International Civil Aviation Organization

SIXTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND METEOROLOGY SUB-GROUP (CNS/MET SG/16) OF APANPIRG

Bangkok, Thailand, 23 – 27 July 2012

Agenda Item 7: Aeronautical electromagnetic spectrum utilization

3) Radio spectrum management related issues

ICAO SPECTRUM STRATEGIC OBJECTIVES

(Presented by the Secretariat)

SUMMARY

This paper presents the draft ICAO Spectrum Strategic Objectives which are being developed by ACP Working Group F. Working Group F is expected to complete these Strategic Objectives in September 2012. The Strategic Objectives address, for each frequency band used by aviation, the medium and long term requirement for these bands to support CNS systems. The Spectrum Strategic Objectives will be presented to Council in 2013 for approval.

Note: The ICAO Policy Statements include in many cases references to Footnotes or Resolutions/Recommendations as are contained in the ITU Radio Regulations. These Radio Regulations are reproduced in the ICAO "Handbook on radio frequency spectrum requirements for civil aviation" (DOC 9718) in full.

Action by the meeting is in paragraph 4

This paper relates to -

Strategic Objectives:

A: Safety - *Enhance global civil aviation safety*
C: Environmental Protection and Sustainable Development of Air Transport - *Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment*

Global Plan Initiatives:
GPI -23 Radio Spectrum

1. Introduction

1.1 Working Group F (Frequency) of the Aeronautical Communications Panel (ACP) has taken the initiative to develop ICAO Spectrum Strategic Objectives. These Strategic Objectives will provide the medium and long term spectrum requirements for civil aviation that will be necessary for implementing the ICAO Global Air Navigation Plan.

1.2 The draft Spectrum Strategic Objectives were initially reviewed at the 26th meeting of ACP WG F (March2012) and further updated through e-mail correspondence in WG-F. The draft ICAO Spectrum Strategic Objectives, after completion by the ACP Working Group F in September 2012, will be reviewed by the Air Navigation Commission and will be eventually submitted to the Council in 2013 for approval.

1.3 The 27th meeting of ACP WG F will be held in Montreal, Canada from 17 to 26 September 2012. The meeting is expected to complete the draft ICAO Position on ITU World Radiocommunication Conference 2015 (WRC-15) Agenda Items of critical interest to civil aviation. This meeting will also complete ICAO Spectrum Policy statements and ICAO Spectrum Strategic Objectives. This material, after review by the Air Navigation Commission and after incorporating comments by the States, will be submitted to the Council for the formulation of the overall ICAO policy on spectrum matters and will be incorporated in the ICAO *Handbook on Radio Frequency Spectrum Requirements for Civil Aviation* (Doc 9718). This WG F meeting will also complete the new draft Volume II of the Handbook. This Volume II includes detailed guidance material in support of the amendments to Annex 10 Volume V (State letter 2012/33). This guidance material is published separately from Annex 10, Volume V and currently includes material for frequency assignment planning of VHF air/ground voice and data communication systems. The draft Agenda of the ACP-WG F meeting includes:

- Development of ICAO position for WRC-15;
- Review, update and develop ICAO Frequency Spectrum Handbook
  a) Update ICAO Policy statements (Strategy) to be included in Volume I; and
  b) Finalize new Volume II - Frequency Assignment Planning in support of Annex 10, Vol. V update
- Interference from non-aeronautical sources;

1.4 The draft ICAO Spectrum Strategic Objectives and updated ICAO Policy Statements are provided in the **Appendix** to this paper which have been developed taking into consideration all known plans for implementing systems that are necessary for supporting development of international civil aviation. The Strategic Objectives are submitted to regional spectrum planning groups or relevant sub-groups of PIRGs with the view to incorporate any regional element in the overall ICAO Spectrum Strategic Objectives, as necessary. Incorporation of Regional elements and requirements in the ICAO Spectrum Strategic Objectives will avoid the need for developing separate Regional Spectrum Strategic Objectives within ICAO.

2. Timescale and coverage

2.1 The time scale for the ICAO Spectrum Strategic Objectives is about 25 – 30 Years. It should be realized that certain CNS systems, including stand-alone on-board radio navigation systems (such as radio altimeters and weather radar systems) are expected to be continued to be used for a

practically undetermined period beyond 30 years. The Strategic Objectives are required to be updated from time to time, taking into account the development in air transport and the Global Air Navigation Plan, Regional developments as well as the changing Radio Regulations.

2.2 The coverage of the Strategic Objectives is to satisfy the spectrum requirements for CNS systems for international civil aviation as well as for national civil aviation purposes and as a result combines all requirements for civil aviation in general.

