



| ICAO

INTERNATIONAL CIVIL AVIATION ORGANIZATION

A UN SPECIALIZED AGENCY



APANPIRG/36

Bangkok, Thailand, 24-26 November 2025

Global Developments in Air Navigation

Elie El Houry

Air Navigation Bureau Regional Coordinator
International Civil Aviation Organization

Presentation Overview

01 Traffic forecast

02 AN and LTAG

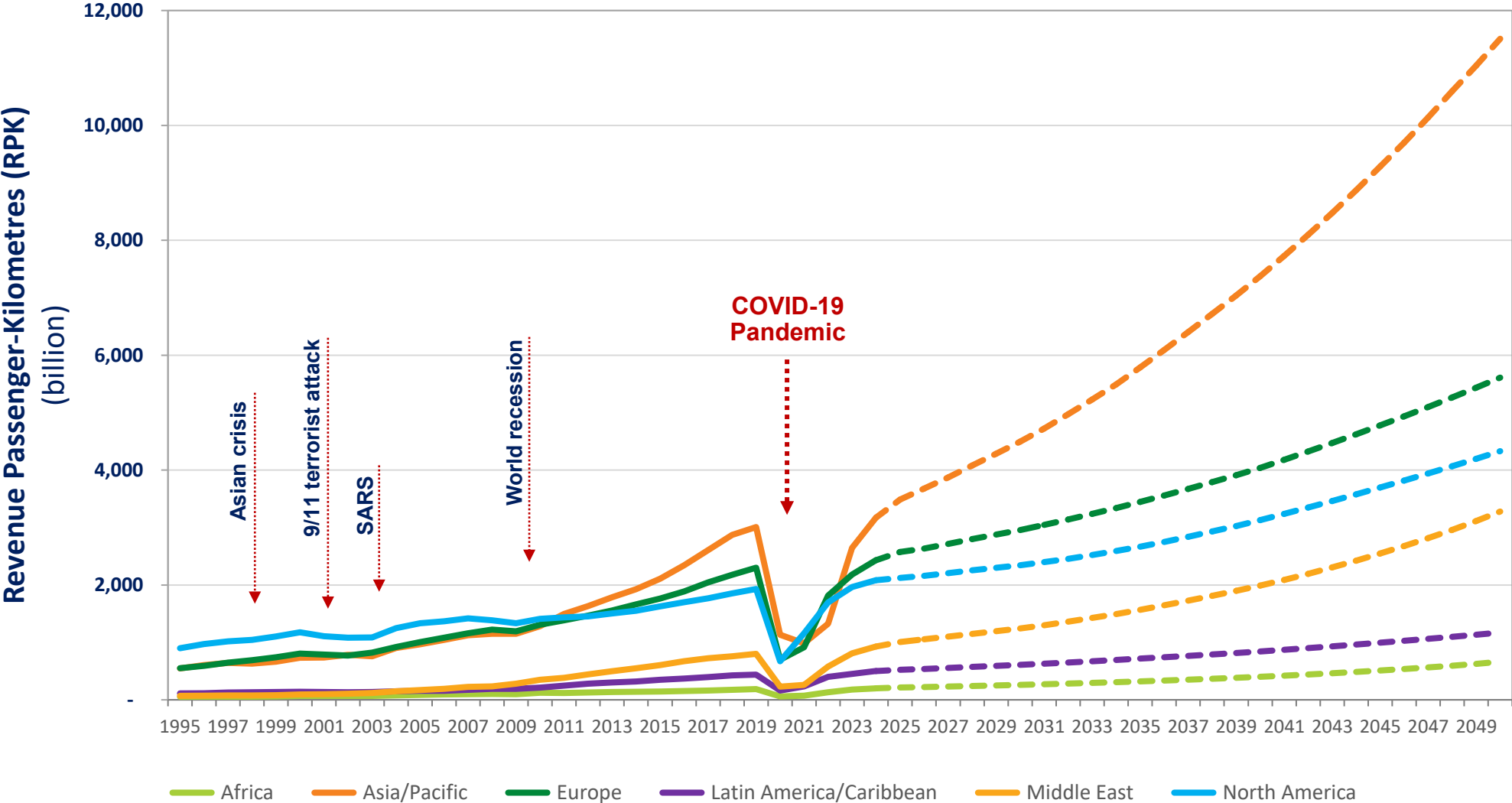
03 AN-Conf/14 Outcomes

04 Crisis and Contingency Management

05 GNSS RFI

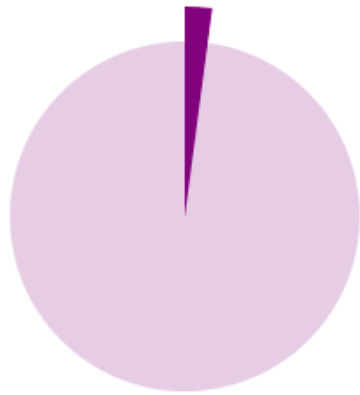
06 Upcoming Provisions

Global Traffic: The Pandemic and Recovery



Aviation and Environment

(Source: Air Transport Action Group Facts and Figures)



2.1%

The global aviation industry produces around 2.1% of all human-induced CO2 emissions. ⓘ



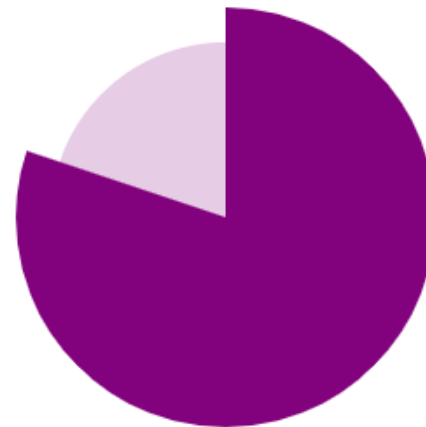
12%

Aviation is responsible for 12% of CO2 emissions from all transport sources, compared to 74% from road transport.



