UAV

EIMAN SALLEH BIN MOHD AZIAN

1728753

Main components

- 1. Design
- 2. Propulsion system
- 3. Navigation and control system
- 4. Data Collection
- 5. Data Transmission
- 6. Power Management

Design

Types of UAV

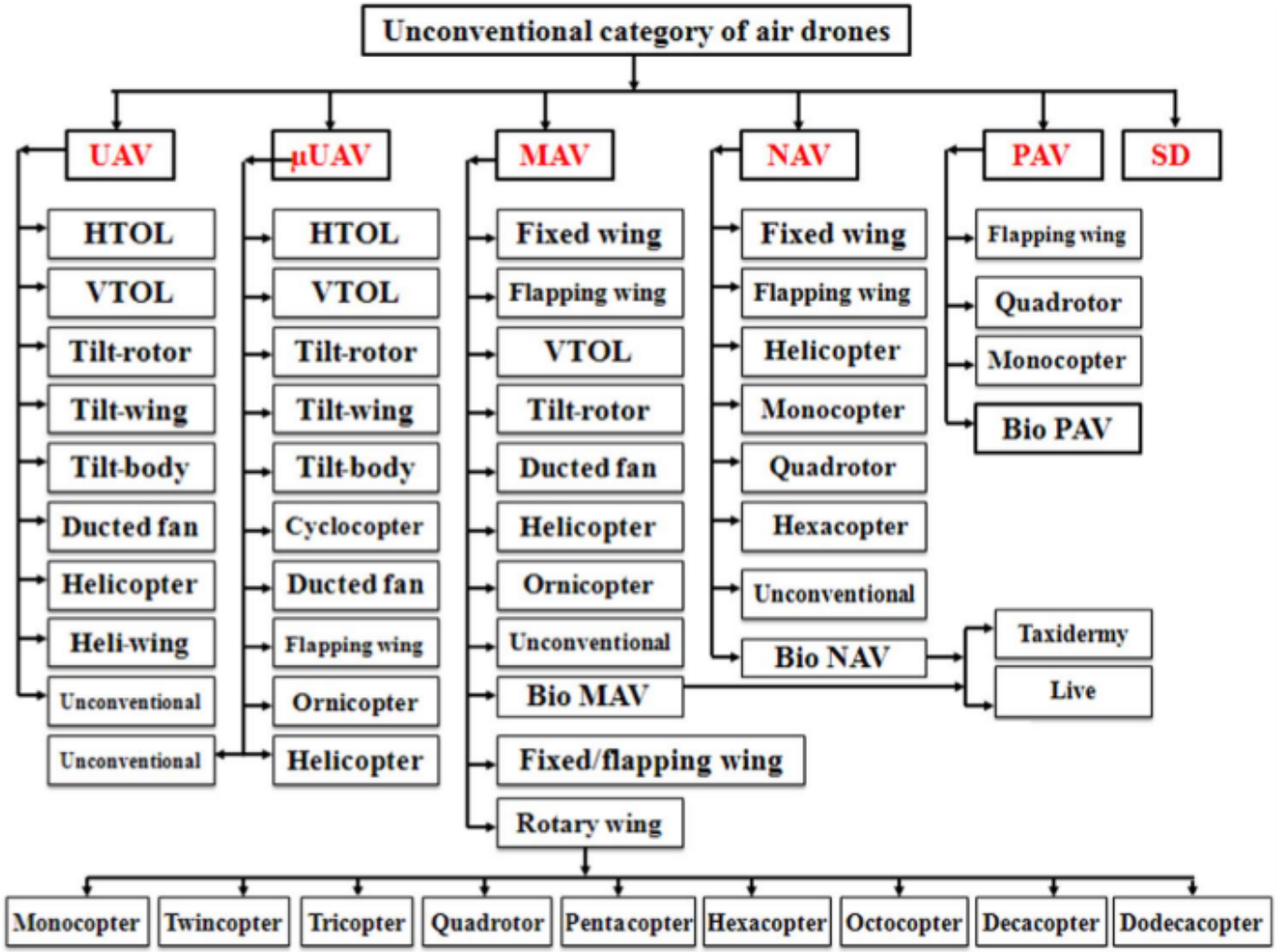


Fig. 2. Different types of air drones.

