

# Drones - Uses and Abuses

Introduction to drones, what VI are using them for, and some privacy issues

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## ***Drones, UAV or AAV what is the difference?***

### **Drones**

Term used by the press and public for almost any unmanned flying object. Including military systems with weapons

### **UAV/UAS/RPAS**

Unmanned Aerial Vehicle/system, scientific name for drones

### **AAV/AAS**

Autonomous Aerial vehicle, under computer control. Usually flying preset path.



## ***UAV types***

### **Fixed wing**

Like small planes

Flight time up to 60 mins

Can not hover

### **Multicopter**

Hovering flight

Short flight times

Good camera platform





# Types of control

## Remote control

- Needs a skilled pilot
- All actions are controlled by the pilot
- Needs line of site to control, 100-200m



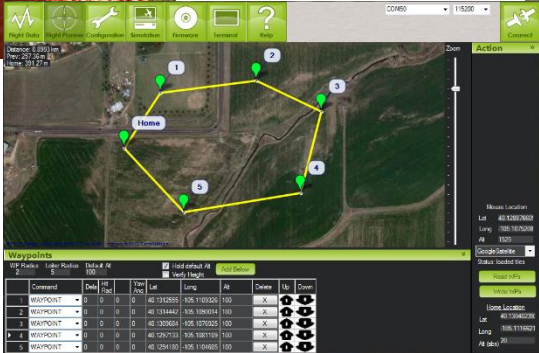
## Stabilised/FPV (First Person View)

- Simpler pilot control
- Plane holds current position or direction and height
- FPV pilot sees the view from the aircraft
- Typically can operate a few 100m from the operator
- May have 2 operators (aircraft and camera)



## Autonomous

- Needs almost no pilot skill
- Computer (autopilot) flies the aircraft
- Range can be several km
- Follows a planned route and actions



## ***Why are VI doing this?***

### **Requirements**

In-situ measurements of volcanic gasses ( $\text{SO}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{CO}_2$ )

Temperature and humidity

### **Usual reasons for autonomy**

Dirty

Dangerous

Dull





## How?

Use cheap RC hobby planes

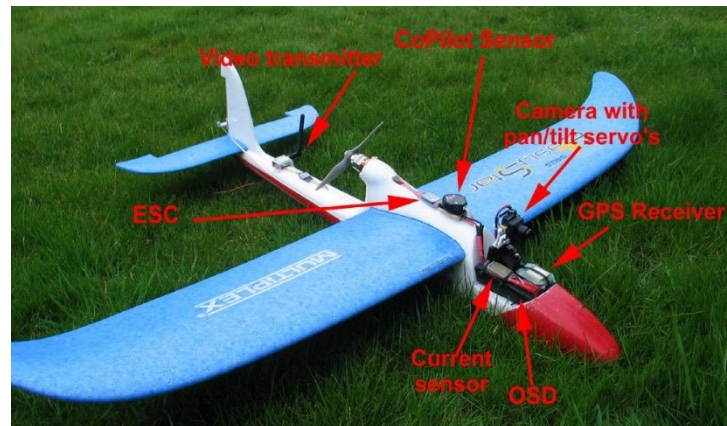
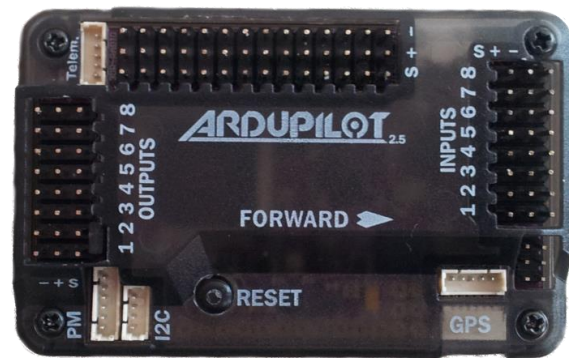
Simple open-source autopilot

Auto takeoff and landing - easy to fly

Based on existing FPV platforms

Expect system losses

Cheaper and lighter every year/Month



## ***Current VI systems - small UAV***

**1.5m wingspan**

**200-400g science payload**

**~ 1kg total weight**

**Airframe costs ~ 20.000kr**

**~ 1 hour flights**



## ***Current VI systems - larger UAV***

**Payload up to 2kg?**

**2.1m wingspan**

**40,000kr airframe**

**60kph**

**>1 hour flight time?**





## ***Payloads*** **Gas sensors**

- **SO<sub>2</sub>, H<sub>2</sub>S, CO<sub>2</sub> etc**
- **Logged to autopilot?**
- **Send to operator?**

## **Cameras**

- **Light**
- **Thermal?**
- **Mapping**

## **Other**

- **Wind from Pitot tube?**
- **Visibility/backscatter?**



## ***Current status***

Small airframe has completed 6 flights

Large airframe almost ready for flight tests

Small airframe in transit

Gas sensors being tested

Other science payloads possibly  
on loan from other institutes



## *Next steps?*

### **More flights**

- Calibrate sensors
- Practice
- Get useful data

### **Multicopter**

- images and vertical profiles
- Hovering
- Shorter flight times
- Useful in difficult terrain
- 100-200,000isk

### **Different Autopilot**

- Additional sensors
- Ash/particles?
- Thermal images



## ***UAVs and privacy issues***

Camera systems are cheap

Complete quadcopters with cameras start at  
around \$50

Increasing sale of FPV (First Person View)  
systems

Most systems are remote controlled, not  
autonomous

Usually ~15 minutes of flight time



## ***UAV operating and the law***

### **Very wide range of levels of control**

USA - very difficult and slow to change

UK - possible but restricted – need individual permissions for photographs

Australia & NZ, Scandinavia - Simple and Operator-friendly

Iceland – So far very few guidelines or regulations



## ***Conclusion***

UAVs are now cheap and easily available to the public

There are privacy issues, mainly photographic

There are positive gains, such as research, search and rescue etc

Noise limits the stealth of most multi rotor systems

It is not clear if new regulations are needed, or better application of the existing laws

UAVs will continue to become smaller, cheaper and quieter.