80%

Jet aircraft in service today are well over 80% more fuel efficient per seat kilometre than the first jets in the 1950s. ⓘ



80%

Around 80% of aviation CO2 emissions are emitted from flights of over 1,500 kilometres, for which there is no practical alternative mode of transport. ⓘ



ICAO LTAG NET-ZERO

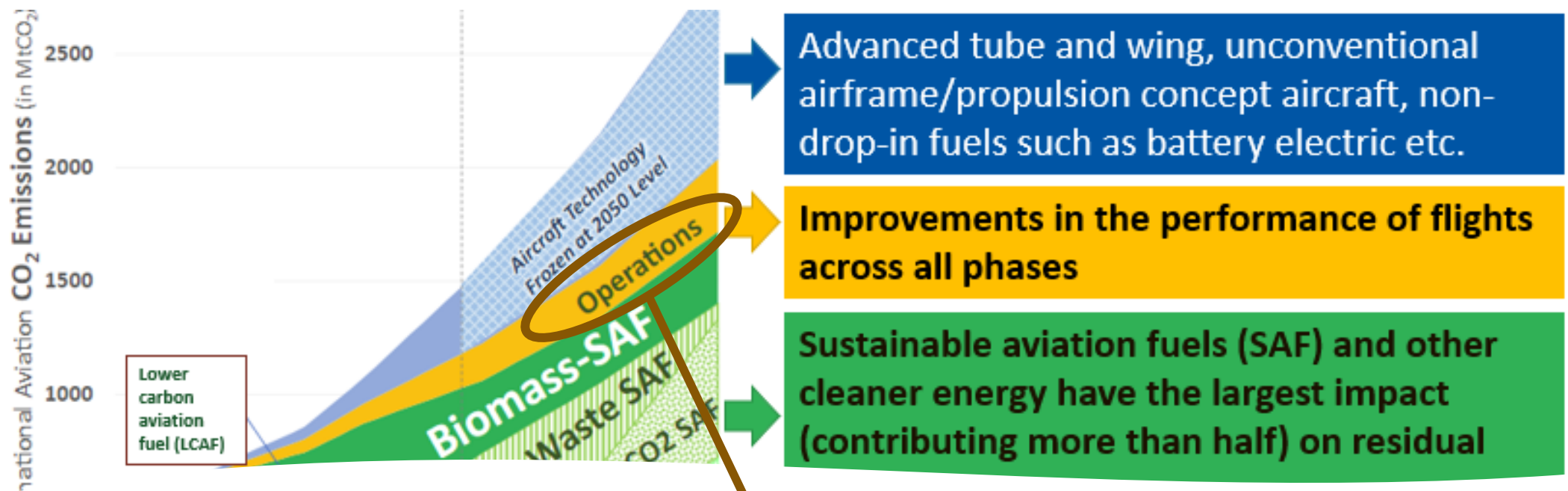
LONG TERM GLOBAL ASPIRATIONAL GOAL FOR INTERNATIONAL AVIATION

2050

Assembly Resolution A41-21 Consolidated statement of continuing ICAO policies and practices related to environmental protection — Climate change

LTAG - Technology, Operations, and Fuel

“When visualizing the ICAO basket of measures to reduce CO2 emissions, **Air Traffic Management (ATM) and operations are often overlooked** as one of the main measures to support the decarbonization process. However, despite being depicted as a small wedge, **ATM and operations offer the highest potential** for reducing CO2 and related **emissions in the short to medium term.**” (ICAO 2022 Environmental Report)



Can be implemented relatively quickly and widely

ICAO Decision-Making Events



Montréal in August 2023: Shaping the Skies of Tomorrow

Singapore in October 2023: ATM procedures today

Coming in 2026

ANW-ATFM 2026 (Montreal, Canada, 5-9 October 2026)

ANW-AAM 2026 – 2nd Symposium (Bangkok, Thailand, 1 -3 December 2026)

ICAO 

AN- CONF/14

14th Air Navigation Conference

26 August to 6 September 2024 | Montréal, Canada



Outcomes and follow-up actions

Agenda Item 1
ICAO 2023-2025 Business Plan
and long-term strategic
planning

Agenda Item 2
Timely and safe use of new
technologies

Agenda Item 3
Air navigation system
performance improvement

Agenda Item 4
Hyper-connectivity of air
navigation system

- ***Informed the aviation community*** of the work that is already prioritized and underway in the ICAO 2023-2025 Business Plan
- ***Held detailed technical discussions*** on new initiatives, leading to agreement on a set of high-level recommendations in the field of air navigation and safety
- ***Obtained timely direction*** for preparation for the 42nd Session of the ICAO Assembly in 2025

• **22 recommendations were actioned by the ICAO Council and ANC**

• **More information in A42-WP/30 (See Slide 16)**

Recommendation 1.1/1 – Support to ICAO’s programmatic business planning approach initiated by the Business Plan 2023 - 2025 priority focus areas

that ICAO:

d) through the planning and implementation regional groups and the regional aviation safety groups, in accordance with the Global Air Navigation Plan and the Global Aviation Safety Plan and their respective regional plans, incorporate into their work programmes and projects, initiatives taking into account alignment with the ICAO priority focus areas.

Recommendation 1.1/2 – Resilience of the air navigation system

that ICAO:

c) together with States and industry, develop global guidance on air traffic management contingency management, including the recovery phase, as well as regional frameworks, to support the implementation of Annex 11 — Air Traffic Services.

