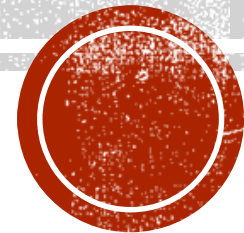


# ITU AND UNMANNED AIRCRAFTS SYSTEM (UAS)



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# KEY ISSUES

- 1) Integrate seamlessly into current air traffic control (ATC) procedures
- 2) Maintain safety-of-flight levels.

This will influence the corresponding spectrum requirements and the quality of spectrum needed to satisfy these requirements.



# ITU'S OBJECTIVES

- 1) **To ensure that safe flight operation of UAS occurs on reliable communication links**, especially for the remote pilot to command and control the flight and to relay the air traffic control communications (*Also referred to as control and non-payload communications (CNPC)*).
- 2) To make UAS CNPC **links via satellite** a part of UAS operations, in particular to relay transmissions beyond the horizon and maintain safe flight operation.
- 3) To provide CNPC links with the ability to operationally **mitigate interference** in order to ensure appropriate overall link integrity and availability that are consistent with UAS operations in non-segregated airspace(s);



# TERMINOLOGIES AND DESCRIPTION

The following are the adopted industrial terminologies and their descriptions as used in UAS operation;

- ***Unmanned Aircraft (UA)***: Designates all types of aircraft remotely controlled.
- ***Control Station (UACS)***: Facilities from which a UA is controlled remotely.
- ***Control Link subsystem***: Communication link between the UA and the UACS carrying tele commands (from the pilot to the UA) and telemetry (from the UA to the pilot).
- ***Sense and avoid (S&A)***: S&A corresponds to the piloting principle “see and avoid” used in all air space volumes where the pilot is responsible for ensuring separation from nearby aircraft, terrain and obstacles.
- ***Radio line-of-sight (LoS)***: the direct radio line of sight radiocommunication between the UA and UACS.
- ***Beyond radio line-of-sight (BLoS)***: the indirect radio communication between the UA and a UACS using satellite communication services.



# TERMINOLOGIES AND DESCRIPTION (CONT...)

- ***Handover operations:*** is the transfer: of a direct (LoS) RF communication from one dedicated UACS to another (LoS) dedicated UACS of a direct (LoS) to an indirect (BLoS) RF communication link or vice versa.



# SPECTRUM ASPECTS



## Frequencies for aviation at world radiocommunication conferences



90<sup>th</sup> Anniversary  
CCIR/ITU-R Study Groups  
(1927-2017)

- WARC 1927, Washington -> first spectrum to aeronautical service in 315 – 350 kHz
- WARCs in 1938, 1947/59/63/64/66, etc. –spectrum for new aviation technologies
- WRC-12 -> spectrum for **terrestrial** component of **RPAS** in 5030 – 5091 MHz
- WRC-15:
  - 8 frequency bands for **satellite** component of RPAS in  $K_u$  and  $K_a$  ranges
  - Spectrum for Global Flight Tracking and Wireless Avionic Intra Communications (satellite reception of ADS-B signals)



Delegates at the 1947 Atlantic City Radio Conference



Delegates at WRC-15





# CATEGORIES OF POTENTIAL SPECTRUM FOR UASs

## Aeronautical safety bands

- Exclusive (mostly)
- Protected from interference
- Managed by ICAO/CAA
- Limited capacity and intensive usage
- E.g. 5030-5091 MHz

## Licensed bands (cellular networks, etc.)

- Shared with other users
- Sufficient capacity
- Control of interference and Quality of service (QoS)
- E.g. 2 110-2 200 MHz

## Unlicensed bands ( Wi-Fi, SRD)

- Subject to general license (power limits)
- Available for short-range communications
- Good capacity and freedom to use
- QoS and protection from interference not ensured
- E.g. 2.4 GHz, 5.8 GHz





# CATEGORIES OF POTENTIAL SPECTRUM FOR UASs.. CONTD...

The unlicensed bands present the following advantages;

- no interference protection, QoS are not ensured
  - Mainly for recreational UAS usage within line-of-site.
  - Possible solution for UAS identification and tracking (UAS radio tags)
  - May be not suitable for BLOS communications and professional UAS
- Usage of unlicensed bands for UAS varies by country. Examples: 27 MHz, 34 – 35 MHz, 40 MHz, **2.4 GHz**, **5.8 GHz**





# Feasibility of aviation safety bands for UAS

(example of some bands)



90<sup>th</sup> Anniversary  
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Range	Frequency band	Current aviation usage	Feasibility for UAs
HF	2.85 – 22.0 MHz	Voice and data	<b>No</b> Congested, subject to careful, formal planning
VHF	117 – 137 MHz	Voice and data	<b>In principle No</b> congested, subject to careful, formal planning
L-band	960 – 1164 MHz	Air-ground coms, DME, UAT, ADS-B...	<b>In principle No</b> Congested
C-band	5030- 5091 MHz	MLS, RPAS C2	<b>Could be studied</b> Mainly for RPAS, but 5030 – 5091 MHz under study for small UAS in some countries

# UAS AND 5G

- 5G is wider than just mobile industry. It will accommodate verticals (industry sectors)
- Future 5G networks will be capable to adapt to a specific application

Automotive



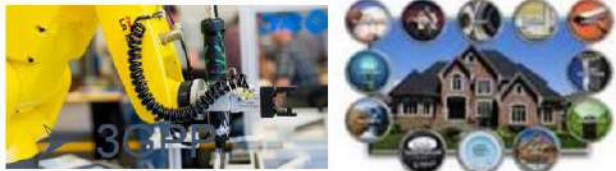
Railways



Media



Industrial and home automation



Public safety



Drones



- 3GPP (3rd Generation Partnership Project) and telecom industry consider UAS as a potential 5G vertical



# SUMMARY

ITU Consideration;

- Possible approach: UAS categories -> requirements for operation range and channel QoS -> choice of spectrum and technologies to meet the requirements.

- Spectrum for UAS C2

Licensed spectrum or dedicated bands for professional UAS and BLOS operations

Unlicensed bands for recreational UAS operated at LOS

- Candidate telecommunication technologies – probably no new, dedicated networks, rather use of existing ones and adapting them:

IMT and satellite networks for BLOS operations

WiFi and SRD for LOS operations

Possibly some aeronautical systems for LOS/BLOS



# WORK IN PROGRESS . . . INTERNATIONAL ENGAGEMENTS

- Studies on spectrum and technologies for UAS C2/payload/tracking are taking place both in ICAO and outside the aviation community:

Regional telecommunication organizations, e.g. **CEPT**

**3GPP** and main telecommunication industry players – accommodation of UAS under 5G

**ITU-T Study Group 20** dealing with IoT - identification of UAV as a digital object

- Possible assistance of ITU:

Adapting regulations to allow UAVs usage in IMT, if chosen

Global harmonization of spectrum for small UAS, if decided



# UCC OUTLOOK . . . . . NATIONAL INTEREST

- The UCC recognises the increasing use and demand for various application and services.
- **Our concern is to ensure that harmonised spectrum resources are available for UAS.** Accordingly, the UCC aligns with the ITU-R in conducting studies and identifying such spectrum.
- Recognizing the need for safety of operations and critical civil aviation safety requirement, UCC is working with all relevant agencies in charged with safety and national security. `



Thank You

