COPERNICUS AND UNMANNED AERIAL PLATFORMS

13th September 2018

Drones: Current Status & Future Trends

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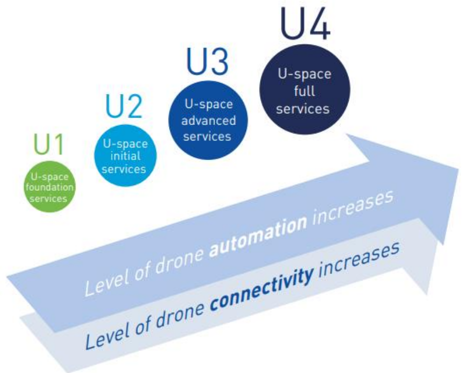
DJI Inspire

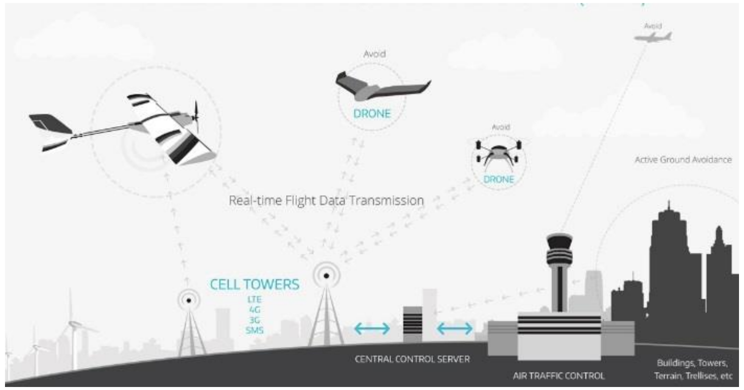

Quantum Systems Tron


Airbus Quad-Cruiser



SESAR, 2017 U-Space Blueprint

Drones – Technology & Market Sectors



Upstream

UAS Platform

- Airframe
- Flight Controller
- Propulsion
- Command & Control
- DAA
- Ground Station

Midstream

U-Space Graph/UTM

- 3D Modelling
- Risk Analysis
- Conflict Handling
- Traffic Optimisation
- Registration
- Cybersecurity
- Privacy

Downstream

Services/Applications

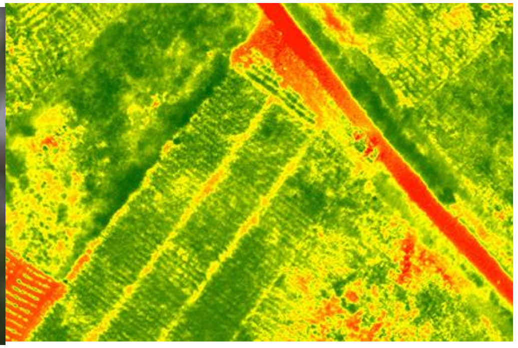
- Mapping
- Searching
- Tracking
- Inspection
- Environmental
- Package Delivery
- Connectivity
- Air Taxi