Recommendation 2.2/1 – Addressing safety risks related to new and evolving aviation technologies and concepts

that States:

d) develop, through appropriate regional mechanisms, harmonized regional regulatory frameworks and interoperable systems to ensure effective integration of unmanned aircraft systems, where appropriate;

Recommendation 2.2/2 – Addressing global navigation satellite system interference and contingency planning

that States:

b) through the mechanism of the planning and implementation regional groups, develop regional global navigation satellite system reporting mechanisms, to the extent feasible, to raise operational awareness of affected geographical areas as described in the Global Navigation Satellite System (GNSS) Manual (Doc 9849);

Recommendation 3.1/1– Optimized implementation of longitudinal separation minima

that States:

a) within the processes of the planning and implementation regional groups, actively collaborate with neighbouring States to implement Project 30/10 – implementation of longitudinal separations of 55.5 km (30 NM) or less in oceanic and remote airspace, and 19 km (10 NM) or less elsewhere.;

that ICAO:

b) through the planning and implementation regional groups, develop regional action plans for the implementation of Project 30/10;



The following are Actions specifically assigned to PIRGs or RASGs (Cont'd)

Recommendation 3.2/2 – Transition to flight and flow – information for a collaborative environment services and cessation of ICAO 2012 flight plan by 2034

that States:

d) planning and implementation regional groups, consider establishing regional focus groups for coordinating the planning and implementation of flight and flow – information for a collaborative environment services and providing necessary support throughout the transition period; and

e) support and contribute to the work of their respective planning and implementation regional group and their sub-groups to develop a regional plan to transition to flight and flow – information for a collaborative environment services on the basis of the 2034 global cessation of the ICAO 2012 flight plan;

that ICAO:

g) through planning and implementation regional groups, provide guidance and support for the development of regional plans to transition to flight and flow – information for a collaborative environment to enable the 2034 global cessation of the ICAO 2012 flight plan;

The following are Actions specifically assigned to PIRGs or RASGs (Cont'd)

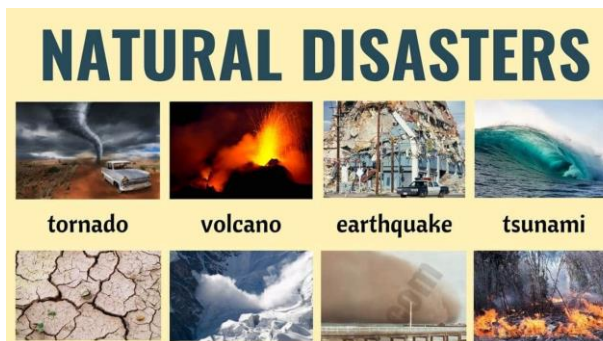
Recommendation 4.2/1 – Aviation cybersecurity

that States:

- b) align aviation cybersecurity activities in the regional air navigation, safety, and security and facilitation plans through the coordination processes of the planning and implementation regional groups, regional aviation safety groups and regional aviation security and facilitation groups; and
- c) report to ICAO their experience in implementing ICAO provisions and guidance material related to aviation cybersecurity, through the appropriate expert group(s) or through the processes of the planning and implementation regional groups, regional aviation safety groups and regional aviation security and facilitation groups;;

Crisis preparedness and response

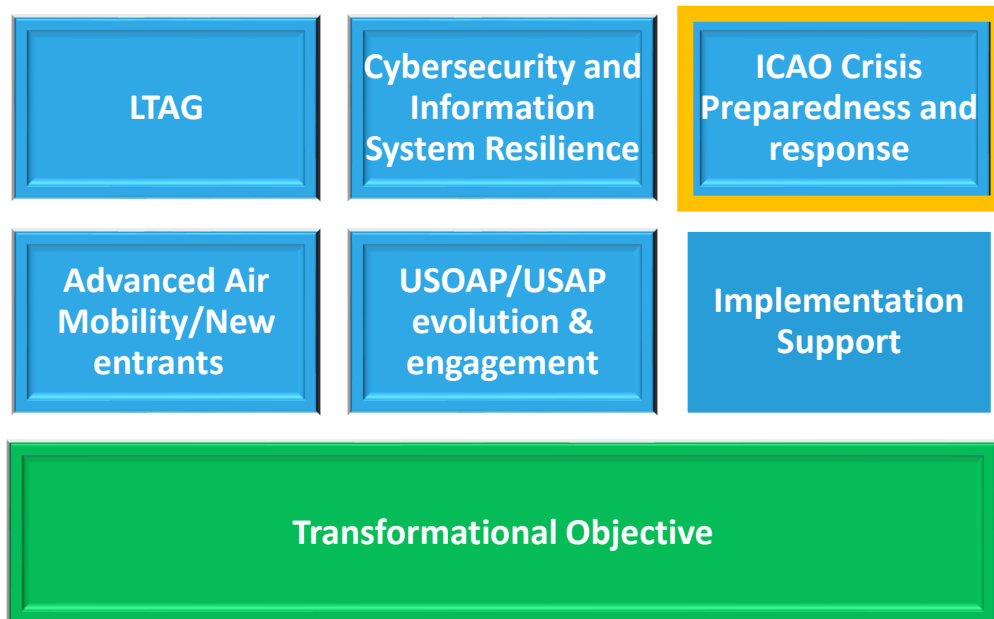
A crisis/contingency event can happen anywhere and
disrupt flight operations



In the ICAO Business Plan

Current Triennium 2023-2025

Priority Focus Areas approved by the ICAO Council



Next Triennium (2026-2028)