Classifications of Drone's applications

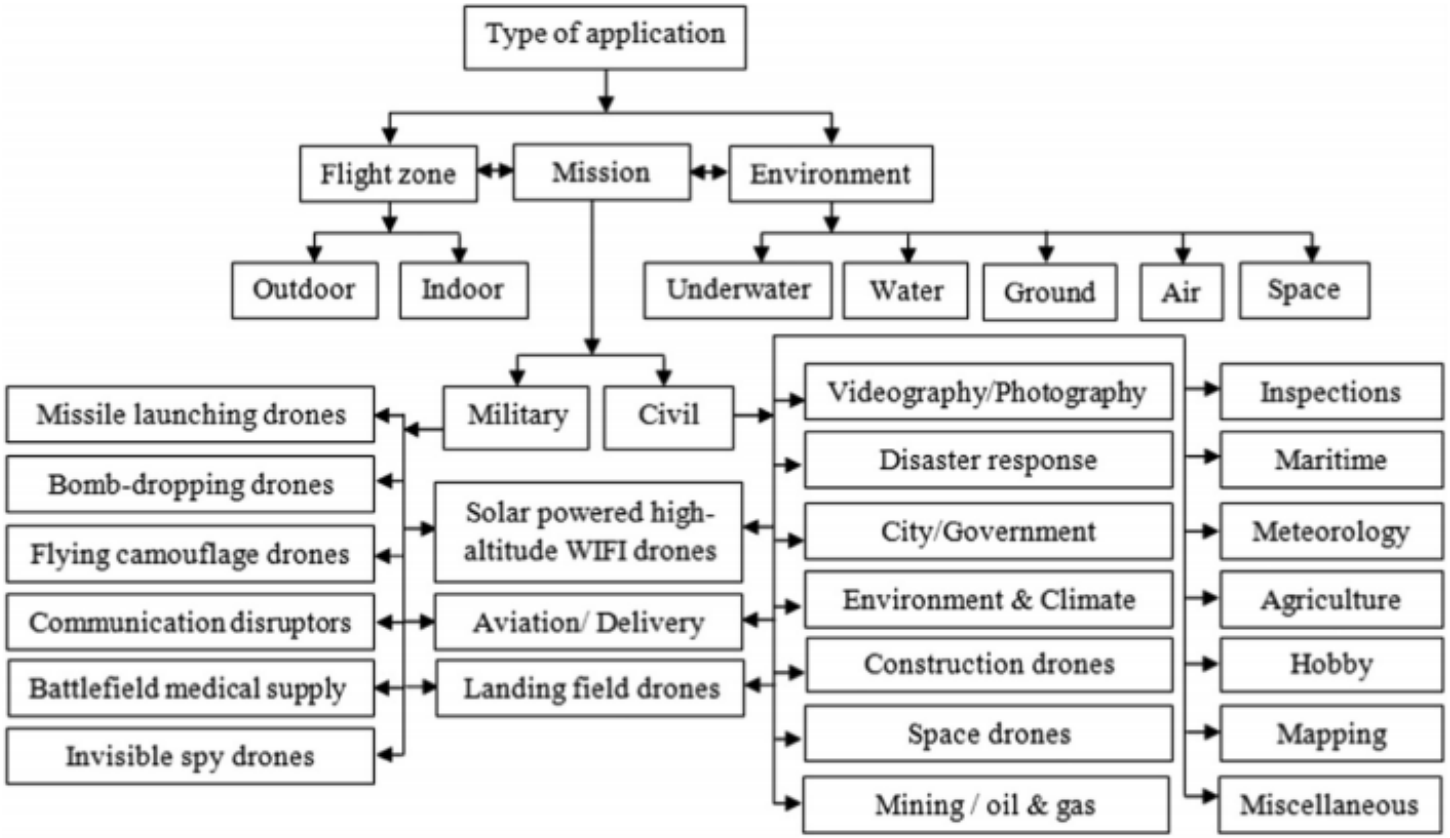


Fig. 15. Classification of drones' applications.

