



ICAO

# INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY

GLOBAL DEVELOPMENTS  
RELATED TO CNS

RECONNECTING **THE** WORLD

# GLOBAL DEVELOPMENTS RELATED TO CNS

---

BY CNSS SECTION AND AOI SECTION

For the twelfth meeting of the  
MIDANPIRG CNS sub-group  
(Amman, Jordan, 2-4 MAY 2023)

## Presentation Overview

---

**01** COMMUNICATIONS

**02** NAVIGATION

**03** SURVEILLANCE

**04** SPECTRUM

**05** INTEGRATED CNS &  
SPECTRUM

**06** OTHER CNSS ACTIVITIES

# COMMUNICATIONS

The 6th meeting of the Data Communication Infrastructure Specific Working Group of the Communications Panel (CP-DCIWG/6) was held 17-20 October 2022. Several deliverables, proposals for amendment to Annex 10 Volume II and Volume III, are expected from CP-DCIWG/6.

- **Provisions on the exchange of information using the aeronautical telecommunication network over the internet protocol suite**

*(SARPS on Aeronautical Telecommunications Network using the Internet Protocol Suite (ATN/IPS) with VOIP)*

# COMMUNICATIONS

- **Provisions on the exchange of information using the aeronautical telecommunication network over the internet protocol suite**

*(SARPS on Aeronautical Telecommunications Network using the Internet Protocol Suite (ATN/IPS) with VOIP)*

An IP-based network for ATM is a key enabler for developments such as SWIM, FF/ICE, TBO and RPASs and many others. However there are complex issues that need to be addressed to ensure network security and mobility across various media. Some of these include stringent performance requirements (especially for A/G); higher availability requirements, accommodation of the ICAO 24-bit aircraft address, a robust network architecture and interfaces, naming conventions unique to aviation. The PfA will assist introduction of global harmonized provisions to make consistent and unique addressing to provide protection from random intrusions.

The Air Navigation Commission (ANC) will carry out its preliminary review in May 2023.

# COMMUNICATIONS

- Update SATCOM SARPs

ATM Operations in the ASBU Block 1 and 2 timeframe will require capacity, performance and ease of use, that cannot be met by the satellite systems in use today. New SATCOM systems referred to as SATCOM Performance Class B systems, offer better overall performance compared to the existing systems, while maintaining continuity with existing legacy ground-based and airborne equipment.

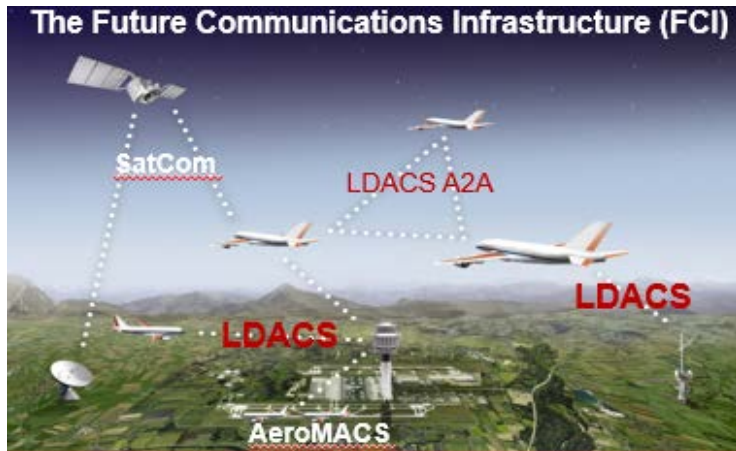
*- PFA preliminary review is expected in Q1 2025*

# COMMUNICATIONS

Several deliverables, proposals for amendment to Annex 10 Volume II and Volume III, are expected from CP-DCIWG/5. Cont

- SARPS on L-Band Terrestrial Data Link System (LDACS)

Future ATM Operations will require capacity and performance that cannot be met by the terrestrial data link systems in use today. hence new data link systems are required. The development of new ATM operational procedures and increasing demands for operational and business continuity require greater robustness, resilience and security in communications systems. These can be realized through the introduction of LDACS. LDACS, a broadband system based on Orthogonal Frequency-Division Multiplexing (OFDM) like current/future mobile radio standards, applies modern and highly efficient transmission concepts and advanced recover design for interference robustness. LDACS is highly flexible and scalable and, thus, enables long-term evolution. LDACS supports high-rate data communications and voice, which enables important future applications.



