Unmanned Air Vehicles (UAVs): Classification, Legislation and Future applications

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The presenter

Dr-Ing

Dimitrios E. Mazarakos

- Dipl. in Mechanical Engineering and Aeronautics
- Ph.D. in Mechanical systems Design and Simulation
- Research Engineer at University of Patras
- Participation in EU- ESA Aerospace (FANTASSY, ESA-LAGARD, GRETEL) and Subsea (DIFIS/MIFIS) Projects
- UPat ATLAS Aero Group Technical Director : Design, Build and Fly Unmanned air vehicles for cargo transportation, ATLAS series I to VB.
- Air Cargo Challenge: ATLAS Team Leader (2007-2015), senior member (2016-nowadays)
- Remote Control Model Aircraft Pilot (2008- nowadays), AMA membership, Chicago, IN, USA.
- Young Aerospace Engineer award of the year 2009/ Technology and Innovation Award: ATLAS Project: Development of a Remote Controlled Aircraft from composite materials

UPat ATLAS Aero Group

- Founded October 2006 at Applied Mechanics Laboratory by Undergraduate students and PhD candidates of the Mechanical and Aeronautics Department.
- Professor in Charge: Prof. V. Kostopoulos (AML)
- Participated 6 times at Air Cargo Challenge (ACC) : 2007&2013-Lisboa (PL), 2009-Covihla (PL), 2011&2015-Stuttgart (GER), 2017-Zagreb (CRO)
- Ranks: 8th /24 (2007), 6th /26(2009), 2nd Concept design prize and 8th/28 place (2015).

UPat ATLAS Aero Group

ATLAS I (2007)

Fixed Wing, Composite materials 100%

Empty weight: 2.6 kg

Wingspan: 1.6 m

Max payload: 3 kg

Take-off runway: 60 m

Propulsion: 300 W/ Electric Motor

ATLAS V (2015)

Fixed Wing biplane, Composite materials 40%

Empty weight: 2.4 kg

Wingspan: 2.5 m

Max payload: 8.3 kg

Take-off runway: 60 m

Propulsion: 400 W/ Electric Motor

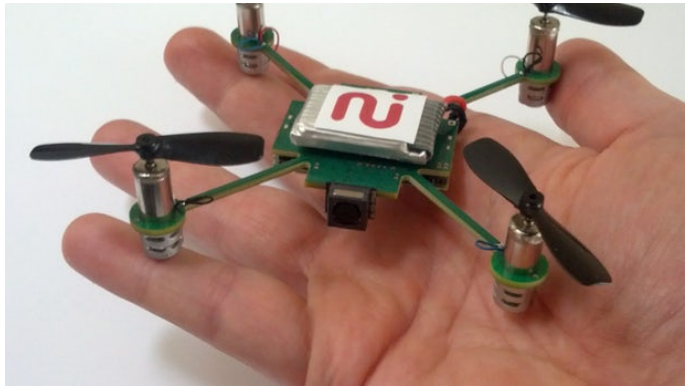
Unmanned Aircraft Systems Definition

UAVs ?

Drones ?

OR

RPAS ?



UAS?

Unmanned Aircraft Systems Definition

Drone: historically refers to a UAS which exists to act as a target for live-fire air defence weapons training by armed forces, with this remaining the correct terminological reference. Popular culture, particularly the media, uses the term as a generic descriptor for all classes of unmanned or remotely piloted aircraft, but particularly in relation to military systems with weapons carriage capabilities.

UAV: It is an aircraft that flies around to collect required data and imaginery.

UAS: It is an upgraded UAV. It includes the UAV itself, the Ground Control System, the Camera, the GPS, communication data links, and software in order to perform as a system for specific use.

RPAS: It is an UAS that is based on cutting-edge developments in aerospace technologies, offering advancements which are opening new and enhanced civil-commercial applications as well as improvements to the safety and efficiency of the entire civil aviation.

Unmanned Aircraft Systems Definition

'The operational functions and the certification define the role of an unmanned air vehicle '.

Operational functions: 1) How it flies/works? Flight profile-mission? Types?
2) How it communicates with the operator? VLOS, EVLOS, BVLOS / Remote Controlled, semi-autonomous, autonomous

Certification and Legislation: 1) JARUS
2) NATO STANAG.
3) Else??? New considerations? EASA, CASA, FAA, CAA.