3. Publication of the ICAO Spectrum Strategic Objectives

3.1 ICAO Spectrum Strategic Objectives are to be published in the ICAO *Handbook on radio frequency spectrum requirements for civil aviation (Doc. 9718 Part 7-II).* The relevant ICAO policy Statements should be considered as providing the preferred method to implement ICAO Spectrum Strategic Objectives. The ICAO policy statements refer, in a number of cases to particular provisions in the ITU Radio Regulations. These references are clarified in a separate information paper (IP24) containing the comprehensive updates in the ICAO RF Handbook (Doc. 9718).

3.2 The ICAO Spectrum Strategic Objectives and the ICAO Policy Statements have taken into account the amendments to the ITU Radio Regulations as per the ITU World Radiocommunication Conference 2012. In addition, it was considered necessary, the Strategic Objectives are accompanied with descriptive material that identifies details that are supporting the Strategic Objectives. This material addresses in particular the expected time scales for the continued use of current systems or transition to new systems.

4. Action by the meeting

4.1 The meeting is invited to note the information provided in this paper and to:

i) review the draft ICAO Spectrum Strategic Objectives which are contained in the Appendix;

ii) provide any comment on these objectives, in particular with regard to the Regional relevance;

iii) provide any Regional element that should be included in the overall ICAO Spectrum Strategy; and

iv) urge States to further review the material and provide comments to the ICAO Regional Office on the Spectrum Strategic Objectives.

Note: comments on the modifications to the Handbook Volume I which are developed after the current CNS/MET meeting by States can be submitted to the Secretariat for review by the ACP-WG F meeting in September 2012.

4.2 Considering substantial changes to the Handbook on radio frequency spectrum requirements for civil aviation (Doc. 9718) which includes, in addition to amendments or updates to the ICAO spectrum policy in particular to address the potential change to the frequency assignment planning criteria as adopted by ASIA/PAC RAN meeting in 1993, a SIP workshop may be considered necessary to share these developments with States in the APAC Region. The changes to the regionally agreed frequency assignment planning criteria are expected to be reviewed by the APANPIRG in 2013. The meeting is invited to consider following draft Conclusion:

Draft Conclusion 16/xx - A SIP Workshop on Radio Spectrum Management

That, a Special Implementation Programme (SIP) workshop on radio spectrum management including revision to the overall ICAO Spectrum Policy and relevant frequency assignment planning criteria be organized in the Asia and Pacific Region.

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APPENDIX

SPECTRUM STRATEGIC OBJECTIVES and SPECTRUM POLICY STATEMENTS

(to be incorporated in the Chapter 7 Volume 1 of ICAO Handbook on radio frequency spectrum] requirements for civil aviation)

Note: The material in this Appendix is an extract of the modifications to the ICAO Handbook on radio frequency spectrum requirements for civil aviation (Doc. 9718) and includes all new ICAO Spectrum Strategic Objectives and the modified ICAO Policy Statement. IP24 of CNS/MET SG/16 presents the complete Handbook, including all revisions.

Introduction

The safety aspects on the use of radio frequency spectrum by aviation require spectrum to be available on an exclusive basis or, when shared with non-aeronautical radio services, with regulatory and technical conditions that recognize aeronautical safety requirements. The overall ICAO spectrum policy includes the Strategic Objectives and the Policy Statements which provide a measure to implement the spectrum Strategic Objectives and is approved by the ICAO Council.

Implementation of the Strategic Objectives will enable the advancement of technological developments and innovation to enhance safe and efficient global air transport. This is to be achieved through the development of ICAO SARPs as necessary. The radiofrequency spectrum capacity for aviation needs to be sufficient to meet the growing needs for aeronautical communication, navigation and surveillance systems, including any new systems that are being considered in ICAO to meet future CNS/ATM requirements. This is essential to adequately support changing trends air traffic management such as foreseen in the ICAO Global Air Navigation Plan and the ICAO Regional Plans.

Spectrum for aeronautical radio communication and radionavigation (including surveillance) is allocated by the International Telecommunication Union (ITU) with the recognition of the safety aspects identified above. The ICAO spectrum policy aims at continuing this situation, with the intention of securing that aeronautical spectrum capacity requirements are satisfied during the frequency allocation process, taking into consideration the trends in future Air Traffic Management.

Timescale of the Strategic Objectives

The ICAO Strategic Objectives have been developed on the basis of current (Global and Regional) plans for implementing CNS systems, including (ground based and on-board an aircraft) radar systems in the period until about 2035. The Strategic Objectives include a statement of the spectrum necessary for each of the CNS elements and each relevant frequency band. The Strategic Objectives also include spectrum requirements for stand-alone on-board (radar) systems such as airborne radio altimeters, airborne weather radar and airborne ground mapping radar systems.

