What is mandatory in the different airspaces and the different requirements between VLOS and BVLOS (Beyond Visual Line Of Sight) operations?

Copenhaguen May 2018

Christian Fleury / Catherine Ronflé-Nadaud

	High Altitude UASs	Drones sharing the airspace	Low Altitude drones
Operations	Above the ceiling of conventional manned aviation activities	RPAS applying IFR rules or accommodation	In parts of the airspace which are usually not open to manned aviation
C2Link	Reliable C2link + VHF relay?	Reliable C2Link + VHF relay	C2Link requirements TBD Low cost
Surveillance	TBD	Mode S / ADS-B (1090ES / UAT)	Identification, surveillance (situational awareness for the remote pilot) and tracking
Management	ATM* + accommodation	ATM* + UTM** (U-Space)	UTM** (U-Space) but interface with ATM*

*Air Traffic Management **UAS Traffic Management

ATM* versus UTM**

ATM

- Existing Concept of operations (CONOPS) and systems
- Services provided by Air Navigation Service provider
- High level of safety
- High costs

UTM (U-Space)

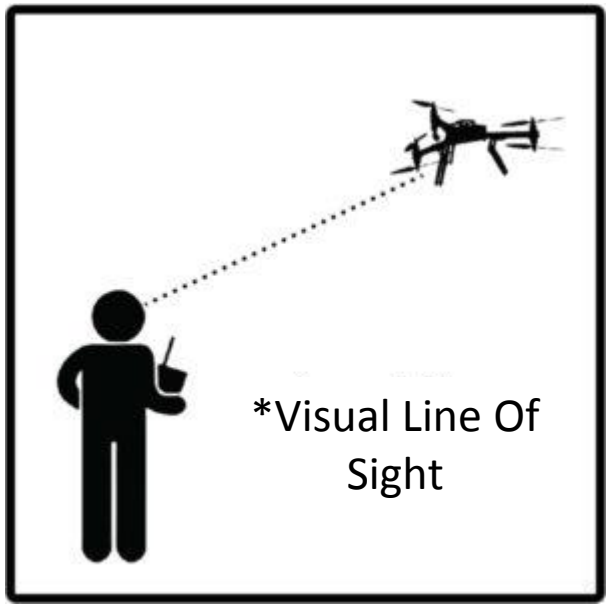
- Need to define CONOPS and systems
- Safety and security issues
- Relationship between ATM* and UTM*
- Business model (low costs)

UTM (U-Space) = A new idea all over the world, many initiatives!!!

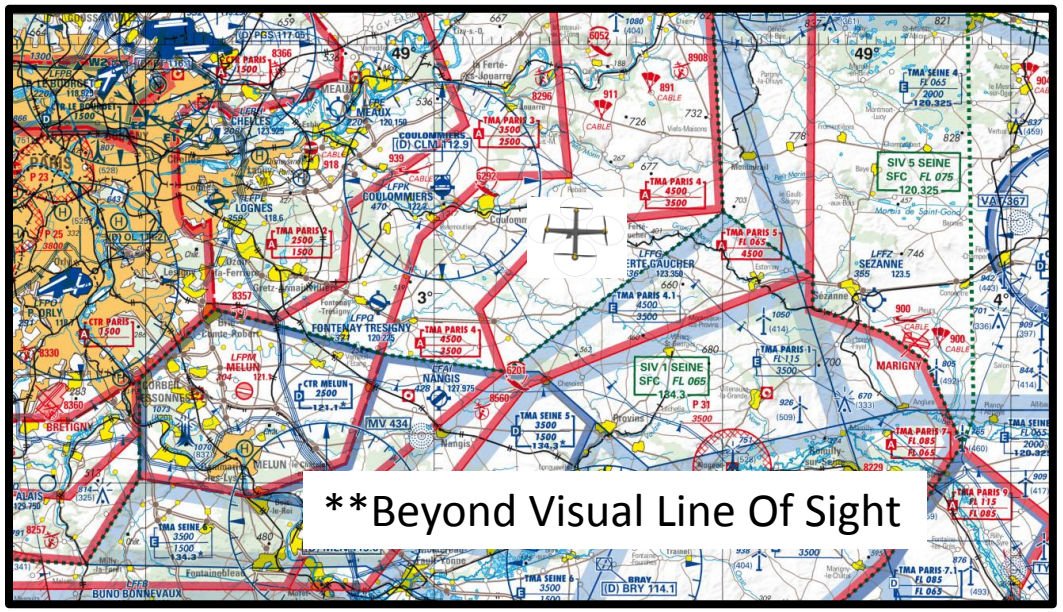
*Air Traffic Management **UAS Traffic Management