Unmanned Aircraft Systems types
How it flies?

Fixed Wing

-Requires a minimum speed (stall speed)
-High aerodynamic efficiency.
-High endurance and range
-Low Thrust to Weight ratio.
-Low power consumption
-Dynamic stability & control is achieved by design characteristics.
-Automatic control is optional.
-Take-off/landing runway is necessary
-High maximum speed

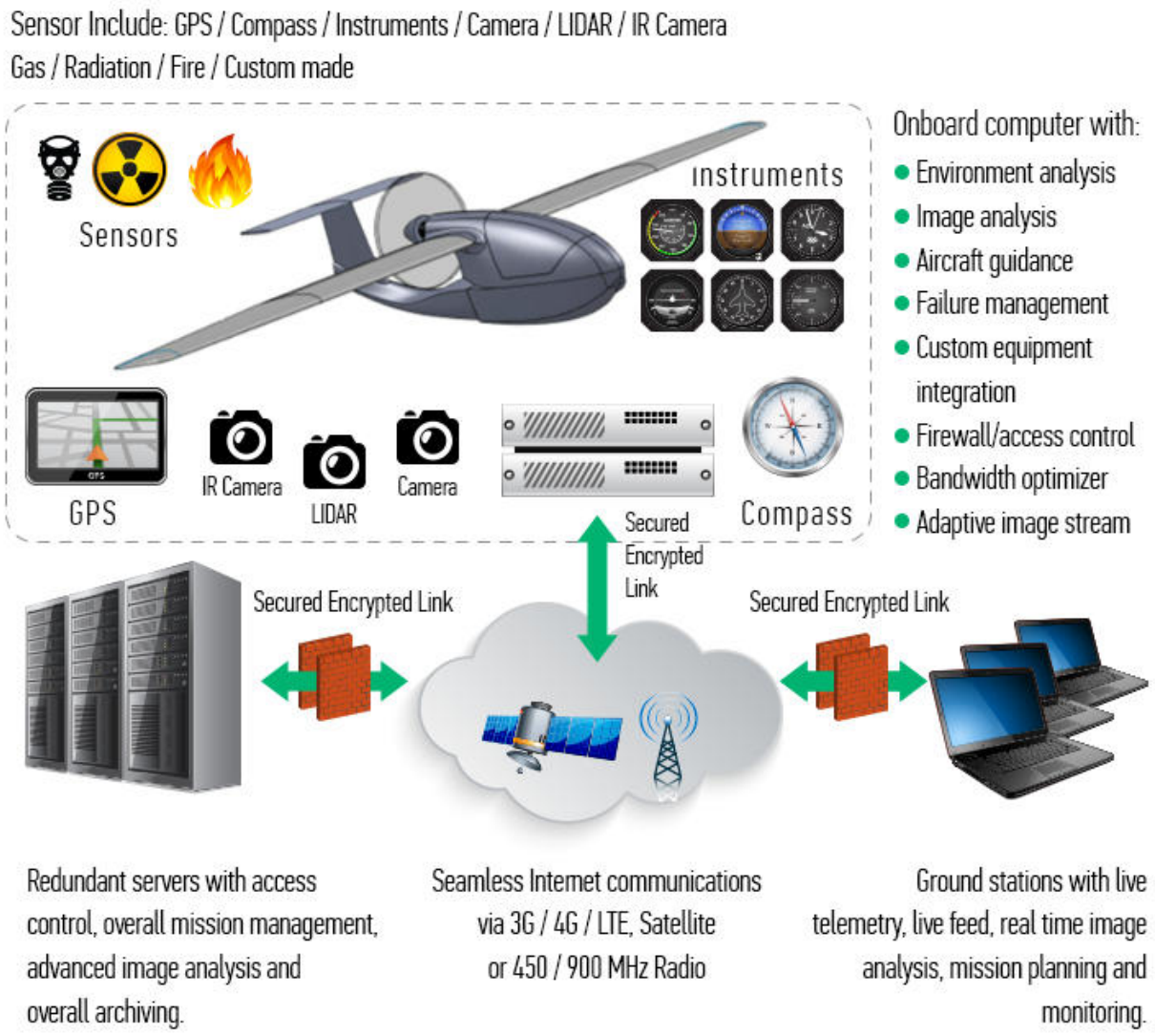
Multicopter

-Requires a minimum speed (Hover speed)
-Low aerodynamic efficiency
-Low endurance and range
-High Thrust to weight ratio
-High power consumption
-Stability and control is achieved by automatic control system.
-Vertical take-off and landing
-Low maximum speed