One of the Programmes under One Strategic Goal



**AVIATION DELIVERS
SEAMLESS,
ACCESSIBLE, AND
RELIABLE MOBILITY
FOR ALL**

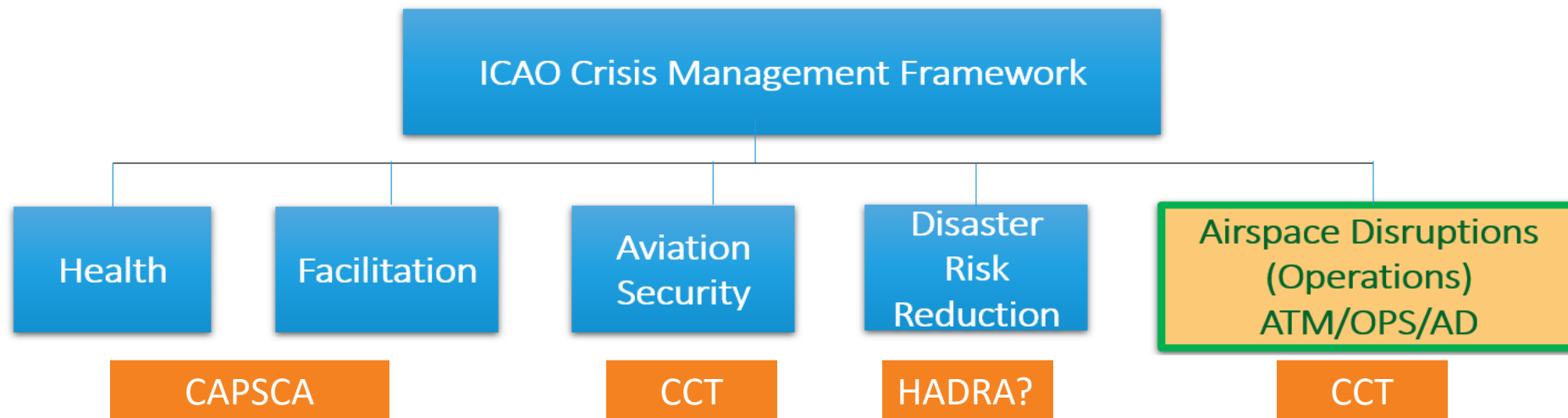
Crisis Preparedness and Response

This programme envisages to create a comprehensive and adaptable crisis response programme within ICAO to help States meet obligations under the Chicago Convention and other sectors, improving crisis response capabilities for ATM disruptions, health emergencies, and humanitarian crisis

Purpose

- ✓ **Address the current crisis response challenges**, in such areas as governance, coordination and communication.
- ✓ **Improve response capabilities by States** in the face of various crises (e.g., pandemics, natural disasters) causing disruption, or potential disruption, of airport, air traffic and other related support services,
- ✓ **Improve preparedness of ICAO and the aviation-related entities** to respond to these diverse crises in a timely, efficient, coordinated and effective manner.

Initial proposed structure



03

Harmonized Regional ATM Contingency Frameworks

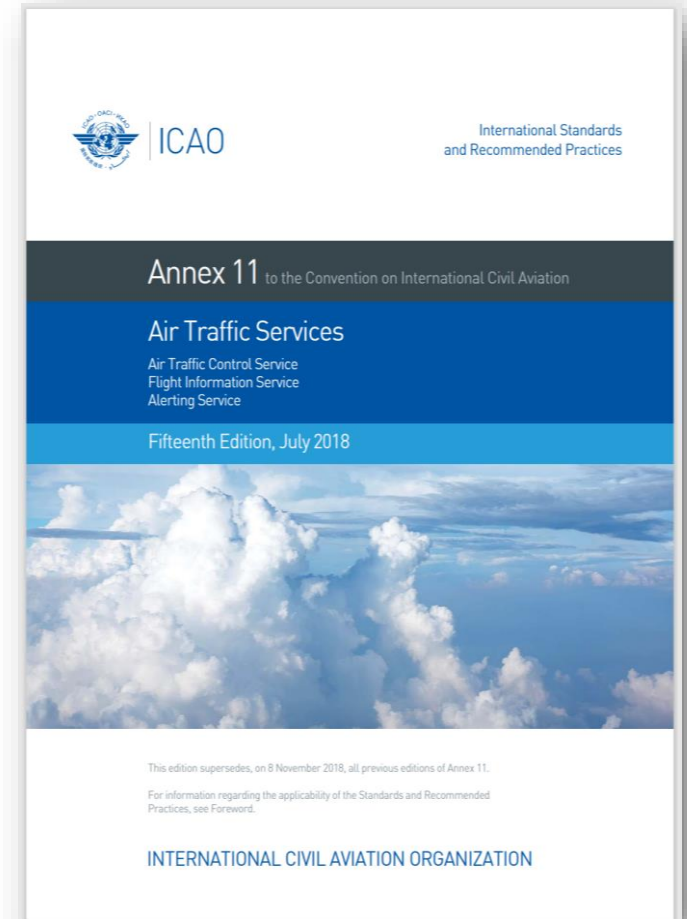


Annex 11 - 2.32 Contingency arrangements

Air traffic services authorities shall **develop and promulgate contingency plans** for implementation in the event of **disruption, or potential disruption**, of air traffic services and related **supporting services** in the airspace for which they are responsible for the provision of such services. Such contingency plans shall be developed **with the assistance of ICAO** as necessary, in **close coordination with** the air traffic services authorities responsible for the provision of services in **adjacent** portions of airspace and with airspace users concerned.

Note 1.— Guidance material relating to the development, promulgation and implementation of contingency plans is contained in Attachment C.

Note 2.— Contingency plans may constitute a temporary deviation from the approved regional air navigation plans; such deviations are approved, as necessary, by the President of the ICAO Council on behalf of the Council.



