UAV (VTOL) Vertical Takeoff & Landing

Robotic Hardware Systems

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Definition

- UAVs are unmanned aircraft piloted automatically or remotely, for civilian use or for the benefit of the armed or security forces of a State. Depending on the capacities required, their mass varies from a few grams to several tonnes. Their autonomy can reach up to several dozen hours (compared to the typical two hours of autonomy for a hunter).
- Today, their applications have been expanded and they are no longer limited to the industrial sector. They are also used in hospitals, museums, airports, etc.
- A vertical take-off and landing (VTOL) aircraft is one that can hover, take off, and land vertically.

Physical Design for various applications

- Foxtech Nimbus VTOL V2 Aircraft for Mapping and Survey
- More steadily
- Max 15km range
- Adapt to heavy wind
- DA16s 16-channel radio
- Newly upgraded system
- Integrated with datalink and radiolink

Physical Design for various applications

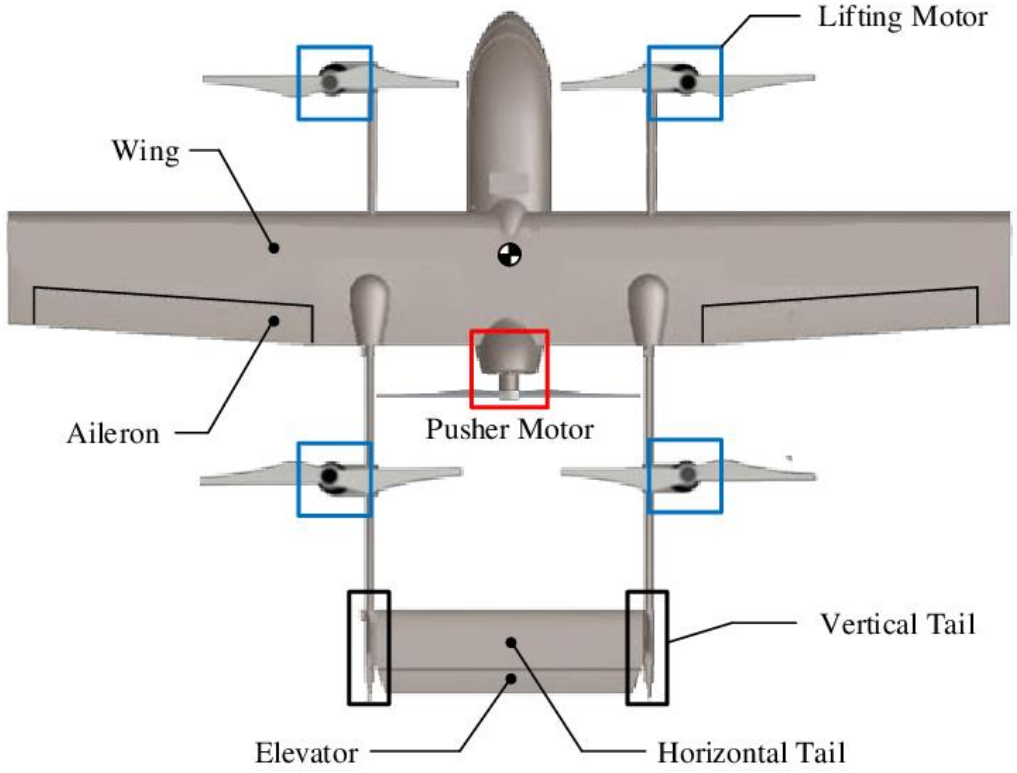
- UKRSpecSystems Hybrid VTOL UAV
- Hybrid VTOL UAVs combine VTOL capability with the standard forward propulsion of a fixed wing UAV. In many hybrid VTOL UAVs, rotary lift propellers are typically incorporated into the aircraft's wings, which then transition for forward flight.Scan the shelves and deliver data such as "Out-of-stocks, on-shelf items requiring correction, missed price changes, and missing flag tags"

Physical Design for various applications

- Halvetis-Jabali VTOL
- Vertical Take-Off And Landing Fixed-Wing UAV Designed For Mapping, Inspection, Surveillance And Rescue Operations.
- able to process data in real time for automatic recognition of license plates, people and vehicles counting, target tracking, object detection and much more.
- Jabali is an extremely versatile platform with multiple payloads, for mapping and ISR applications.