**- PfA preliminary review is expected in Q1 2025**

# COMMUNICATIONS

➤ Also CP-DCIWG/6 discussed and approved

- New editions of Doc 9880 and Doc 9869
- Updates to the CP-DCIWG job cards and
- New job card on Development and standardization of emerging aeronautical communication technologies and systems operating in VHF frequency band



# NAVIGATION

Amendment 93 to Annex 10 — Aeronautical Telecommunications, Volume I — Radio Navigation Aids, regarding:

- support of the introduction of dual-frequency, multi-constellation (DFMC) global navigation satellite system (GNSS) by adding provisions for additional frequencies of operation for the global positioning system (GPS), the global navigation satellite system (GLONASS) and the satellite-based augmentation system (SBAS), and by introducing provisions for the new BeiDou Navigation Satellite System (BDS) and Galileo system; and
- support of ionospheric gradient mitigation for the ground-based augmentation system (GBAS).



# NAVIGATION

- support of the introduction of dual-frequency, multi-constellation (DFMC) global navigation satellite system (GNSS) by adding provisions for additional frequencies of operation for the global positioning system (GPS), the global navigation satellite system (GLONASS) and the satellite-based augmentation system (SBAS), and by introducing provisions for the new BeiDou Navigation Satellite System (BDS) and Galileo system; and
- support of ionospheric gradient mitigation for the ground-based augmentation system (GBAS).

- The proposed amendment arose from the sixth meeting of the Navigation Systems Panel (NSP/6).
- After consultation with States and international organizations and final review by the Air Navigation Commission, the amendment was adopted by the ICAO Council on 20 March 2023.
- It will become effective on 31 July 2023 and applicable on 2 November 2023.

# NAVIGATION

Amendment 93 to Annex 10 — Aeronautical Telecommunications, Volume I — Radio Navigation Aids cont.

## Impact on States:

- Implementation of DFMC GNSS (any element) is not mandatory and will be driven by the specific cost/benefit and policy considerations that apply to individual States.
  - For most States that choose to implement DFMC GNSS, no additional infrastructure costs will be involved.
  - For DFMC GNSS provider States (core satellite constellation, SBAS) typically infrastructure costs will not be carried by aviation users given that the related infrastructure is of universal utility and aviation users represent a small fraction of the user community.
- Implementation of the GBAS changes would consist of a minor modification to existing material.

# NAVIGATION

Ongoing NAV developments (after Amendment 93):

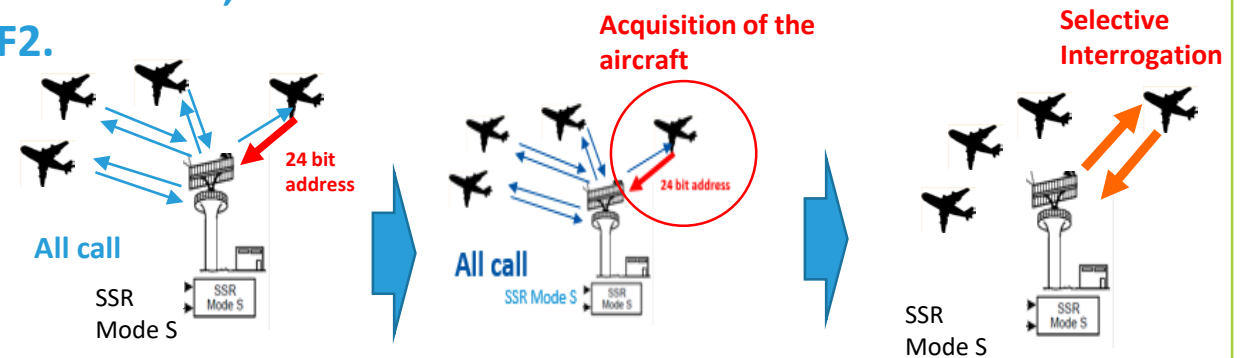
- ARAIM (Advanced RAIM)
- SBAS authentication
- DFMC GBAS
- GNSS interference mitigation
- APNT (alternative position, navigation and timing)

# SURVEILLANCE

## Proposal for amendments (PfA) to Annex 10, Volume III, related to 24-Bit aircraft address

On 29<sup>th</sup> Nov 2022, the Air Navigation Commission (ANC) carried out the preliminary review of the PfA to Annex 10, Volume III, related to 24-Bit aircraft address. This PfA includes:

- a) refinement of provisions related to aircraft address assignment;
- b) increasing State allocation of aircraft addresses; and
- c) deletion of unused registers F1 and F2.