VLOS* - BVLOS**

VLOS



BVLOS: Specific or Certified



The remote pilot is responsible for exercise of vigilance at <u>any time</u>:

- In VLOS, with his eyes;
- In BVLOS, using situational awareness provided by systems (sensors on-board or from UTM/ ATM)

EASA A-NPA

A-NPA : Advanced Notice of Proposed Amendment, published in July 2015, is based on the operation risk.

Yves Morier, EASA

Categorization

Categories of operations

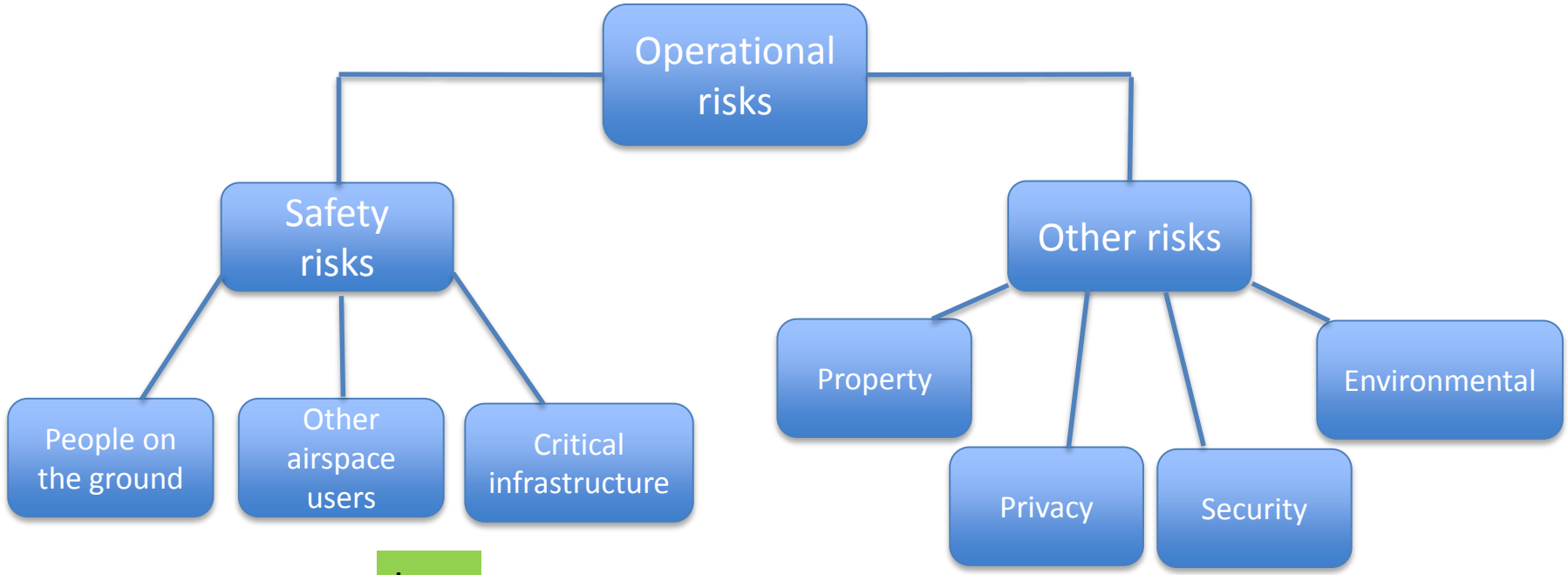
	Open	Specific	Certified
Operational approval	No	Yes	No
Type Design (TC/STC)	No	Maybe*	Yes
Certificate of Airworthiness	No	Maybe*	Yes
Conformity to Design Standard	Maybe	Maybe*	Yes
Pilot License	No	Maybe*	Yes
Operator Approval	No	Maybe*	Yes
Maintenance Approval	No	Maybe*	Yes
Production Approval	No	Maybe*	Yes