Design (multi-rotor UAV or drone)

- Typical use for aerial photography and video aerial inspection
- Accessibility
- Ease of use
- VTOL and hover flight
- Good camera control
- Can operate in a confined area

Design (multi-rotor UAV or drone)

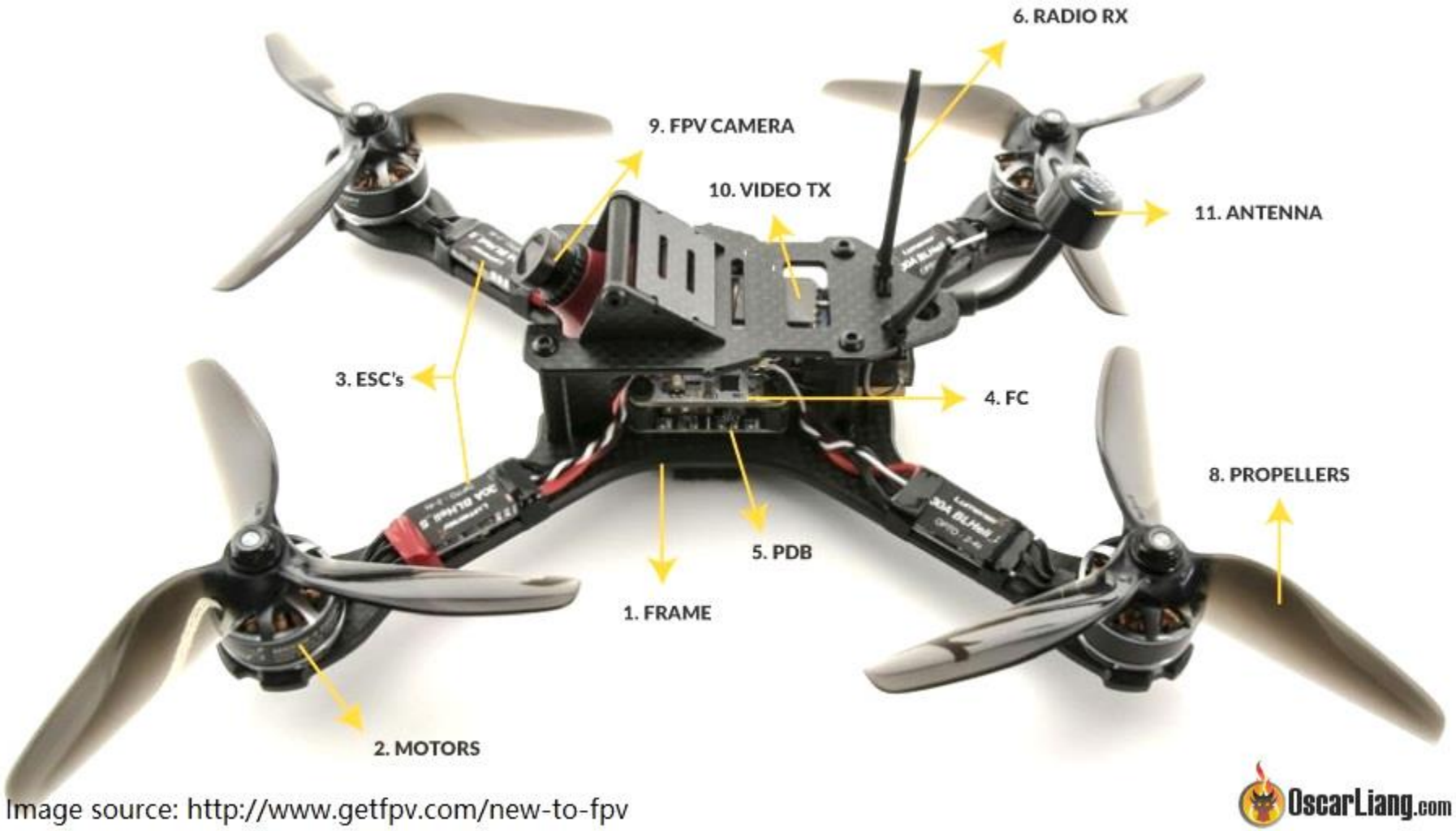


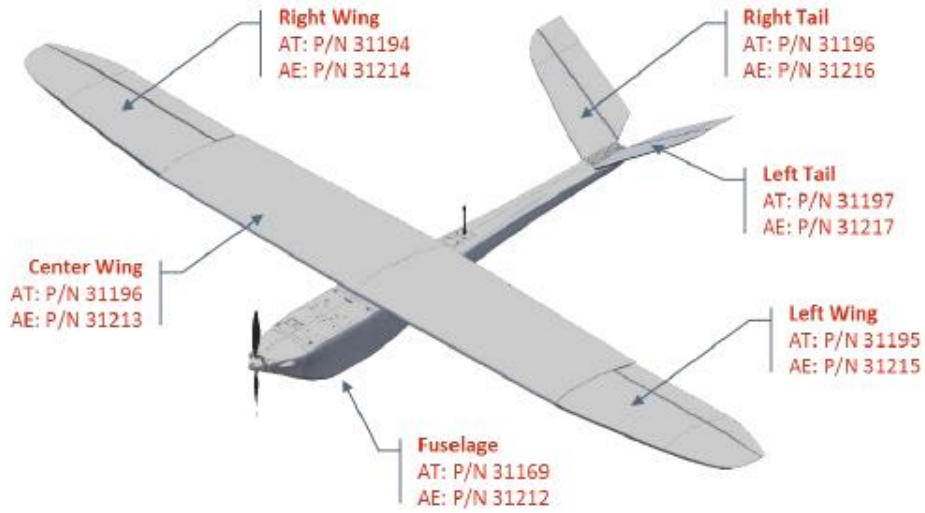
Image source: http://www.getfpv.com/new-to-fpv

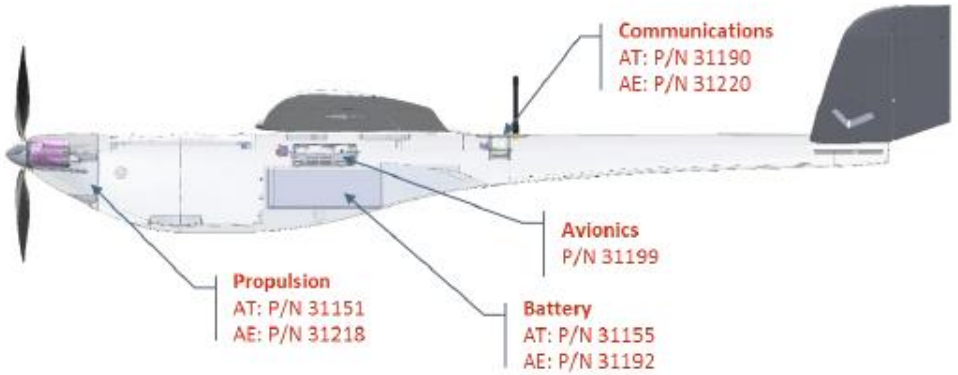
OscarLiang.com

Design (fixed wing UAV)

- Typical use for aerial mapping, pipeline and power line inspection
- Long endurance
- Large area coverage
- Fast flight speed

Design (fixed wing UAV)





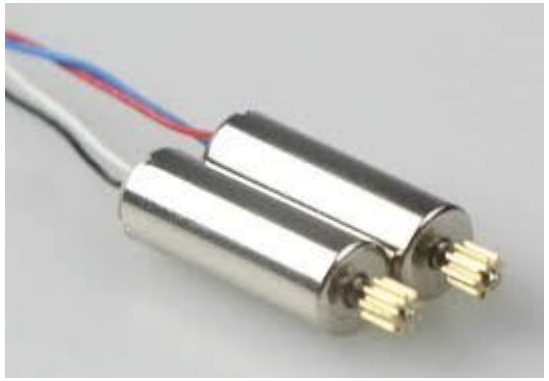
Design (single-rotor UAV or drone)

- Typical use for aerial LIDAR laser scanning
- VTOL and hover flight
- Long endurance (with gas power)
- Heavier payload capability

Propulsion System & Actuators

Motors

- Brushed motors – small drones
- Brushless motors – medium size to big drone. Can carry extra weight with additional electronics.