# SURVEILLANCE

## Proposal for amendments (PfA) to Annex 10, Volume III, related to 24-Bit aircraft address Cont



The State Letter (AN7/1.3.95-22/106) was published on 22 Dec 2022 and circulated to States and international organizations for their comments.

The due date for those comments is 22 June 2023.

The Secretary will present the results of the consultation for final review by the ANC during its 224th Session (Fall 2023).

The expected applicability date for the PfA is 28 November 2024.

# SURVEILLANCE

## On going activities

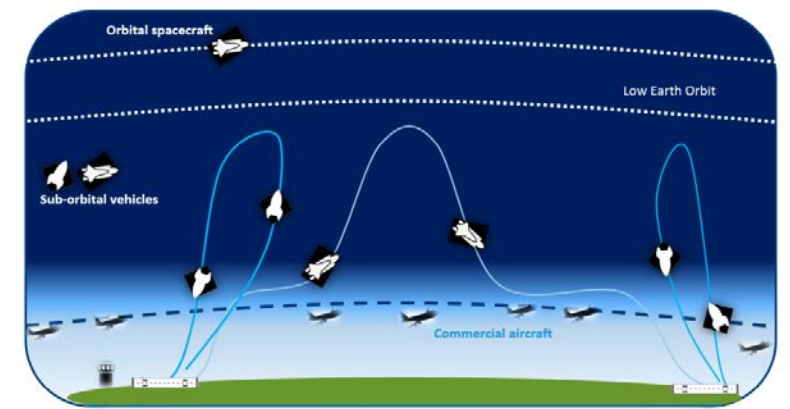
The 5<sup>th</sup> meeting of the Surveillance Panel (SP/5) to be held 20-29 Sep 2023 is planning to progress the PfA to Annex 10, Volume IV, related to updates to transponder requirements for compatibility with the new 1090 MHz extended squitter ADS-B version 3 Format.

**ADS-B version 3 will provide new capabilities** including :

- autonomous distress tracking support
- information to support future interval management operations;
- broadcast of aircraft–based derived weather data;
- Broadcast of lost C2 Link state for UAS/RPAS;
- broadcast of 1030/1090 MHz spectrum monitoring data; and
- functionality to support sub-orbital vehicle operations.

**This is related to:**

➤ **WRC-23 Agenda item 1.6 and 1.8**



# SURVEILLANCE

## On going activities Cont.

The SP/5 to be held 20-29 Sep 2023 is also planning to progress the PfA to Annex 10, Volume IV, related to :

- technical provisions for **the efficient use of the 1090 MHz radio frequency (RF)**, providing means and measurements to reduce 1090 MHz RF congestion, ensuring better performance of surveillance systems and continued use of 1090 MHz systems;
- introduced ACAS III technical provisions, based on **ACAS Xu** (Unmanned Aircraft System) avionics standards developed by RTCA/EUROCAE; and
- a proposed revision to Chapter 7 of Annex 10 Volume IV, which specifies technical requirements for **airborne surveillance applications utilizing ADS-B IN.**





# FREQUENCY SPECTRUM MANAGEMENT

- **ICAO Position for the International Telecommunication Union (ITU) World Radiocommunication Conference 2023 (WRC-23)**
  - The ICAO Position was approved by the ICAO Council and sent to all ICAO Contracting States and relevant international organizations under cover of ICAO State letter E 3/5-21/37 dated 18 August 2021.
  - It looks like the WRC-23 to be held 20 Nov- 15 Dec this year will be busier than ever for aviation. WRC-23 Agenda Items 1.6, 1.7, 1.8, 1.9, 1.10 and 9.2 address issues where aviation is seeking action by the WRC.

