

August 8, 2018

Use of the Cormorant UAV in Agriculture

OVERVIEW

Cormorant is an Unmanned Aerial Vehicle (UAV) developed by Tactical Robotics Ltd., a fully owned subsidiary of Urban Aeronautics Ltd. Following a decade of R&D, Cormorant's prototype, which



combines VTOL capabilities, agile control and all-internal lift rotors, is already achieving an 'order-of-magnitude' improvement in safety and operational capabilities over standard helicopters. With all internal rotors, a car-sized footprint and a 500 Kg load, the potential for employing Cormorant for Aerial Application is enormous.

Aerial application is the use of airplanes and helicopters to seed, fertilize and treat crops with protective products.

Moving into the future, agricultural aviation is facing two significant challenges. First, the world is facing a growing shortage of pilots that is also affecting the availability of Ag pilots. The agricultural industry has an aging pilot workforce and not enough young pilots to replace them. Second, increasing restrictions are being placed on aerial application due to the drift of material to adjacent fields and populated areas, which is far less tolerated today than in the past.

The dwindling pool of pilots is taking place at a time when the technology for unmanned aerial vehicles (UAVs) is rapidly evolving and offers hope that a technological solution is on the horizon.

CONSIDERATION OF UNMANNED AIRCRAFT

The use of small, unmanned helicopters for aerial application was introduced in Japan in the 1990s. To date, more than 2,000 Yamaha, Fuji and other manufacturers' unmanned helicopters for aerial application have been sold, predominantly in Japan and Korea. These small helicopters however cannot replace traditional aerial application aircraft due to their limited payload capacity, (between 20-30 kg of material) which is sufficient only for small fields. The average farm size in Japan is 1.5 hectares (3.7 acres), compared to 441 acres in the US. In recent years, electric quad-copter and multi-copter 'drones' have become ubiquitous in the field of aerial surveillance and are also being considered for small package delivery, however they carry an even lower payload Compared to the small RC helicopters.

High payload, fixed wing planes and helicopters require a deployment infrastructure (where the aircraft are loaded, take off and land) which is most often an airstrip at a distance from the fields requiring treatment. This would impose a flight path that crosses roadways and potentially other civil airspace. For an unmanned aircraft, carrying 500 Kg of potentially toxic chemicals, such authorization to fly over people is far from certain.

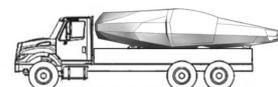
The ideal solution would be a compact aircraft that would carry at least 500 kg of material but would still be able to perform precision aerial application, a function that virtually necessitates a VTOL platform. But this aircraft should also be transportable by road to the area to be treated and then deployed within the perimeter of that area, as a pre-arranged closed airspace. This would enable the entire process to take place at the convenience of the operator without the need to arrange clearance for every sortie, alongside of a requirement to close roads or follow a lengthy circuitous flight path in order to bypass inhabited areas.

Tactical Robotics' Cormorant is the answer. It is a compact, VTOL aircraft that can be transported by truck, deployed within the perimeter of the area to be treated and has a payload capability of 500 kg. In addition, it is an aircraft with unique aerodynamic characteristics that generate groundbreaking advances by providing precise and efficient application while at the same time eliminating drift altogether.

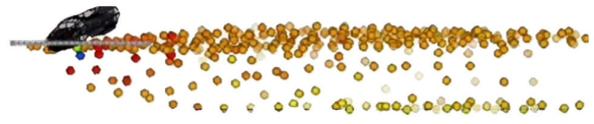
CORMORANT

Cormorant is an aircraft that:

- Takes off and lands vertically with high precision
- Can vary its application speed from runs at up to 100 knots down to very slow flight or hover
- Is the size of a car and can be road transported to any field on top of a truck or on a trailer



- Has internal rotors that allow it to fly in obstructed airspace (electrical wires, trees, poles) without the risk of rotor blade strikes
- Does not create updrafts behind it, eliminating the main cause of drift on aircraft and helicopters
- Has high a velocity downwash directly below the aircraft, enabling extremely precise aerial application of selected areas of the field with 100% of the material finding its way to the affected plants, including superb coverage of the bottom of the leaves
- Ideal for plantations where the chemicals need to be pushed down through the tree canopy
- Quiet, so when working at night to increase its utilization, does not create a disturbance to neighboring inhabited areas



Cormorant is also extremely cost effective in that it eliminates all the costs associated with employing a pilot, can work 24/7 due to its quiet operation and can save materials by adjusting the flight speed, dosage and level of foliage penetration to match the exact requirements of the crops in the field being sprayed.

Cormorant is designed to the same FAA standards that are used for manned helicopters with equivalent reliability and safety. It relies on the most advanced and reliable sensors and flight control systems available. These are the same instruments and computers that are integrated into today's commercial aircraft. Its unique, enclosed rotors add an additional level of safety both in the air with regard to obstacles and on the ground with respect to personnel

The Cormorant prototype has successfully completed more than 250 flights and is currently flying fully autonomously.

- Powerplant: Single Turbomeca Arriel 2N turboshaft
- (985 SHP Uninstalled T.O. Power @ S.L. ISA)
- Basic Empty Wt.918 kg (2,020 lb)
- Max T.O. Wt.1,682 kg (3,700 lb)
- Payload + Useful Fuel Wt764 kg (1,681 lb)
- Mission Wt. (440kg payload Ref)1,520 kg (3,344 lb)
- Max Speed 180 Km/hr (100 Kt)
- Fuel Flow @ Mission Wt; 90 Kt *.....208 kg/hr (458 lb/hr)
- Endurance (300kg Payload (Ref))2.6 hrs
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