Propellers

- Rotary motion -> liner thrust
- Can lift UAV robots

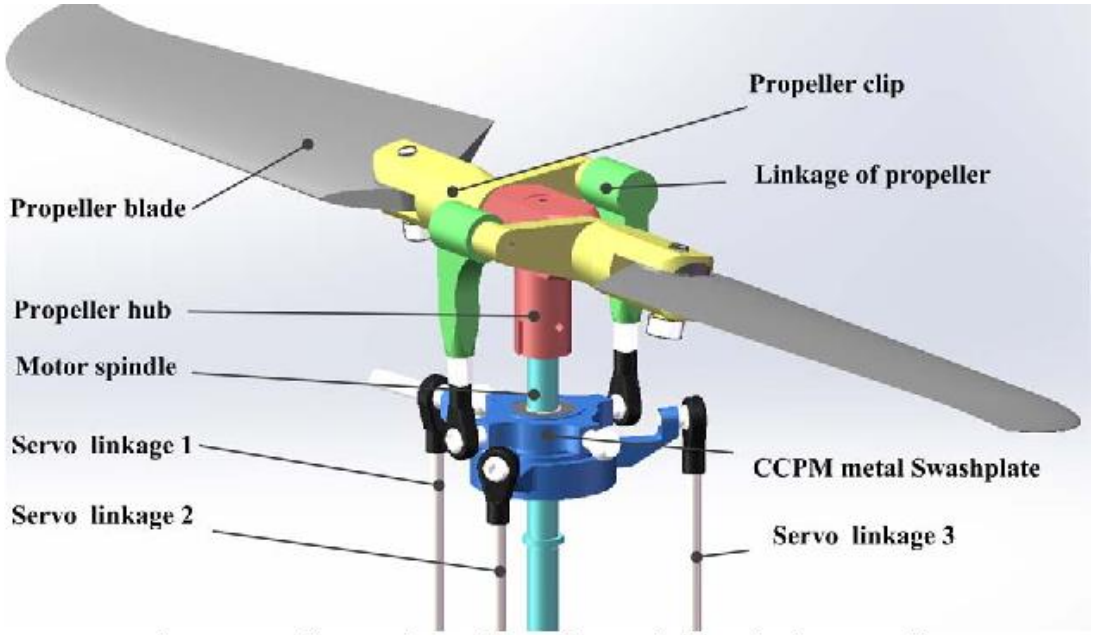


Fig. 1 Configuration of cyclic variable pitch propeller

Engines

- engine is equipped with a microprocessor ignition for easy starting and smooth running in all modes of engine speed.
- 4-stroke propulsion system with OHV and 2 valves per cylinder

Navigation and Control System

Inertial Navigation Sensors

- To measure various flight parameters (velocity, positions, and altitude)

Table 5.1: Primary functions of a few navigation sensors

No	Name	Measures	Remarks
1	Accelerometer	Linear acceleration	The linear acceleration is converted to linear velocity.
2	Basic gyroscope	Attitude	Based on gyro law
3	Rate gyro	Angular velocity	The angular velocity can be converted to angular positions.
4	Magnetometer	Attitude	e.g., heading
5	Pitot tube	Altitude, airspeed	Using air pressure
6	Compass	Magnetic north	Heading angle is measure w.r.t. north

Other sensors

- 1. Small, lightweight and low power consumption
- 2. Cm-level (RTK) and dm-level (PPP) position accuracy