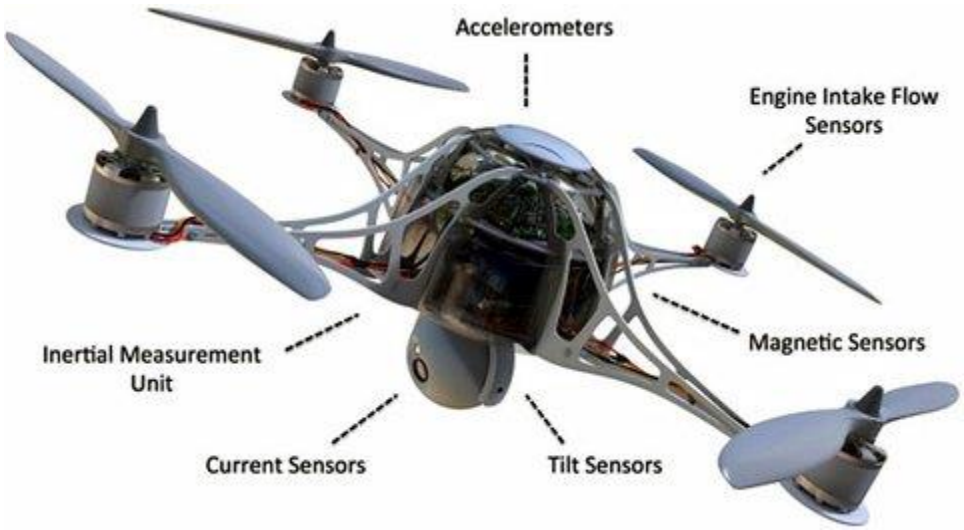
Locomotion System & Actuators

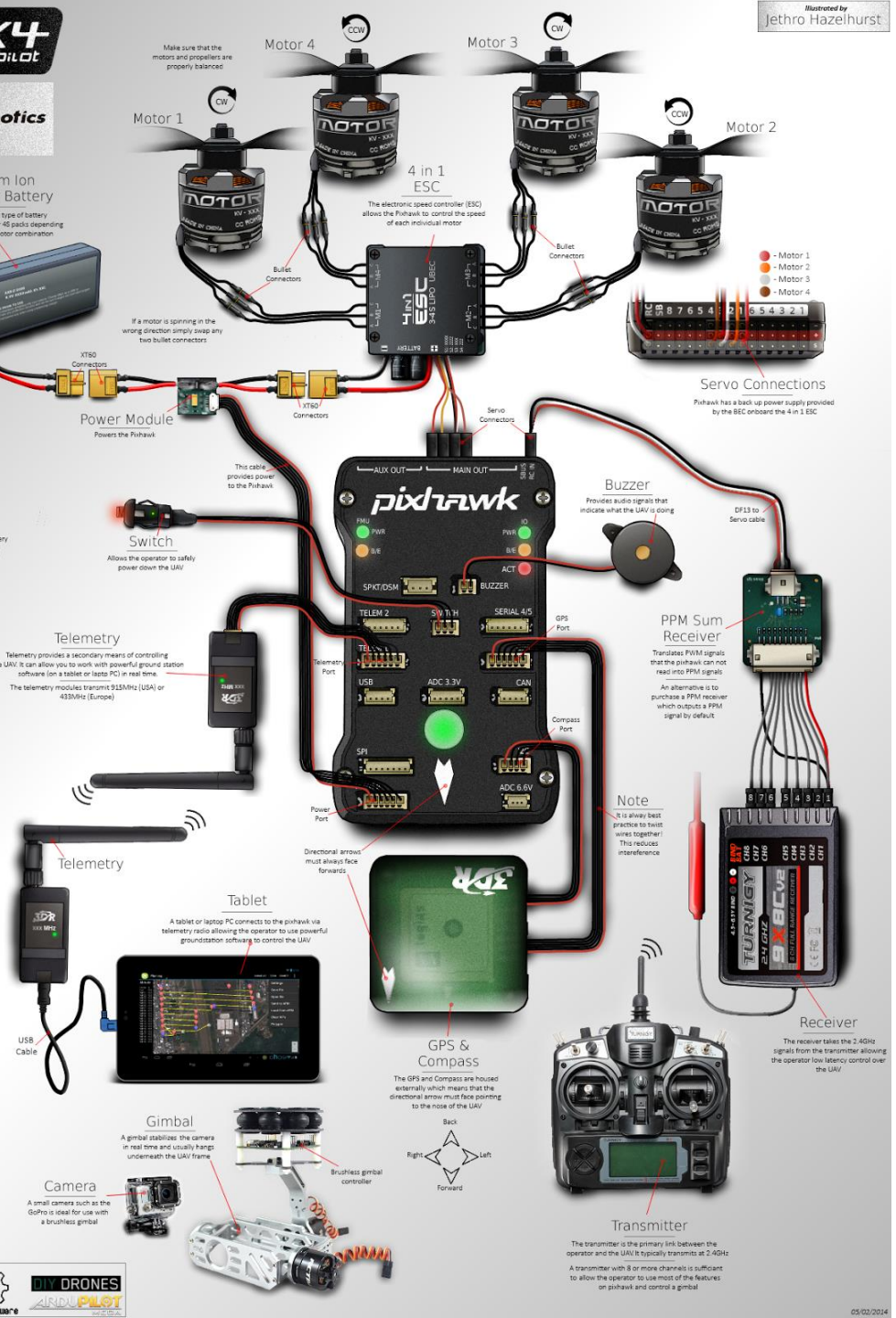
- UAV actuators include digital electronic speed controllers (which control the RPM of the motors) linked to motors/engines and propellers, servomotors (for planes and helicopters mostly), weapons, payload actuators, LEDs and speakers.