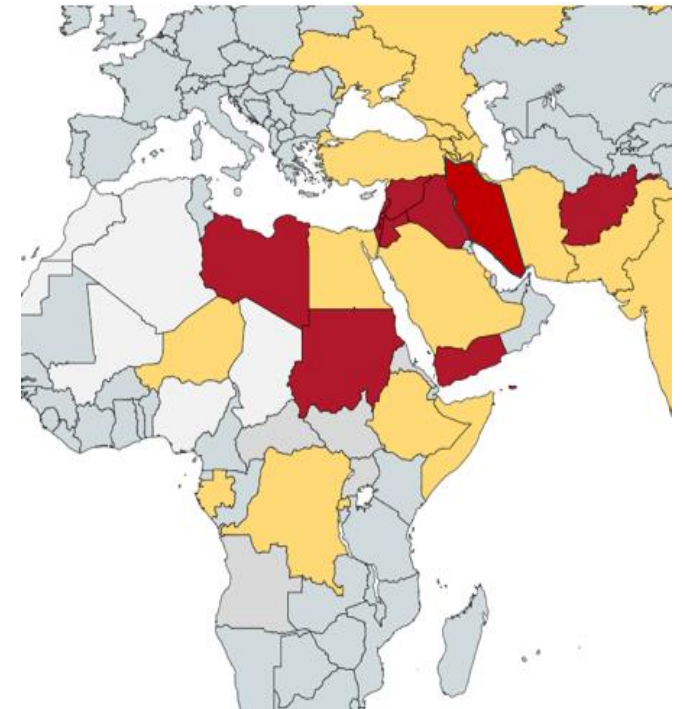
Contingency Coordination Teams (CCTs)

CCTs objectives

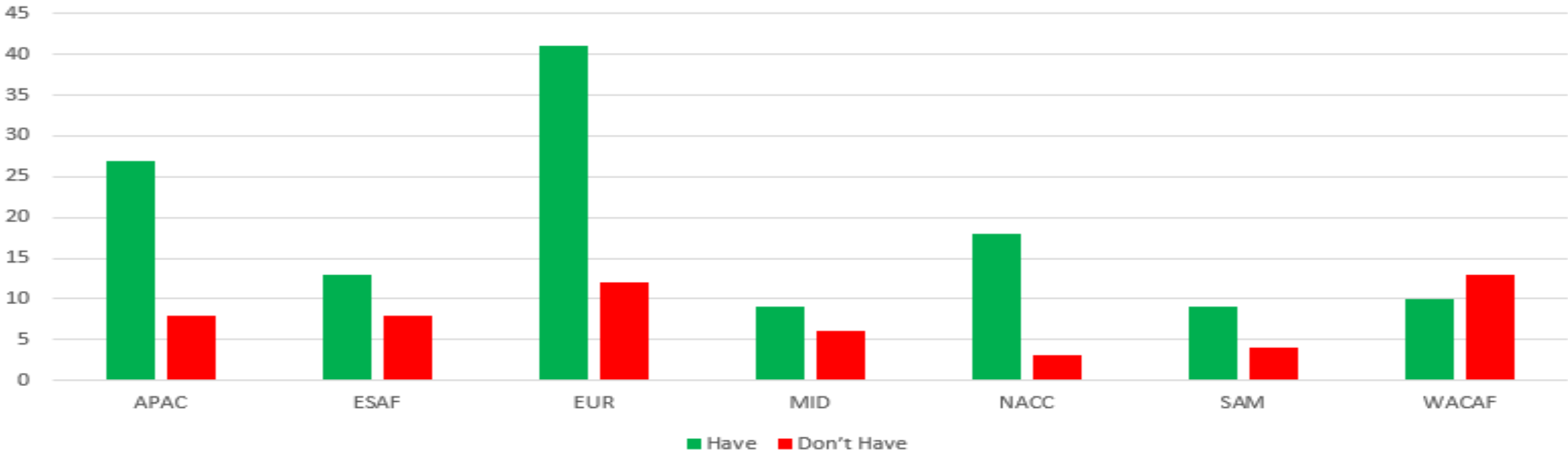
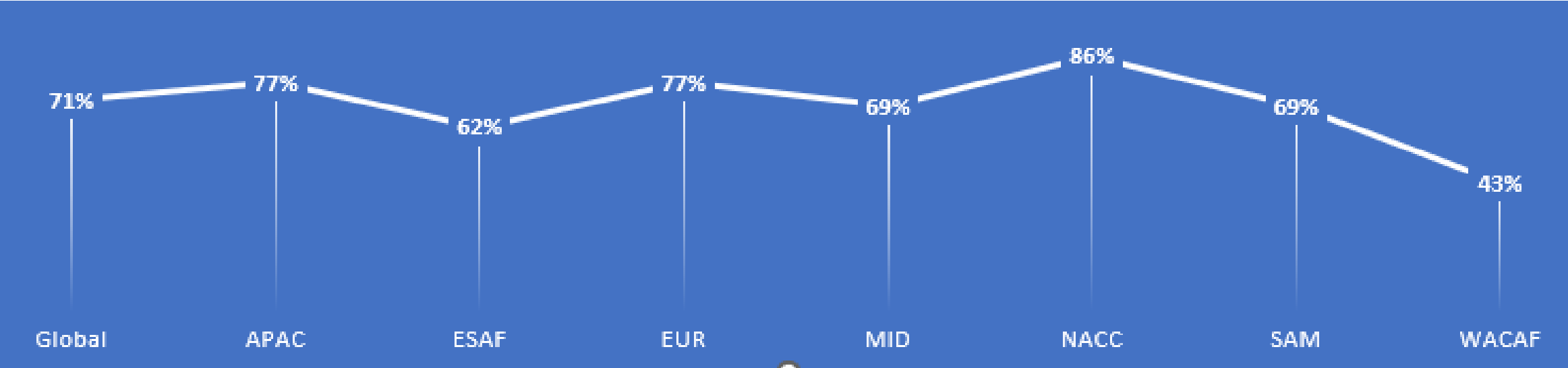
- ✓ Part of the ATM Regional Contingency Plan endorsed by Planning and Implementation Regional Groups (PIRGs)
- ✓ Forum for **coordination** and **sharing** of information between stakeholders;
- ✓ Agree on **contingency arrangements**.
- ✓ Ensure the **safety** and **continuity** of flight operations in the event of **disruption** of ATS.