In many cases, radiocommunication and navigation systems currently in use will continue to operate well beyond 2035, either on a global basis or in certain Regions. The strategic objectives in this Chapter identify requirements for the *medium term as until and beyond 2035*. Spectrum requirements identified for the l*ong term indicate that such spectrum is expected to continue to be necessary for an undetermined period, extending to well beyond 2035*.

On a regular basis, the Strategic Objectives, including the time scale, are updated taking into consideration developments in the use of current and new CNS systems.

As required, the Strategic Objectives include specific Regional requirements for CNS systems and the associated radio frequency spectrum. These Regional requirements are part of the overall ICAO spectrum strategy.

ICAO Policy Statements

The ICAO Policy Statements provide for specific actions that were identified to assist in meeting the ICAO Strategic Objectives and form the policy of ICAO to implement the Strategic Objectives.

Spectrum allocations for CNS systems

The allocation of spectrum for new services and systems in frequency bands already allocated for aeronautical use needs to take place within the framework set by the relevant ICAO Standards and Recommended Practices (SARPs) for communication, navigation and surveillance systems, as well as other (industry) Standards that apply to current operational systems

Note: Requirements for spectrum for meteorological radar and meteorological satellite systems are addressed by the World Meteorological Organization (WMO). However, specific requirements for airborne weather radar systems are included in the ICAO Spectrum Policy.

ICAO OVERALL STRATEGIC OBJECTIVES:

- To secure the continuing availability of adequate radio frequency spectrum to support the foreseen aeronautical CNS infrastructure (Re. Global Plan)
- To enable the advancement of technological innovation to maintain and enhance the safety of the global air transport system as well as increased efficiency in spectrum utilization

ICAO POLICY:

- Oppose any proposal that places undue or unreasonable constraint on aeronautical systems.
- Insist that any sharing studies carried out for frequency bands used by aviation take full account of the possible impact on the aeronautical safety case and that they encompass the total technical, operational and economic aspects of aeronautical system use.
- Compatibility of ICAO standard systems with existing or planned aeronautical systems operating in accordance with international aeronautical standards will be ensured by ICAO. Compatibility of ICAO standard systems with non-ICAO standard systems will be addressed in ITU, with the assistance of ICAO as required.
- To support efficient use of the frequency bands allocated to relevant aeronautical services, ICAO develops globally harmonized frequency assignment planning criteria and a global frequency assignment plan in support to the ICAO Global Plan.

The above strategic objectives and policy statements are applicable to all frequency bands, and should be regarded as implicit in the policy statements for all bands used by civil aviation.

Band: 90–110 kHz
Service: Radionavigation (LORAN-C)

ACP WG F is considering deletion of the ICAO policy and the related information for the frequency band 90 – 110 kHz for LORAN-C from the Handbook LORAN-C stations are only sub-regionally or nationally used in some areas.

No ICAO Spectrum Strategic Objective for this band has been developed to date. ICAO Spectrum Strategic Objectives may be required in case LORAN continues to play an important role in international civil aeronautical navigation.

Note: the APAC Region is invited to provide comments on the proposed deletion of material relaying to LORAN-C from the Handbook.

Band: 130–535 kHz
Service: Aeronautical radionavigation (NDB/locator)

- **ICAO STRATEGIC OBJECTIVE:** Secure the continuing availability of the frequency band 130 – 535 kHz which is allocated to the aeronautical radionavigation service on a global basis for use by NDB/Locator systems for the medium term and, on a Regional basis, for the long term.

ICAO POLICY:

- No change to 5.70, 5.80 and 5.86.
- In regions where the global navigation satellite system (GNSS) is implemented and non-directional radio beacon (NDB) assignments are withdrawn from international and national usage, aviation requirements for spectrum in these bands may be reduced.
- Until NDBs have been phased out, the current allocations to the aeronautical radionavigation service must be safeguarded.

On a global basis, the use of NDB/Locator beacons is expected to continue in the medium term and for the long term subject to Regional or sub-Regional requirements. The use in general is stabilized and may be reduced over time as a result of on-going GNSS and RNAV implementation. However, the use of NDB and Locator beacons will continue subject to regional requirements (e.g. to provide a backup network to GNSS). No (significant) increase in frequency requirements for NDB and Locator beacons is expected; the aeronautical requirements can be met in the currently available frequency bands. Outer locators which are used in conjunction with the ILS and Marker Beacons are in a number of cases being replaced with DME. Parts of the bands used for NDB/Locator systems are shared with the amateur, broadcasting, maritime radionavigation and the maritime mobile services.