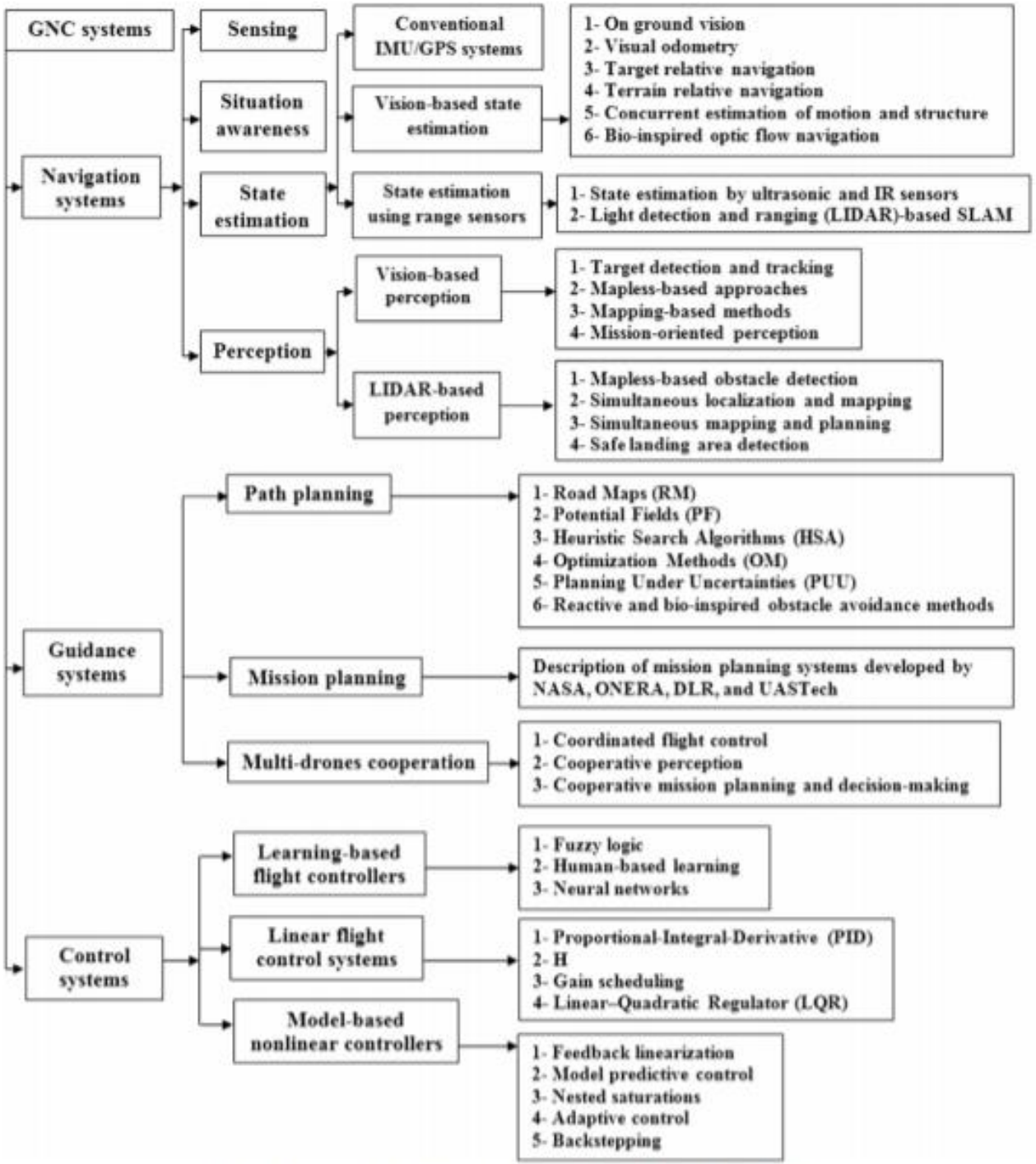
VectorNav


SBG Systems

Inertial Labs


Septentrio

GNC – Guidance, Navigation and Control



Other navigation system

1. Silvus technologies offer communications solutions from high bandwith video and telemetry data.
2. High speed data and high resolution video transfers in unpredictable environments.
3. provide a self-healing, self-forming mesh network that self-optimizes, requiring no operator involvement

Silvus Data Links


RF Power Amplifiers


RF Filters


RF Low Noise Amplifiers

Other Control System

1. GCS is responsible for controlling unmanned vehicles and payloads.
2. Installed application allows easy configuration of UAV
3. monitor measurement and sensing equipment
4. Robust and can be used in harsh environment