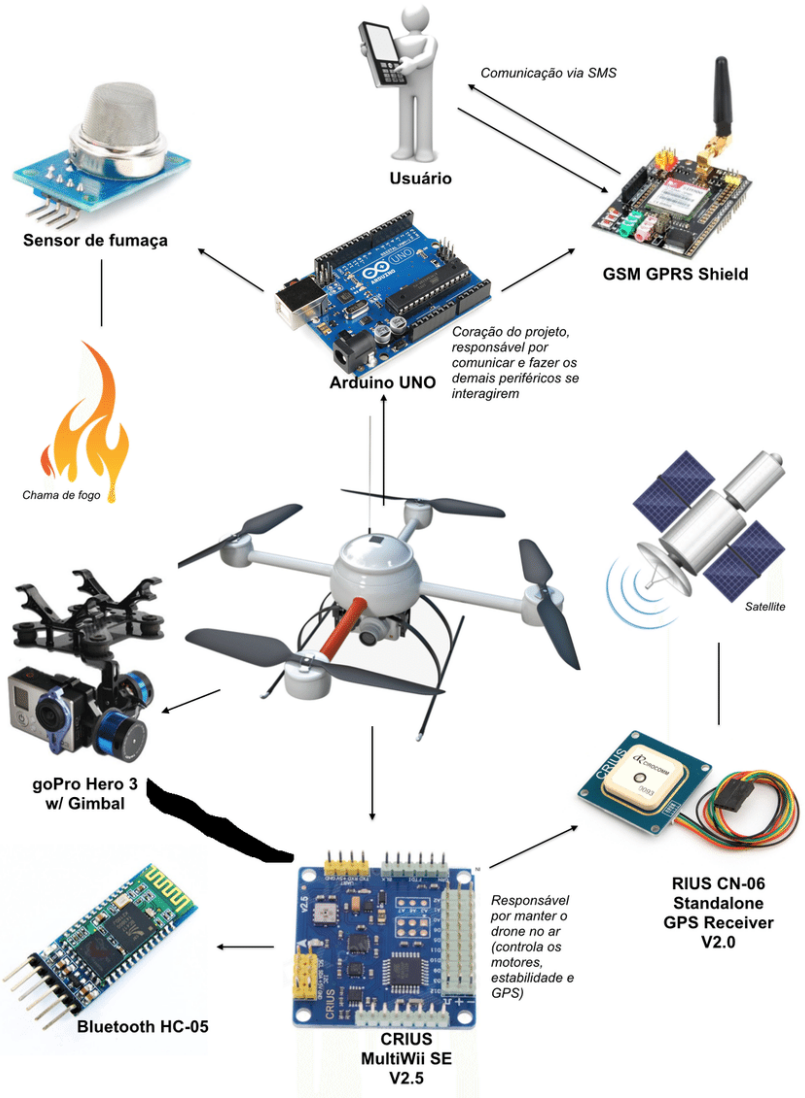
Helicopter

-Requires a minimum speed (Hover speed)
-High aerodynamic efficiency
-Medium endurance and range
-Medium power consumption
-Dynamic stability & control is achieved by design characteristics.
-Automatic control is optional.
-Vertical take-off and landing
-Medium maximum speed