CCTs are:

- ✓ Established with specific **scope** and **size** depending on contingency event;
 - ✓ Also **activated** in cases when **airspace users decide to circumnavigate** airspace(s) due to **conflict zones, weather**, etc., which might significantly increase the air traffic in other airspace(s).
- Used for the implementation of **recovery plans** for the **normalization** of flight operations.



ATS Contingency Plans Status



Proposed ATM Contingency Management (CM) Cycle

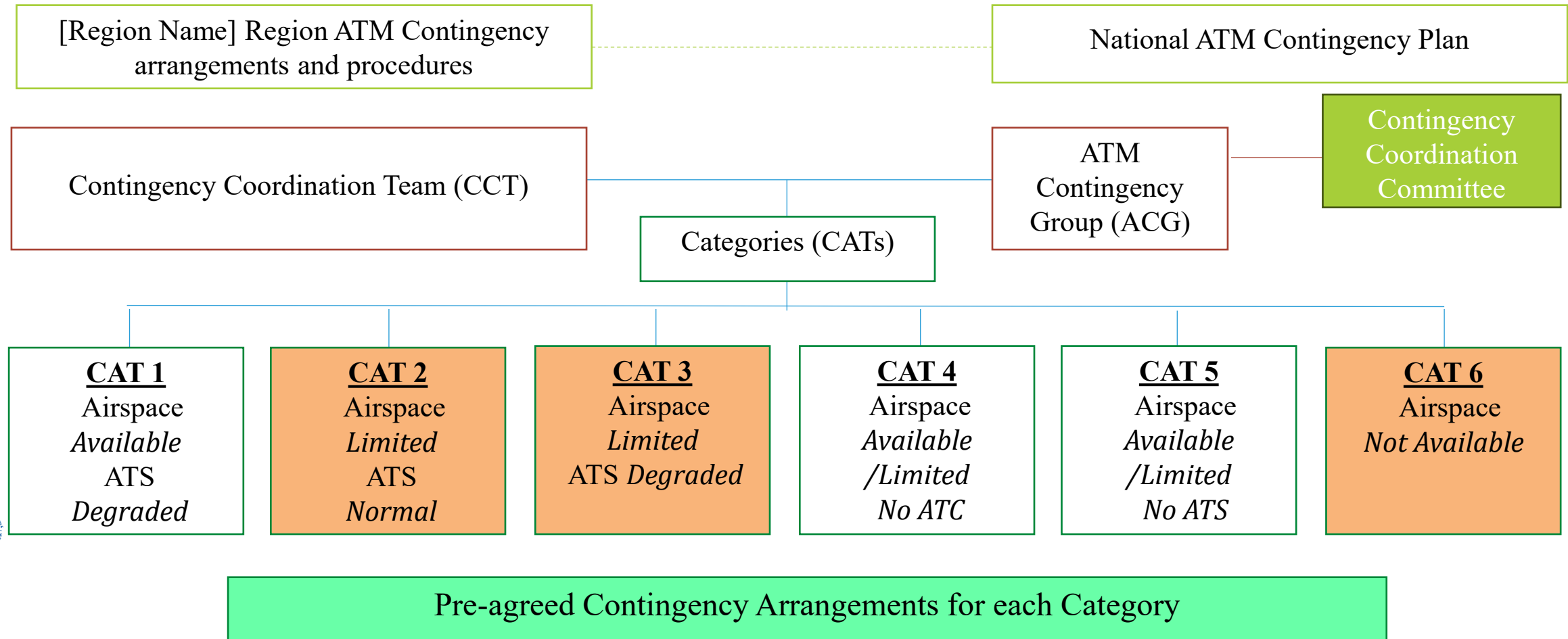


Regional ATM Contingency Framework

[Name] Region ATM Contingency Framework

Regional Level

National Level



1. Development of the Contingency Plan:

- How the plan is developed, agreed to and authorized
- Is it developed in collaboration with airspace users, military authorities, and adjacent FIRs?

2. Airspace arrangements:

- Utilizing existing ATS routes during disruptions, or contingency routes, FLAS, ATFM measures, etc.?

3. ATS Contingency Procedures:

- Specific procedures for ATS during disruptions (e.g., conflict zone, volcanic ash, severe weather, military activity).

4. Pilots and Operator Procedures:

- Guidance for pilots and operators during contingency situations.

5. Source of information

MET service providers, security, airport operators, airlines, military, media, etc.

6. Cooperation and Communication Procedures:

- How information is exchanged among stakeholders and disseminated to relevant parties.

7. Aeronautical Support Services:

- Supporting services available during contingencies (AIS, CNS, MET, SAR, etc).

8. TRAINING and more TRAINING and EXERCISES

Global Navigation Satellite System Radio Frequency Interference (GNSS RFI)

A42-WP/34 TE/8



Loss of Control in-Flight
(LOC-I)



Controlled flight into terrain
(CFIT)



Mid-air Collision (MAC)

Global Navigation Satellite System Radio Frequency Interference (GNSS RFI)

Implementation Package (iPack) for the mitigation of the impact of GNSS RFI

The iPack will:

- help States effectively manage GNSS RFI occurrences while ensuring uninterrupted, safe and efficient air navigation services.
- provide tailored solutions to address each State's unique challenges and needs. Through a combination of preventive and reactive measures, the iPack aims to minimize the likelihood and impact of GNSS RFI, ultimately strengthening the resilience of air navigation services.
- be ready for implementation in Q4 2025.