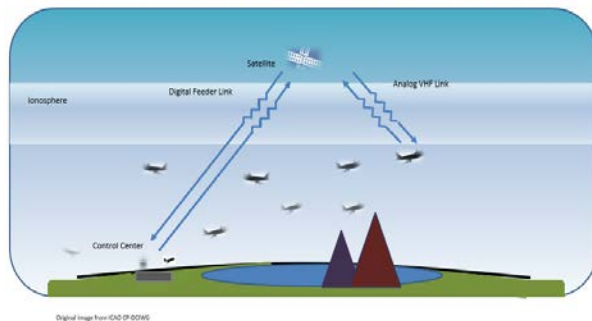


Many WRC agendas are directly related to CNS & Spectrum expert activities!

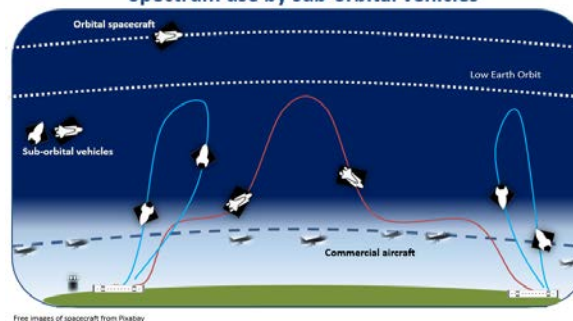
# FREQUENCY SPECTRUM MANAGEMENT

- **ICAO Position for the International Telecommunication Union (ITU) World Radiocommunication Conference 2023 (WRC-23)**
  - Active support from States is deemed to be the only means to ensure that the results of the WRC-23 reflect civil aviation's need for spectrum.
  - Frequency Spectrum Management Panel (FSMP) reviewed and approved changes to the ICAO Position in February 2023. The ANC will review these changes on 16 May 2023 and the ICAO Council will review the updates for their approval around June 2023 timeframe.

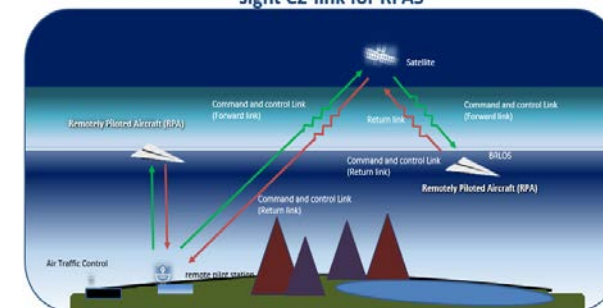
**WRC-23 Agenda Item 1.7:**  
Potential facilitation of aeronautical VHF over satellite



**WRC-23 Agenda Item 1.6:**  
Spectrum use by sub-orbital vehicles



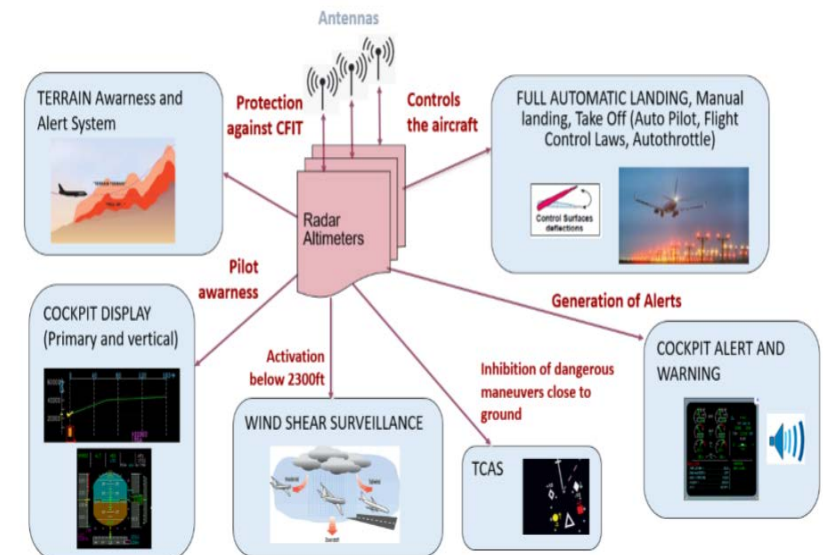
**WRC-23 Agenda Item 1.8:**  
Finalization of a satellite allocation enabling beyond-line-of-sight C2-link for RPAS