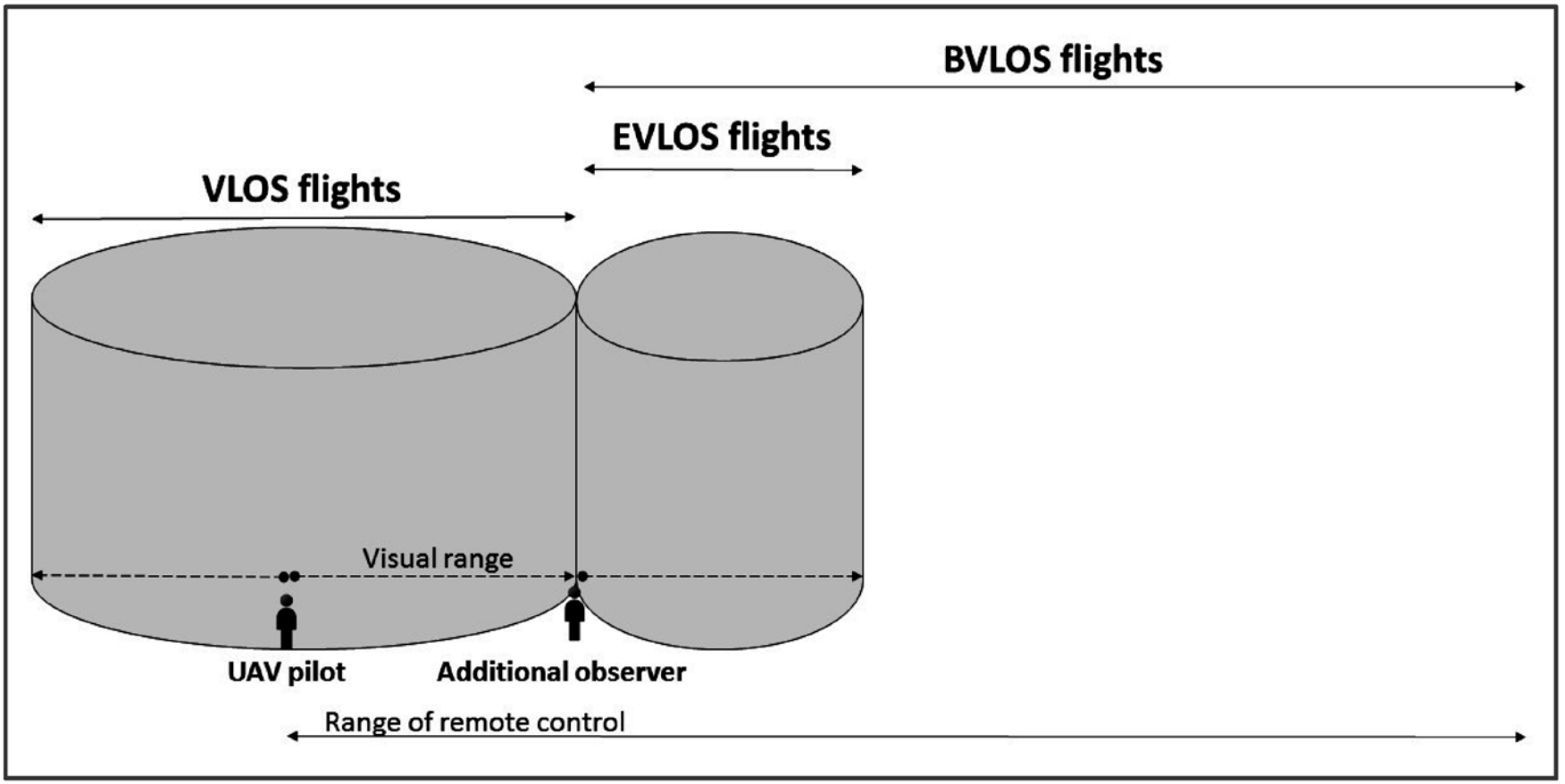
Unmanned Aircraft Systems
How it works?
Fixed Wing System