*- implies that some approvals may not be mandatory depending on the outcome of the risks assessment

Source : JARUS

Risk consideration (Category specific)

Specific Operational Risk Assessment (SORA)



Mitigations with 3 levels of robustness

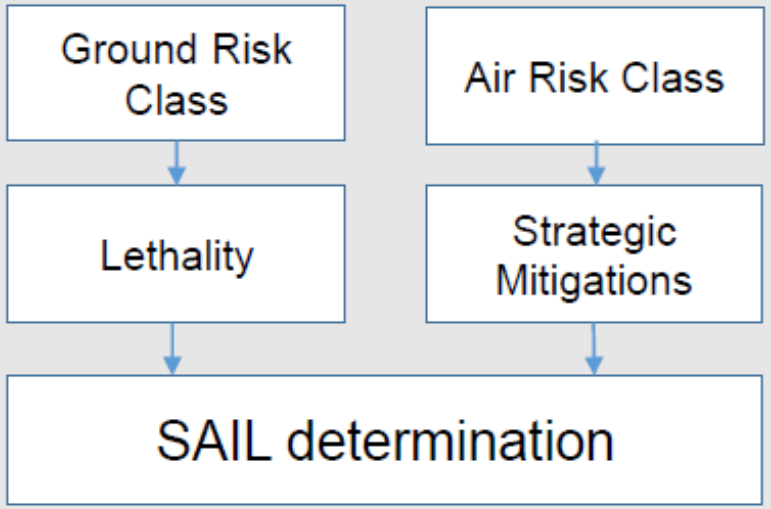
- Low
- Medium
- High

given by the SAIL (Specific Assurance and Integrity Level)

Note: SORA has been proposed by JARUS and is still under development

Specific Assurance and Integrity Levels (SAIL)

Specific Assurance and Integrity Level (SAIL) determination



SAIL							
UAS Lethality	Operation Ground/Air Risk Class						
	7	6	5	4	3	2	1
HIGH	VI	VI	V	IV	III	II	I
AVERAGE	VI	V	IV	III	II	I	0
LOW	V	IV	III	II	I	0	0

Source: JARUS WG-6

Risk consideration (Category specific)

Example: C2Link required performances

Technical issue with UAS		Level of Integrity		
		Low (Sail II and III)	Medium (SAIL IV)	High (SAIL V and VI)
C2Link Performances	Criteria	- RF spectrum usage - Means to continuously monitor the performance of C2 to assure the adequacy of that performance to the operation requirements	Same as Low	Same as Low. In addition, the use of licensed frequency bands for C2 is required
	Notes	Unlicensed frequency bands might be accepted: - The operator demonstrate the compliance with other RF spectrum requirements (e.g. for EU: Directive 2014/53/EU) - The use of protection against interference (e.g. FHSS, frequency deconfliction by procedure) The RP has access at all times and in a timely manner to the relevant information on C2 affecting the safety of flight.	The used of licensed frequency bands might be necessary depending on the operation, although the use of non-aeronautical bands (e.g. licensed bands for cellular network) might be acceptable	A minimum level of performance, not limited to aeronautical licensed frequency bands is expected. Some operations may require the use of bands allocated to the areonautical mobile (satellite or not) route service for the use of C2 (e.g. C-Band 5030-5091 MHz, L-Band 960-1164 MHz…) In any case, the use of licensed frequency bands needs to be authorized.