Big Challenge : BLOS Operation : Safety, Security, Regulatory, Privacy

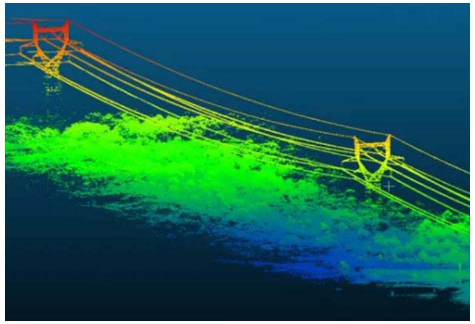
Drones & Sensors : Applications

Cadastral Mapping

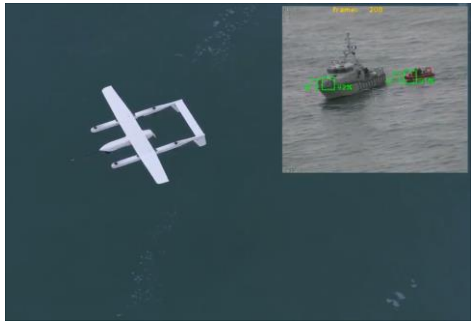
Precision Agriculture



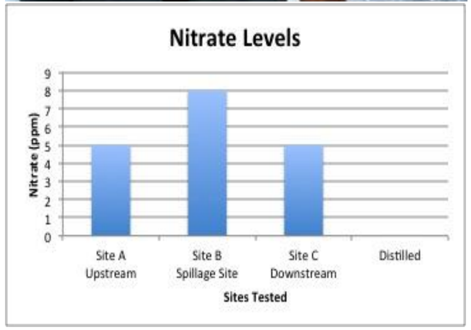
Critical Infrastructure



Maritime Monitoring

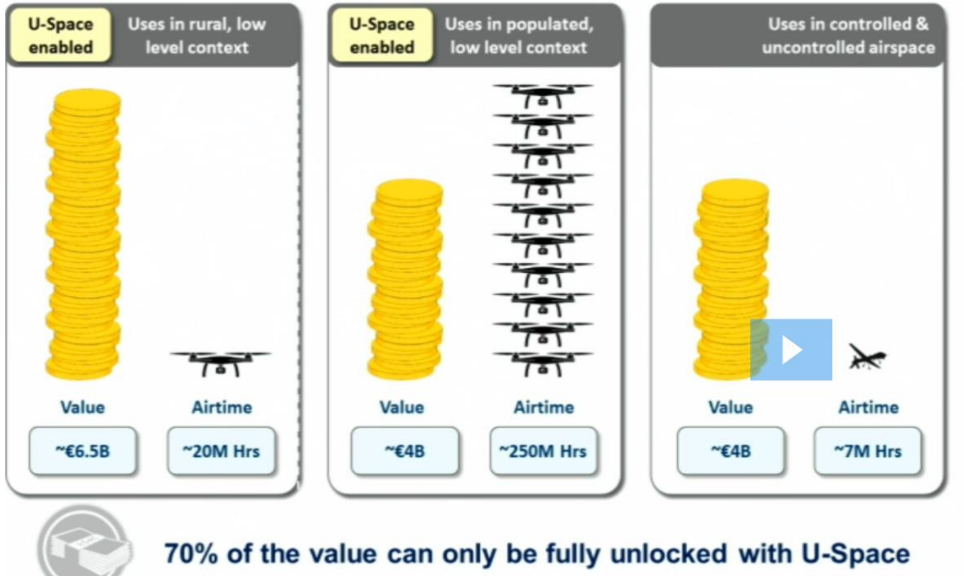


Air/Water Quality

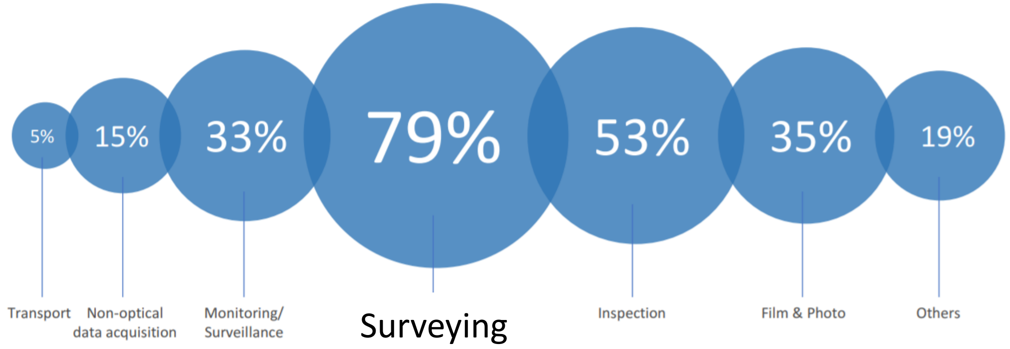


Emergency Response

Changing Drone Market Place

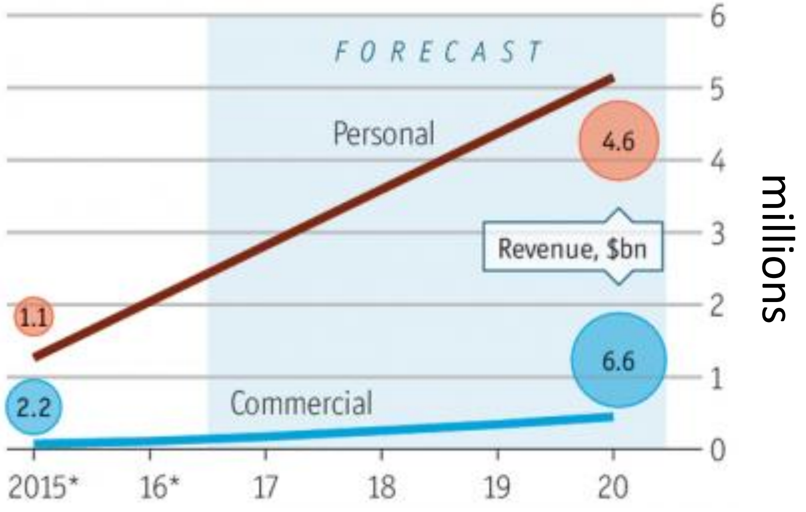


Source: SJU, 2nd Feb 2018



European Commercial Drone Industry – Current uses (Droneii June 2018)