# FREQUENCY SPECTRUM MANAGEMENT

## Potential interference to Radio Altimeters and development of relevant SARPs

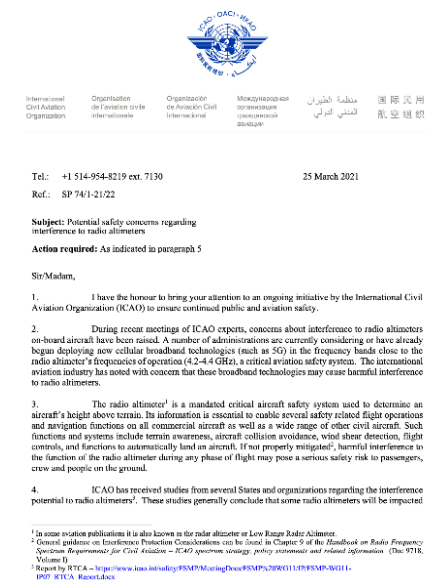
- A number of administrations are currently considering or have already begun deploying new cellular broadband technologies (such as 5G) in the frequency bands close to the radio altimeter's frequencies of operation (4.2-4.4 GHz).
- The international aviation industry has noted with concern that these broadband technologies may cause harmful interference to radio altimeters, which is a mandated critical aircraft safety system used to determine an aircraft's height above terrain. If not properly mitigated, harmful interference to the function of the radio altimeter during any phase of flight may pose a serious safety risk to passengers, crew and people on the ground.



# FREQUENCY SPECTRUM MANAGEMENT

## Potential interference to Radio Altimeters and development of relevant SARPs Cont.

- ICAO has received studies from several States and organizations regarding the interference potential to radio altimeters. These studies generally conclude that some radio altimeters will be impacted if high power cellular systems are implemented near the frequency band used by the radio altimeters.
- ICAO published a State Letter (Refer to SP 74/1-21/22 published on 25 March 2021) which encourages States and the aviation industry to consider as a priority, public and aviation safety when deciding how to enable cellular broadband/5G services in radio frequency bands near the bands used by radio altimeters.
- A41 Outcome related to ICAO policy on radio frequency spectrum matters: Requested ICAO and its Member States to continue taking necessary measures and efforts to ensure that radio altimeters and other aeronautical systems are free from harmful interference, including implementation of mitigation measures, sharing of best practices, as well as development of relevant provisions and guidance.



## Potential interference to Radio Altimeters and development of relevant SARPs Cont.

Planned ICAO Circular in 2023: Guidance on Safeguarding measures to protect Radio Altimeter from potential harmful interference from Cellular 5G Communications

See:

[FSMP WG/16 WP/02 Attachment](#),  
available for download at FSMP  
website

*Note.- The draft Circular is based on the MID document, while also including/accomodating several comments received by the FSMP members.*

### TABLE OF CONTENTS

	<i>Page</i>
Abbreviations and acronyms .....	(v)
References .....	(vii)
Executive Summary.....	9
Chapter 1 - Background on 5 G and frequency band allocation .....	11
Chapter 2 - Potential impacts of 5G on Radio Altimeters during aircraft operations .....	13
Chapter 3 – Short Term Safeguarding measures adopted at regional and global levels /Long Term Planning .....	19
Chapter 4 - Methodologies for defining safeguarding measures for aerodromes & heliports .....	32

# FREQUENCY SPECTRUM MANAGEMENT

- **Develop and maintain SARPs and guidance to prevent WAIC / Radio Altimeter interference**
  - WRC-15 agreed to changes to the international radio frequency regulations which provide for sharing of the frequency band 4 200 – 4 400 MHz by Wireless Avionics Intra-Communications (WAIC) systems under the aeronautical mobile (route) service, and radio altimeters under the aeronautical radionavigation service.
  - The associated ITU Resolution 424 (WRC-15) requires that the WAIC systems protect the operation of the radio altimeters and operate in accordance with SARPs as contained in Annex 10.

# FREQUENCY SPECTRUM MANAGEMENT

## Develop and maintain SARPs and guidance to prevent WAIC / Radio Altimeter interference

- A WAIC System provides wireless communications between points on board a single aircraft for aircraft applications related to the safety and regularity of flight using the aeronautical mobile (route) service (AM(R)S) allocation in the frequency band 4 200 – 4 400 MHz.
- FSMP/3 held in September 2022 approved the draft WAIC SARPs, which will prevent interference between WAIC systems and radio altimeters in order to ensure the safe operation of aircraft.
- The Air Navigation Commission will carry out its preliminary review in May 2023 and its relevant State Letter will be circulated to States and international organizations for their comments in Q2-Q3 2023. The expected applicability date for the PfA is Nov 2025.
- WAIC SARPs will be included in Chapter 4 of Annex 10, Volume V, under a new section 4.5 dealing with the frequency band 4200-4400 MHz. That section will also then be appropriate for the radar altimeter SARPS once they are completed.