ICAO - OACI - ICAO

नागर विमानन मंत्रालय
MINISTRY OF CIVIL AVIATION


भारतीय विमानन प्राधिकरण
AIRPORTS AUTHORITY OF INDIA

ICAO APAC RADIO NAVIGATION SYMPOSIUM

GNSS RFI: Collectively Bridging Gaps and Shaping the Path Forward

7th – 9th April 2025 New Delhi, India

The banner features a stylized illustration of the Indian skyline with landmarks like the Taj Mahal and the Red Fort. A satellite is shown in orbit, emitting signals to a network of ground stations. Two commercial airplanes are depicted flying in the sky, one of which is receiving a signal from the satellite. The background is a light blue gradient with soft clouds.



International Civil Aviation Organization
ELECTRONIC BULLETIN
For information only

EB 2025/20 28 July 2025

RECENT REGIONAL RADIO NAVIGATION WORKSHOPS AND SYMPOSIA TO PURSUE INCREASED RESILIENCE TO GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) RADIO FREQUENCY INTERFERENCE (RFI)

1. To address growing concerns about the impact and potential consequences of GNSS RFI and its detrimental effect on aviation safety, ICAO has been actively engaging its Regions through radio navigation workshops and symposia to develop timely and effective mitigation strategies.
2. The ICAO Asia Pacific (APAC) Radio Navigation Symposium was held from 7 to 9 April 2025, in New Delhi, India, under the theme "GNSS RFI: Collectively Bridging Gaps and Shaping the Path Forward". This Symposium examined existing and potential mitigation strategies with the objective to identify gaps and offer insights into actions required to address the evolving challenges posed by GNSS RFI in terms of technological, procedural, and human-centric aspects of mitigation.
3. The Symposium further echoed the discussions of the ACAO/ICAO Radio Navigation Workshop, held in Rabat, Morocco, from 24 to 26 February 2025 as well as the recommendations made by the EUR/MID Radio Navigation Symposium held in Antalya, Türkiye, from 6 to 8 February 2024 (State letter 24/54 refers).
4. The Symposium reaffirmed the significance of the recent International Telecommunication Union (ITU), ICAO and International Maritime Organization (IMO) Joint Statement on the Protection of the Radio Navigation Satellite Service (RNSS) from Harmful Interference. For information and awareness of Member States, information on the ICAO APAC Radio Navigation Symposium can be accessed at: icao.int/APAC/Meetings/Pages/Radio-Navigation-Symposium.aspx.
5. The ITU, ICAO and IMO Joint Statement on the Protection of the RNSS from harmful interference can be accessed at: [ITU, ICAO and IMO Joint Statement](#)

Issued under the authority of the Secretary General

EB 2025/20

ICAO APAC Radio NAV Symposium examined existing and potential mitigation strategies with the objective to identify gaps and offer insights into actions required to address the evolving challenges posed by GNSS RFI in terms of technological, procedural, and human-centric aspects of mitigation.

Electronic Bulletin (EB2025/20) was published on 28 July 2025, includes link to the Symposium's webpage, for information and awareness of Member States

Upcoming ICAO Provisions



Technical Area	SARPs and PANS	Description	Expected Applicability Date
FF-ICE	Annex 1, 2, 6.1, 6.2, 6.3, 10.2, 11, PANS-AIM, PANS-ATM, PANS-OPS Vol III, PANS-ABC	Initial implementation of the flight and flow information for a collaborative environment (FF-ICE) services	28 November 2024
SWIM	Annex 3, 10.2, 10.3, 15, PANS-AIM, PANS-IM (New)	System-wide information management (SWIM) and information security.	28 November 2024
SAR	Annex 11, 12	Implementation of the Global Aeronautical Distress and Safety System (GADSS) concept. Drift measurement, responsiveness of search and rescue (SAR) points of contact, methods for allowing other States to assist in SAR operations, safety of SAR personnel at accident sites, conduct of exercises, and procedures to be followed when intercepting a distress transmission.	28 November 2024
Helicopter PBN operations	PANS-AIM, PANS-OPS Vol II	Instrument flight procedures (IFP) for helicopter PBN operations	28 November 2024
hang gliding and paragliding activities	PANS-ABC	The NOTAM code for hang gliding and paragliding activities.	28 November 2024
Charting	Annex 4, PANS-AIM, PANS-OPS Vol I and II	Charting navigation specifications and accuracies, assurance for flight procedure design and maintenance of criteria	28 November 2024
Aircraft with folding wing tips	Annex 4, PANS-AIM	Aeronautical information related to areas where it is safe to operate aeroplanes with wing tips extended.	28 November 2024
FDAP	Annex 6.1	Updated provisions concerning flight data analysis programmes (FDAP)	28 November 2024
Aerodrome	PANS-Aerodrome	Amendments related to pavement rating	28 November 2024
Aerodrome	Annex 14.1,	aerodrome design, visual aids and apron management service	27 November 2025
MET	Annex 3, 6.1, 6.2, 6.3, 10.2, 11, PANS-MET (New)	Restructured Annex 3, space weather information services, quantitative volcanic ash information and the international airways volcano watch (IAVW), the ICAO meteorological information exchange model (IWXXM), the world area forecast system (WAFS), and improved definition of meteorological authority and introduction of a new definition of meteorological service provider	27 November 2025