Navigation System (Sensors) & Control

- Position and movement sensors give information about the aircraft state. Exteroceptive sensors deal with external information like distance measurements, while exproprioceptive ones correlate internal and external states.
- Non-cooperative sensors are able to detect targets autonomously so they are used for separation assurance and collision avoidance
- Degrees of freedom (DOF) refers to both the amount and quality of sensors on board: 6 DOF implies 3-axis gyroscopes and accelerometers (a typical inertial measurement unit – IMU), 9 DOF refers to an IMU plus a compass, 10 DOF adds a barometer and 11 DOF usually adds a GPS receiver





Navigation System (Sensors) & Control

- UAV computing capability followed the advances of computing technology, beginning with analog controls and evolving into microcontrollers, then system-on-a-chip (SOC) and single-board computers (SBC).
- System hardware for small UAVs is often called the flight controller (FC), flight controller board (FCB) or autopilot.

Data Collection and Transmission

- Most UAVs use a radio for remote control and exchange of video and other data. These bi-directional narrowband radio links carried command and control (C&C) and telemetry data about the status of aircraft systems to the remote operator.
- For very long range flights, military UAVs also use satellite receivers as part of satellite navigation systems. In cases when video transmission was required, the UAVs will implement a separate analog video radio link.
- In most modern UAV applications, video transmission is required. So instead of having 2 separate links for C&C, telemetry and video traffic, a broadband link is used to carry all types of data on a single radio link
- As mobile networks have increased in performance and reliability over the years, drones have begun to use mobile networks for communication. Mobile networks can be used for drone tracking, remote piloting, over the air updates, and cloud computing

Data Collection and Transmission

The radio signal from the operator side can be issued from either:

- Ground control – a human operating a radio transmitter/receiver, a smartphone, a tablet, a computer, human movement recognition.
- Remote network system, such as satellite duplex data links for some military powers.
- Another aircraft, serving as a relay or mobile control station – military manned-unmanned teaming (MUM-T)
- A protocol MAVLink is increasingly becoming popular to carry command and control data between the ground control and the vehicle

Power Management

- Small UAVs mostly use lithium-polymer batteries (Li-Po), while larger vehicles often rely on conventional airplane engines or a hydrogen fuel cell.
- The record of travel for a UAV (built from balsa wood and mylar skin) across the North Atlantic Ocean is held by a gasoline model airplane or UAV. Manard Hill in "in 2003 when one of his creations flew 1,882 miles across the Atlantic Ocean on less than a gallon of fuel" holds this record.
- Electric power is used as less work is required for a flight and electric motors are quieter. Also, properly designed, the thrust to weight ratio for an electric or gasoline motor driving a propeller can hover or climb vertically.