Unmanned Aircraft Systems
How it works?
Multicopter/Heli System

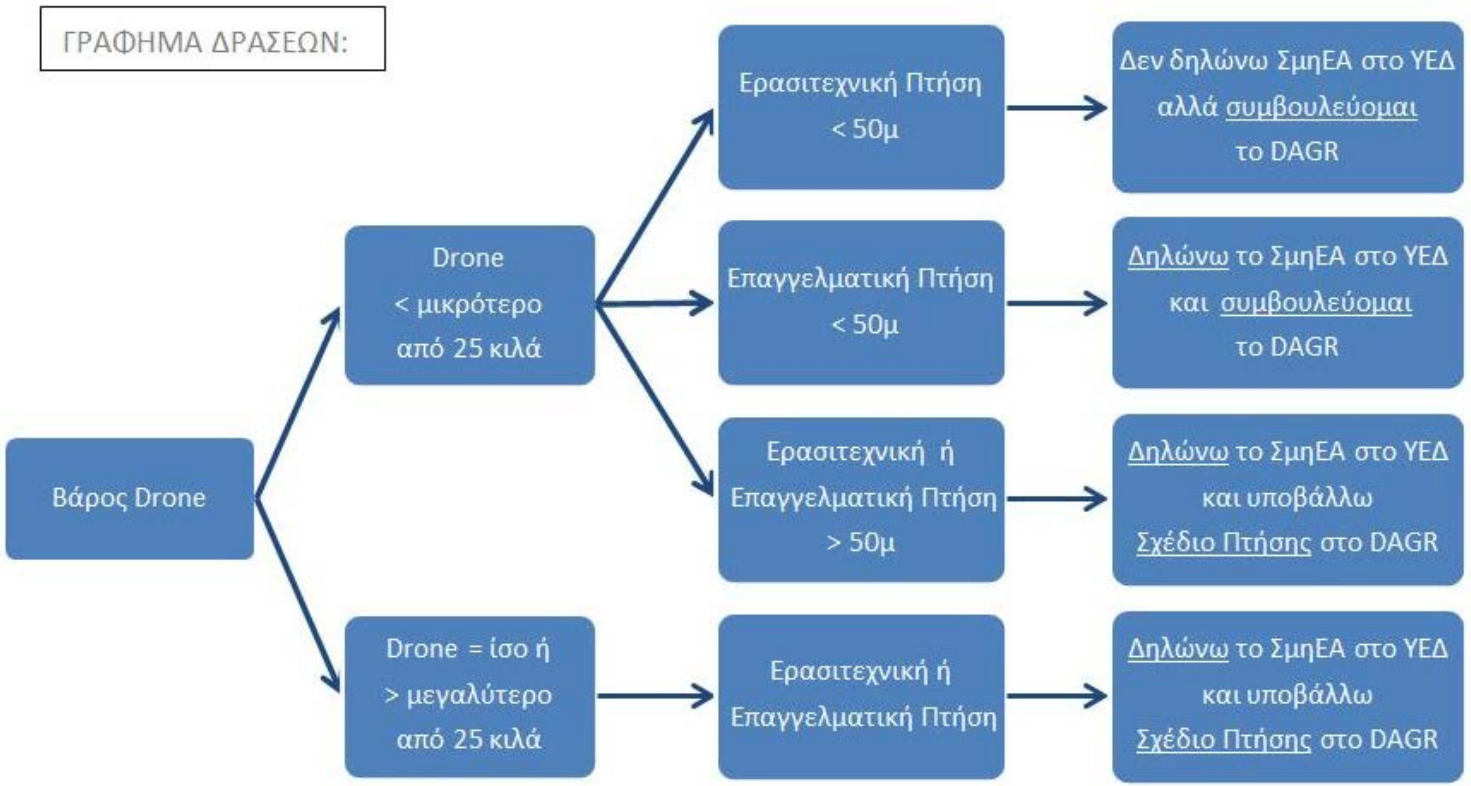


Unmanned Aircraft Systems
How it communicates?



Unmanned Aircraft Systems Legislation (Flight regulation)

- CIVIL (EASA)



Unmanned Aircraft Systems Legislation (Flight Regulation)

- M ILITARY (NATO)

Class	Category	Normal employment	Normal Operating Altitude	Normal Mission Radius	Primary Supported Commander	Example platform
CLASS I (less than 150 kg)	SMALL >20 kg	Tactical Unit (employs launch system)	Up to 5K ft AGL	50 km (LOS)	BN/Regt, BG	Luna, Hermes 90
	MINI 2-20 kg	Tactical Sub-unit (manual launch)	Up to 3K ft AGL	25 km (LOS)	Coy/Sqn	Scan Eagle, Skylark, Raven, DH3, Aladin, Strix
	MICRO <2 kg	Tactical Pl, Sect, Indi-vidual (single operator)	Up to 200 ft AGL	5 km (LOS)	Pl, Sect	Black Widow
CLASS II (150 kg to 600 kg)	TACTICAL	Tactical Formation	Up to 10,000 ft AGL	200 km (LOS)	Bde Comd	Sperwer, Iview 250, Hermes 450, Aerostar, Ranger
CLASS III (more than 600 kg)	Strike/ Combat	Strategic/National	Up to 65,000 ft	Unlimited (BLOS)	Theatre COM	
	HALE	Strategic/National	Up to 65,000 ft	Unlimited (BLOS)	Theatre COM	Global Hawk
	MALE	Operational/Theatre	Up to 45,000 ft MSL	Unlimited (BLOS)	JTF COM	Predator B, Predator A, Heron, Heron TP, Hermes 900

Unmanned Aircraft Systems Legislation (Certification)

WHY??