# INTEGRATED CNS AND SPECTRUM

## (Long Term Evolution of CNS and Spectrum matters)

In addition to the continued engagement in the ITU spectrum management process, aviation also needs to engage in a proactive and long-term evolution of the CNS systems

### AN-Conf/13 Recommendation 2.2/1

- › ICAO to launch a study on evolving the required CNS and spectrum access strategy in the long term, to ensure that CNS systems remain efficient users of the spectrum resource
- › request States to engage in the spectrum regulatory process to ensure the continued necessary access and protection of the safety critical aeronautical CNS systems



Work is being initiated to undertake this study. This activity is expected to benefit the development of aeronautical CNS systems and their spectrum use in the medium to longer term and eventually the formulation of the ICAO spectrum policy for future WRCs



# INTEGRATED CNS AND SPECTRUM

## The Global concept for Integrated Communications, Navigation, Surveillance (CNS) and Spectrum

The ICNSS-TF is drafting the global concept for Integrated Communications, Navigation, Surveillance (CNS) and Spectrum, which will include the following deliverables:

- a) a roadmap of CNS evolution including a blueprint for CNS systems evolution; and
- b) a new and streamlined framework for CNS standardization which delivers:

Relevant WPs were discussed under the agenda item 31 (Aviation Safety and Air Navigation Standardization) at the 41<sup>st</sup> Assembly (27 Sep to 7 Oct 2022).

The draft Global Concept for Integrated CNS & Spectrum was shared with States and aviation community through the link embedded in the A41-WP/58.

(For more information, refer to the Integrated CNSS project: [Pages - Integrated CNSS Project \(icao.int\)](#) )

# INTEGRATED CNS AND SPECTRUM

## The Global concept for Integrated Communications, Navigation, Surveillance (CNS) and Spectrum Cont.

Feedback received was very positive and lead to the following strong support:

“The Commission reviewed A41-WP/58, presented by the Council, which contained information on progress achieved by the Integrated Communications, Navigation, Surveillance and Spectrum (ICNSS) project.

Noting that the ultimate objective of the ICNSS project was to propose a set of recommendations for endorsement by the next Assembly, the Commission expressed its satisfaction with the efforts underway and encouraged States, international organizations and other stakeholders to support the continued development and implementation of a medium to long-term roadmap for the evolution of ICNSS and a new streamlined framework for communications, navigation, surveillance (CNS) and frequency spectrum standardization”.

# OTHER CNSS ACTIVITIES

## Refinement of Frequency Finder (FF)

- In order to better support States and ICAO regional offices, ICAO has successfully further enhanced and implemented the following features to Frequency Finder tool:

- Plotting interference contours in the NAV module; and

- A global database for Mode S II/SI code assignments.