Source: JARUS WG-6

High level picture

The aviation infrastructure used for Communication, Navigation, Surveillance, such as VHF, GPS and Automatic Dependant Surveillance

C2: Frequency Bands identified in ICAO SARPs* (Standards And Recommended Practices)
Surveillance: Mode S, ADS-B (1090ES/ UAT)

And/ Or

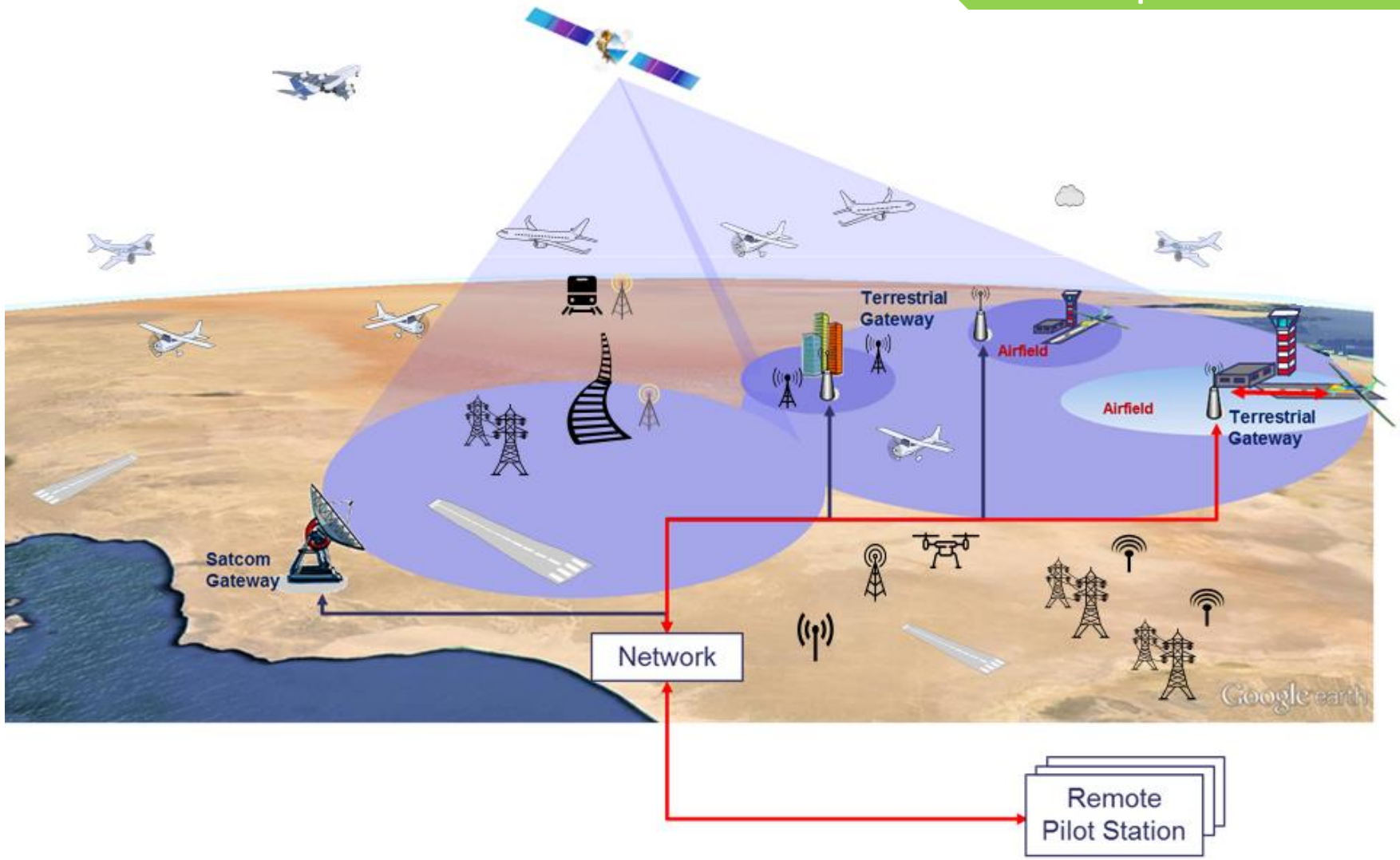
The mobile telecom infrastructure made available by mobile telecom operators or free frequency bands

C2: Wifi, LTE, 868 MHz, …
Identification: Wifi, 868 MHz, LTE, …
Surveillance: UTM?