Portable GCS

Video Receivers

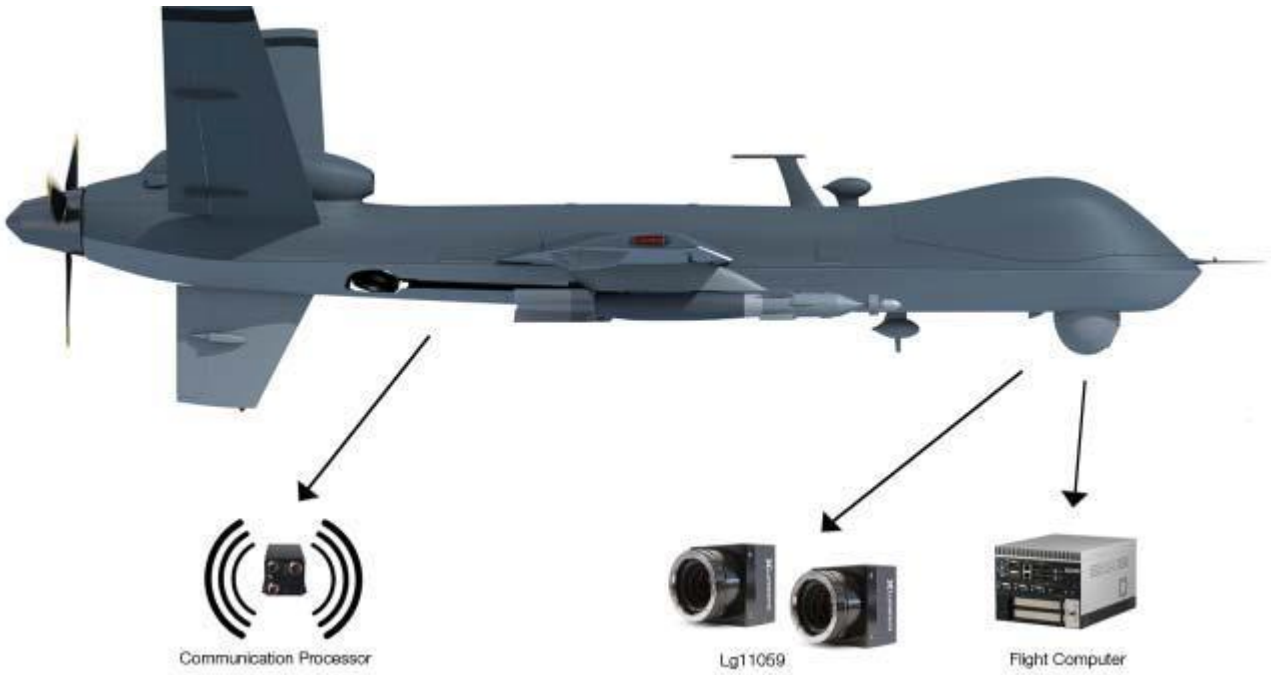
iMOCs

Handhelds

Data Collection

Camera

- For surveillance purpose



Data Transmission

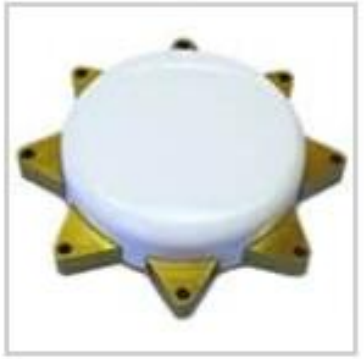
Antennas

1.Antennas are used for data recording and transmission and avionic functions.

2. Allow information transmission to other systems and people on ground.

3. Ground-to-ground, Ground-to-air, air-to-ground.

Tracking Antennas



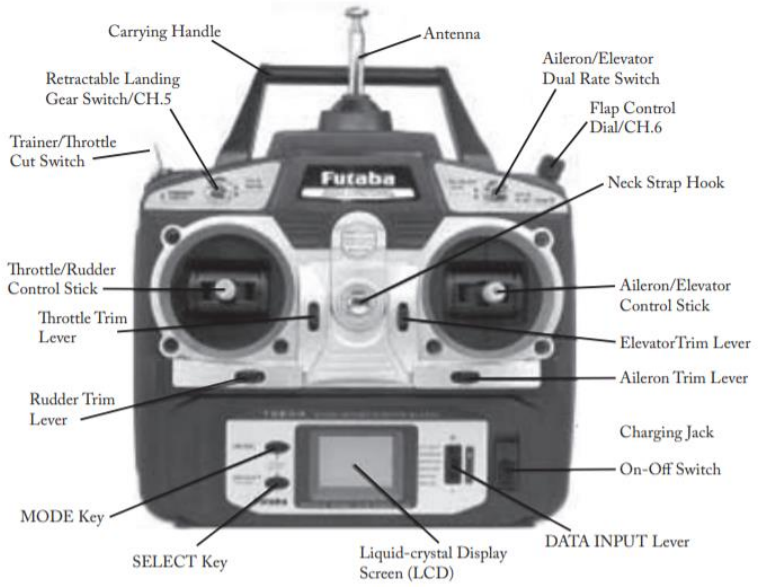
GNSS Antennas

Yagi Antennas

Flat Panel Antennas

Ground Control Station

Handheld controller



gure 8.2: Handheld remote control of a small UAV (image courtesy of hooked-on-rc-airplanes.com).