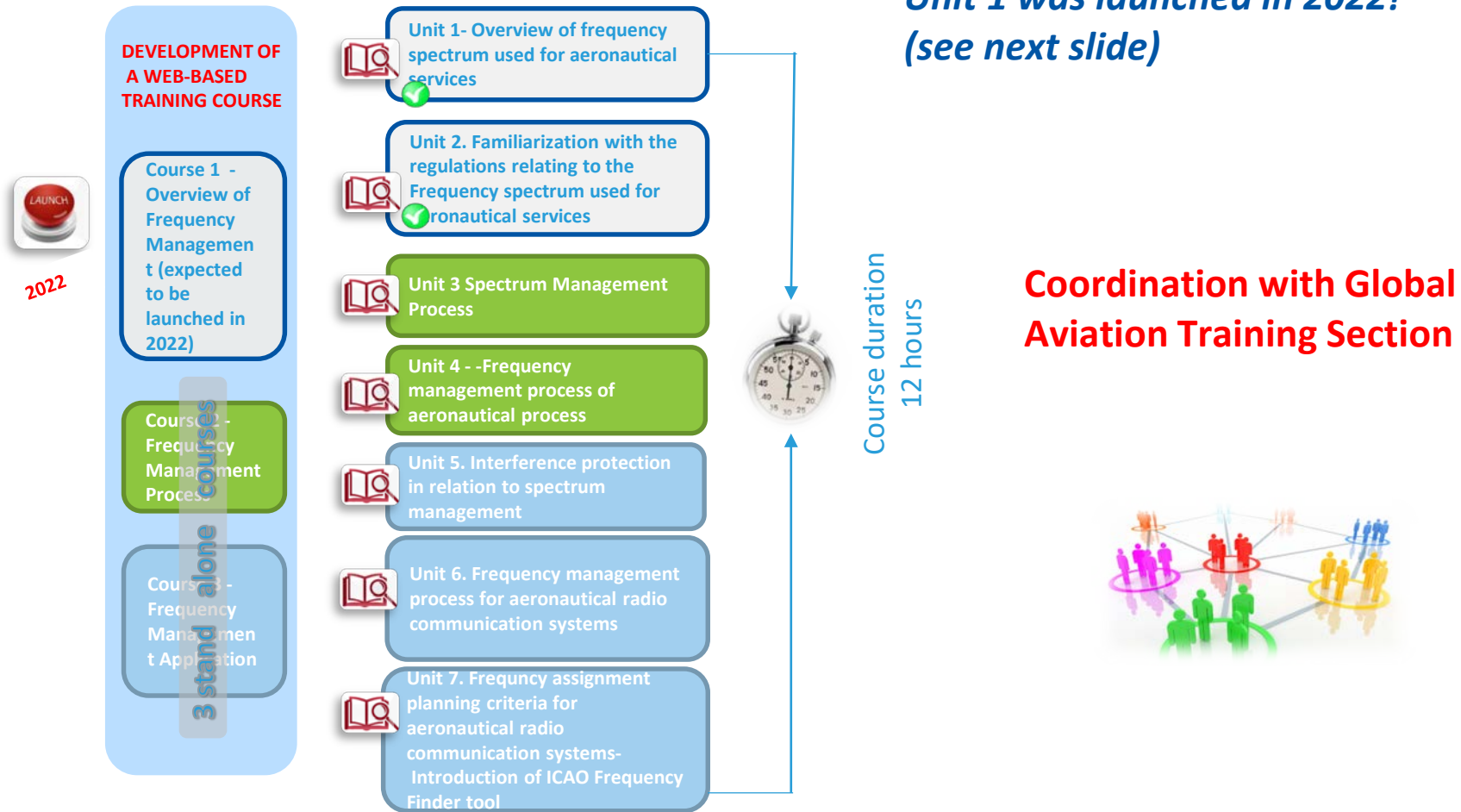
*Furthermore, there are several other enhancements planned to be developed and implemented (such as adding simulation capability, better cyber resilience of the tool) to facilitate efficient use of spectrum, assisting States and ICAO regional offices to visualize the current and future frequency congestions as well as to identify the optimal spectrum assignment globally and regionally*

## Workshops to promote Frequency Finder (FF)

- Several workshops were/will be conducted to assist States in use of FF

Development of the online course, frequency management for civil aviation (refer to the next slide)

# ONLINE COURSE DEVELOPMENT RELATED TO FREQUENCY MANAGEMENT FOR CIVIL AVIATION



# ONLINE COURSE DEVELOPMENT RELATED TO FREQUENCY MANAGEMENT FOR CIVIL AVIATION

## Aeronautical Spectrum Use with Special Focus on VHF (ASU) | ICAO Store



**Self-paced Training**

### **Aeronautical Spectrum Use with Special Focus on VHF (ASU)**

Offered in English only

**USD 300.00**

[Special price information](#)

CAA Personnel receive a 25% discount.

To obtain the CAA Personnel price, please contact [etraining@icao.int](mailto:etraining@icao.int) to validate your identity and receive a discount code.

<https://store.icao.int/en/aeronautical-spectrum-use-vhf-special-focus-training>

### **Description**

#### **Goal**

This course aims to provide the fundamentals of frequency and spectrum management, focusing mainly on Very High Frequency (VHF) used by aeronautical communications systems, as well as a description of the specific terms used in frequency management in civil aviation including a brief discussion about aeronautical communications and navigation systems.



Thank You