*still under consideration , but the choice of the terrestrial frequencies does not seem to evolve for the band C and L

Communication infrastructure

Example of RLOS operation



Example of RLOS operation

Example of aero
C-band antenna (ANTCOM)
5cm (W) x 13cm (L) x 8cm (H)
150g

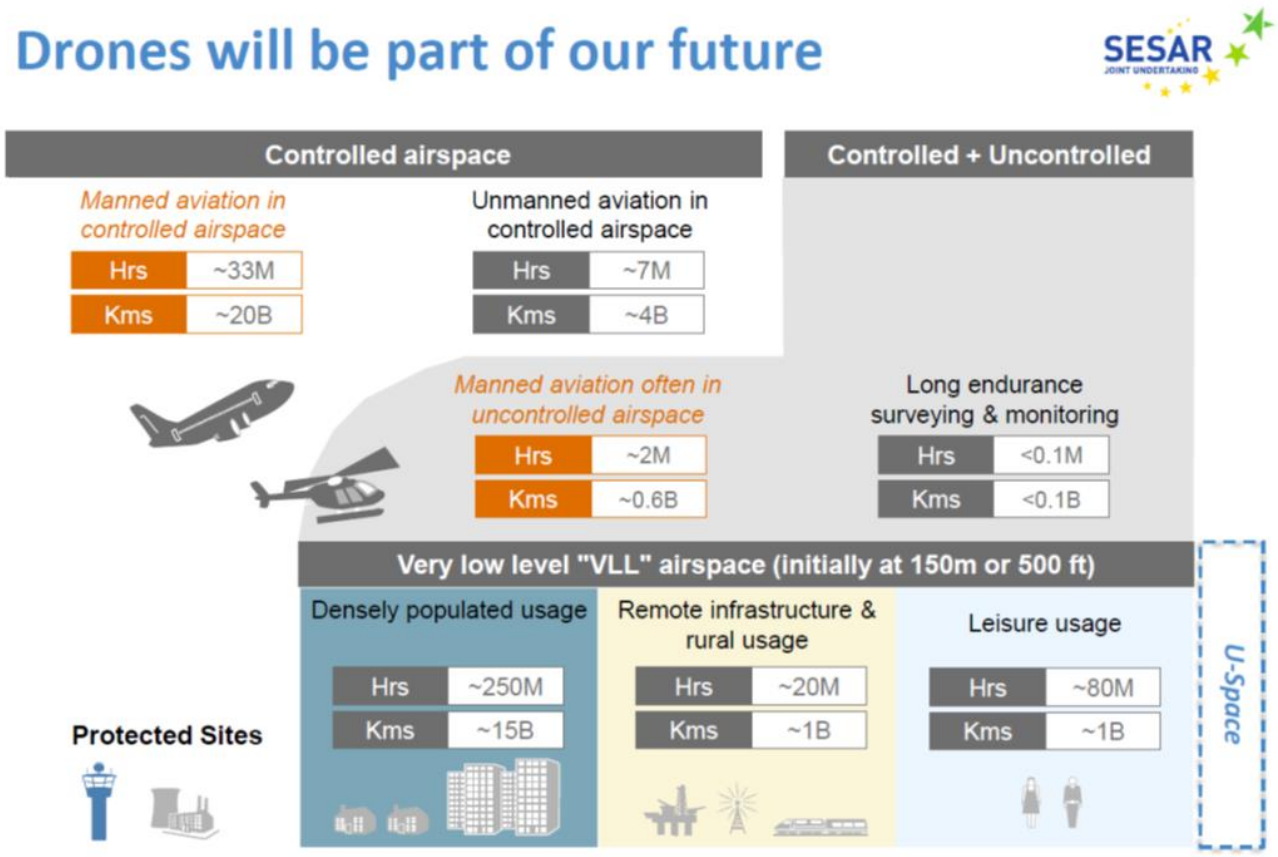
Source: Thales Alenia Space

Example of BRLOS operation

Example of aero
C-band antenna (ANTCOM)
5cm (W) x 13cm (L) x 8cm (H)
150g

Source: Thales Alenia Space

Remote
Pilot Station



Source: SESAR JU, 2017

- Manned and unmanned aviation shall coexist in a common airspace with the same level of safety
- Need for R&D in ATM and UTM: Tight collaboration between CAAs, laboratories, Industry, EASA, JARUS, ITU, CEPT and ICAO is needed !

Questions ?