Airworthiness and Air Safety

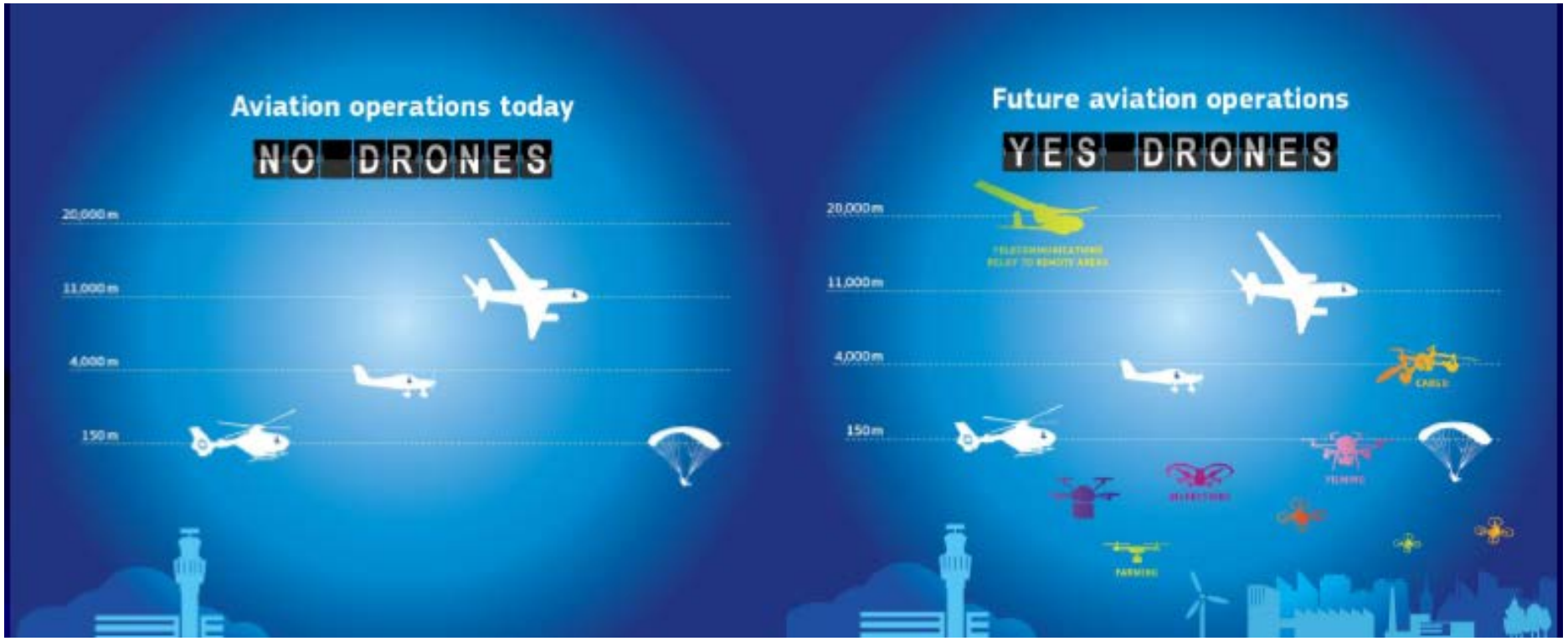
- CIVIL

A) JARUS CS LUAS
B) New processes under development (???) from EASA,CAA,CASA, FAA etc.

- MILITARY

A) NATO STANAG 4671
B) NATO STANAG 4702
C) NATO STANAG 4703
D) EDA EMACC

Unmanned Aircraft Systems
Future Applications



Unmanned Aircraft Systems
Future Applications & Challenges

1) sUAS Traffic Management Systems:

Leonardo and Thales develop a platform with automated flight authorizations as well real-time alerting and intervention in emergency situations (2017)

2) Low altitude obstacles (Birds, Powerlines, etc.)

3) Air safety and air collision avoidance. (interaction between UAVs and Civil aircrafts)

4) Anti-terrorism laws and Cybersecurity.

5) Hybrid (Fixed/copter) UAV and Robotic UAV application in construction, agricultural, etc.

THANK YOU!!

Any questions???