Technical Area	SARPs and PANS	Description	Expected Applicability Date
Navigation Systems	Annex 10.1	Advanced receiver autonomous integrity monitoring (ARAIM), global positioning system (GPS), Galileo system, the satellite-based augmentation system (SBAS), the ground-based augmentation system (GBAS), distance-measuring equipment (DME) and frequency assignment planning for instrument landing system (ILS), VHF omnidirectional radio range (VOR), DME and GBAS	27 November 2025
COM	Annex 10.2	Aeronautical telecommunication network (ATN)/Internet Protocol Suite (IPS) requirements regarding mobility across multiple media, naming and addressing, IPS security, quality of service (QoS), system management and overall transitional aspects	27 November 2025
Radio Frequency	Annex 10.5	Wireless avionic intra-communications (WAIC), as well as frequency utilization for instrument landing system (ILS), VHF omnidirectional radio range (VOR), distance measuring equipment (DME) and ground-based augmentation system (GBAS)	27 November 2025
AIG	Annex 13	Investigations involving unmanned aircraft (UA); the release of investigative information; Global Aeronautical Distress and Safety System (GADSS) data and information; the publication of Final Reports; and the consultation period of Final Reports	26 November 2026
Data Link	Annex 2, Annex 10, Volume II, Annex 11 and PANS-ATM	Update relevant provisions supporting the air-ground data link operations to ensure they remain current and consistent with the improved guidance contained in the GOLD Manual (Doc 10037)	26 November 2026
Surveillance	Annex 10.4	Performance of surveillance systems in light of operational experience and emerging technologies	26 November 2026
RPAS	Annex 1, 2, 6.4, 8	Introduction of provisions for international RPAS operations in controlled airspace and at aerodromes. New Annex 6 Part IV on International Operations Remotely Piloted Aircraft Systems	26 November 2026
Aerodrome	Annex 14.2	Certification and an SMS for heliports	26 November 2026
Aerodrome	Annex 14.1, 14.2, 6.1, 6.2, 6.3, 9, PANS-AERO, PANS-AIM	Related ground handling	25 November 2027
MET	Annex 3, 15 and PANS-MET	<ul style="list-style-type: none"> Volcanic activity report and quantitative volcanic ash concentration information Exchange of meteorological information in IWXXM and the introduction of SWIM service Introduction of next-generation World Area Forecast System information RPAS and via ADS-B-3 aerodrome observation/forecast information services and air reports Space weather information service Requirements for a regional space weather centre 	25 November 2027
Dangerous Goods	Annex 18	Clarification of States' responsibilities with respect to the safe transport of dangerous goods, including dangerous goods risks introduced by entities in the cargo supply chain.	23 November 2028

Technical Area	SARPs and PANS	Description	Expected Applicability Date
IFP	Annex 11, PANS-OPS Vol. I, II, PANS-AIM	Optimized SBAS instrument Criteria, path terminators, merging of ILS and GLS criteria and maintenance of existing criteria.	23 November 2028
FLTOPS	Annex 1, 2, 6.1, 6.2, 6.3, 6.4, 7, 8, 11, 15, 19, PANS-ATM	Operator emergency response plan, ramp inspections, electronic certificates and documents, additional/technical crewmember, runway overrun awareness and alerting system (ROAAS) and minor amendments	23 November 2028
RPASP-ATM	Annexes 2, 10.2, 10.4, 10.6, 11, 12, PANS-ATM, PANS-OPS. I and III, PANS-AIM	detect and avoid (DAA), C2 Link and air traffic management (ATM), RLP, and C2CSP concepts.	23 November 2028
AIM	Annex 15 and PANS-AIM	<ul style="list-style-type: none"> Concerning trigger NOTAM validity period as well as other minor amendments 	23 November 2028
AIG	Annex 13, Annexes 6.1, 6.2, 6.3	<ul style="list-style-type: none"> Clarify the intent of the provisions of Annex 13 on para 5.11 for completing the Annex 13 investigation with a publicly available Final Report for accidents involving acts of unlawful interference Removing the condition associated with the word “available” from Annex 13, 5.4.3, to eliminate the risk of misinterpretation. Simplify and standardize ADREP reporting. Conflict of interest scenarios 	23 November 2028
Wake Turbulence	PANS-ATM	Wake turbulence separation minima for aircraft taking off from the intermediate part of the runway; optimized separation for dependent parallel approaches and pair-wise separation.	23 November 2028
CTC	Annex 4, PANS-ATM, PANS-OPS Vol III	Clarifies the responsibilities for the provision of terrain and obstacle clearance and temperature correction under various circumstances.	23 November 2028
ACAS III	Annex 10.4 (ACAS III)	Airborne collision avoidance system (ACAS) III	23 November 2028
SATCOM	Annex 10.III and 10.V, in coordination with FSMP	Update of the SATCOM SARPS to include more stringent performance requirements	23 November 2028
Aerodrome	Annex 14.1	Obstacle limitation surfaces	21 November 2030
ATFM	Annex 11, PANS-ATM	Requirements to support global implementation of air traffic flow management (ATFM) and capacity determination.	21 November 2030

Action by the Meeting:

The meeting is invited to:

- a) consider the air navigation global developments and the relevant Recommendations of AN-Conf/14 when discussing the APANPIRG work programme;
- b) agree on the necessary measures for the implementation of project 30/10, ATFM, SWIM, FF-ICE and report any perceived challenges that would delay the implementation;
- c) agree on the development and implementation of the APAC Regional ATM Contingency Management Framework, in line with the global initiative; and
- d) invite States to participate in the ICAO APAC/EUR CIV-MIL Cooperation Workshop that will be held in Bangkok from 19 to 23 January 2026.

Thank You