Portable control station

Command control station

C3 – command, control, communication model

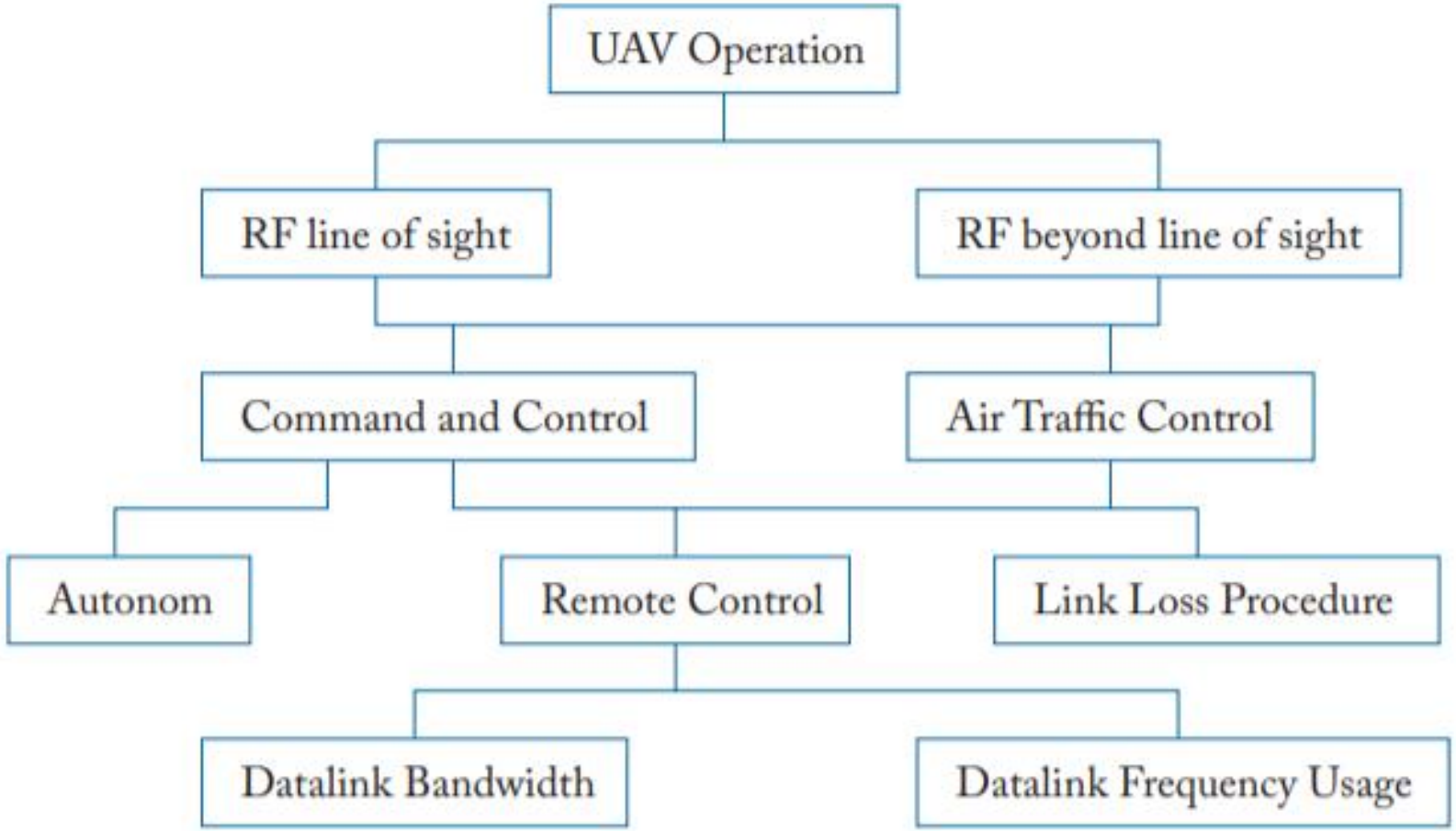


Figure 8.7: Command, Control, and Communications (C3) model.

Power Management

Battery used

BATTERIES, MAX AMPS
LiPo 23,000 4S 14.8v Battery Pack
$499.99

BATTERIES, MAX AMPS
LiPo 12000XL 22.2v S900 RTR Kit
$609.99

BATTERIES, MAX AMPS
LiPo 9000XL 6S 22.2v Battery Pack
$349.99

1. LiPo batteries provide longer flight times
2. Lower weight
3. Sharper flexibility
4. Higher capacity
5. Higher discharge rate
6. Deliver more power
7. LiPo batteries are hardly self discharge. It can be stored up to
1-2 months and still function well
8. Rechargeble
9. Volatile and potential fire hazard