of changing wing geometry. The results of this research was published in Nature on April 26, 2007.

These large benefits are possible because the swift can very precisely adjust its feathers to the flight condition. It changes several parameters simultaneously during morphing, including wing sweep, wind area, the local curvature of the wing (airfoil camber) and the wing slenderness (aspect ratio).

Camera systems and mission performance

RoboSwift will carry three microcameras on board as its payload, each comparable in size to the cameras used in cell phones. Two are mounted on the wings and look forward. These are used for navigation and allow the pilot to look 'through the eyes of the bird'. The wing-mounted cameras are also used to perform bird behavioural research. This could greatly enhance the possibilities of biologists to observe birds (e.g. the swift itself) in flight; currently such research is performed using monochromatic radar imagery that shows a cloud of dots - a flock of birds.

A third camera is placed in the fuselage and points downward. This camera is used for ground surveillance. The aircraft is designed to support ground personnel during a hostage scenario. Other civil observation applications can also be performed using this camera, such as crowd control during demonstrations, or tracking hooligans under the tense conditions of a football match. The Dutch police (KLPD) acknowledged the relevance of these possibilities and showed interest in further development of the system.

Propulsion

Unlike the common swift, RoboSwift does not propel itself by flapping its wings. To gain height between gliding flights, a propeller is used, that can fold back when power is turned off. This will reduce the drag incurred during glides.

RoboSwift is propelled by a very light electromotor. This motor is a brushless engine that produces more than 100 grams of thrust in combination with a propeller. The engine is controlled by an electronic speed control (ESC) that translates the commands that the pilot sends to the receiver into pulses that can drive the rotor. It takes its power from a two-cell Lithium Polymer battery.

Materials

The wings and body of the mechanical bird are made of carbon fibre composite, which is very light and very strong. Conveniently, it also gives the aircraft about the same colour as the real bird. Moulds are used to fix the material in a streamlined shape.