Source: EU commission 26th June 2018



Source: Gartner; CBInsights, Econmist.com (June, 2017)

Europe & USA Civilian Commercial Drone Industry

Europe

- Guesstimate EU Drone Operators **20,000 to 30,000** * (Molina & Ona, 2018)
- Commercial Drones guesstimate **30k to 50k (2018)** to **400k (2050)** (2050 Source: SESAR, Dec 2016)
- EU MS Rules (<150kg) to be superseded by EU-wide *risk-based operation* regulation (June 2018)
- EU Funding: **9 X projects (H2020),** upto **10 X demonstrators (SESAR)** to be funded 2018

Country	Operators	Source
United Kingdom	3046	Civil Aviation Authority (2017)
Ireland	172	IAA (2017)
France	2250	Statista (2016)
Spain	2420	AESA (2017)
Italy	972	ENAC (2017)
Germany	n.a.	n.a.
Switzerland	n.a.	n.a.
Belgium	152	www.beuas.be/fr/membership/licentie

Source different sources (n.a.: not available)

* (Molina & Ona, 2018)

USA

- **103k Part-107** Commercial Drone Operators in USA (Source FAA, Active Airmen Stats, Sept 2018)
- Commercial Drones **110k (2018)** to **450k (2022)** (Source: FAA, 2018)
- Low Altitude Authorization and Notification Capability (LAANC) (Beta testing in 2018)
- **7 X FAA UAS Test sites** – initially est. 2013 - across USA (FAA, 2018)
- **10 X Integration Pilot Program** (IPP) Awards (May 2018) – 30months

Europe 2019 – One possible Drone EO Scenario?

- 50k Civilian-Commercial Grade Drones
- Each Drone capable of capturing 25GB data -per survey, each drone completes, on average, 1 X survey per week
- Survey Area = 2km * 2km (400ha) @120m Alt (15km in 30minutes – 100m flight line spacing)
- 62PB of data per year (50k Drones * 25GB * 50 weeks)
- Potential Market = €1.2Billion (50k Drones * 50weeks * €500 per survey)

Contemporary Drone mapping performance (Quantum Systems, 2018)

Swarm Configuration: 10,000 ha/hr

Opportunity: rapidly changing Drone Industry – compliment Contemporary & Future Copernicus Services

- More **demanding needs of end-users/customers** – require more detailed, richer data, in a faster turn-around time
- Current **choke-point - hyper-localised operation** - (within LoS, segregated airspace <120m) **will be eased over time**
- Drones are increasingly **highly versatile, adaptable, configurable** EO technology;
  - **beneath the cloud**, carry an **array of sensors**, relatively **low-cost**, **real-time** capability, greater **end-user-control** in terms of data gathering **spatial/temporal/thematic & feedback/interactive, robotics**, swarm: **large area mapping** capability
- Drone Technology & Geoinformation Services Providers – **much wider Industry base participation** – Startups/SMEs – reducing need for Big Industry (Droneii Market Map, 2018)
- Developments in Big Data/AI (Machine Learning, Machine Vision/CNNs) & Data Analytics – showing **growing market potential** to automatically process drone video/imagery (**defect inspection, counting/tracking objects, dynamic phenomena & behavioural analysis**)

Drone Industry – Some predictions

- Beyond Line of Sight (BLOS) Drone Operation & integration with conventional airspace will increase
    - Greater **support/roll-out of low-risk BLOS demonstrators** (Marine, Wilderness, Agriculture, Forestry, Private Installation/property)

- U-Space/UTM licenses will be set-up and operated similar to Telco Mobile phone licenses
    - Specific funding to research & **develop future comprehensive U-Space/UTM architectures** (3D risk encoded models, Constrained/Un-constrained topologies, Wayfinding, Optimisation/Multiagent, AI/Reinforcement Learning, Protocols, Business Models)

- **Reduced requirment for drone operators -** when drones are registering and flying in an UTM i.e. the UTM will fly/operate the drone – Machine-to-Machine/AI

- Need for **innovative shared Drone information service model** – fleet of drones serving needs of co-located agencies; Agriculture & Forestry or similar Industries (Critical Infrastructure/Road networks