Note: *The strategic objective foresees that for international civil aviation, NDB systems may be required until the medium term (until and beyond 2035). However, in certain Regions the need for continuing use of NDB on a national (or international) basis may extend to the long term (for an undetermined period after 2035). Regions are invited to state the continuing requirements for NDB, in particular when necessary to support NDB systems on a national basis.*

Band: 2 850–22 000 kHz
Service: AM(R)S (air-ground communications (HF voice and data))

- **ICAO STRATEGIC OBJECTIVE:** Secure the continuing availability of the HF frequency bands 2850 – 22000 kHz which are allocated to aeronautical mobile (R) service for use by air/ground communications on a global basis in the long term.

ICAO POLICY:

- Retain the current allocations in the HF bands to the aeronautical mobile (route) service (AM(R)S) bands and the provisions of Appendix 27 to the Radio Regulations for the foreseeable future for HF voice and data.
- Protect the use of the aeronautical HF bands in accordance with the provisions of Appendix 27.
- No change to Footnotes 5.111 and 5.115.
- Support the measures and participate in the technical studies addressed in Resolution 207 (Rev. WRC-03) concerning the unauthorized use of and interference to frequencies in the bands allocated to the AM(R)S.
- Consider technical solutions which can be implemented efficiently without changes to aircraft equipment or disruption of aeronautical services.

On a global basis, HF communications provide the main means for long distance (beyond the radio horizon) air/ground voice and data communications. Despite the introduction of satellite communication systems (to provide long distance communications as an alternative to the use of HF bands in aviation), HF communications are expected to continue to be required for the long term. The use of these bands for long distance aeronautical voice and data communications is not expected to increase significantly and the future requirements are expected to be met in the currently available frequency bands.

The provisions of Appendix 27 provide for adequate flexibility in the regulatory procedures to implement changes in the use of the HF bands by aviation.

No revision of Appendix 27 is required.

Note: the Strategic Objectives for the aeronautical HF bands foresee the need to retain this band for air/ground voice and data communications for the long term (for an undetermined period after 2035).

Band: 74.8–75.2 MHz
Service: Aeronautical radionavigation (marker beacon)

- **ICAO STRATEGIC OBJECTIVE:** Secure the continuing availability of the frequency band 74.8 – 75.2 MHz which is allocated to the aeronautical radionavigation service for use by Marker Beacons on a global basis for the long term.

ICAO POLICY:

- No change to the current allocations.
- No change to Footnote 5.180.
- Deletion of Footnote 5.181.

Marker Beacons are used, in conjunction with ILS. On a global basis, the frequency band available for Marker Beacons satisfies the aeronautical requirements. In a number of cases, Marker Beacons (and outer Locators) are being replaced with DME. As long as Marker Beacons are in operation, the band 74.8 – 75.2 MHz needs to be available for these systems.

Note: the Strategic Objectives for the frequency band 74.8 – 75.2 MHz foresee the need to retain this band for Marker Beacons for the long term (for an undetermined period after 2035) in support to the continued use of the Instrument Landing System (ILS).

Band: 108–117.975 MHz
Service: Aeronautical radionavigation (VOR/ILS localizer/GBAS/VDL Mode 4)

ICAO STRATEGIC OBJECTIVES:

- Secure the continuing availability of the frequency band 108 – 117.975 MHz which is allocated to the aeronautical radionavigation service for use by ILS-Localizer and VOR on a global basis for the long term.
- Secure the continuing availability of the frequency band 112 – 117.975 MHz (108 – 117.975 for GBAS) which is allocated to the aeronautical mobile (R) service for use by GBAS and VDL Mode 4 on a global basis for the long term.
- Consider, subject to spectrum availability and spectrum requirements, the use of this band to accommodate VHF air/ground communication systems

ICAO POLICY:

- No change to the current allocation to the aeronautical radionavigation service and the aeronautical mobile (route) service (AM(R)S).
- Deletion of Footnote 5.197.
- Ensure conformity with ITU-R Recommendation SM.1009 regarding compatibility with FM broadcast services in the band 87.5–108 MHz and ILS/VOR as well as with ITU-R Recommendation M.1841 for GBAS.

On a global basis the band 108 – 117.975 is used for ILS (Localizer) and VOR. Implementation of GBAS in this band is expected to start around 2015 – 2025 in some areas if GBAS it technically and economically feasible. GBAS may replace in some areas ILS. The spectrum vacated by future ILS decommissioning, if any, will be re-used for GBAS systems. Some residual use of ILS is expected to continue to well beyond 2030.
On a global basis, the future use of VOR systems is expected to decline between 2015 – 2030 due to implementation of GNSS and RNAV. However, a residual number of VOR systems will continue to be in operation to meet specific requirements beyond 2030. The vacated spectrum, if any, will be re-used for GBAS and implementation of VHF air/ground communication systems.

GBAS is expected to be progressively implemented in the period from 2015 – 2030 in the band 108 – 117.975 under the allocation to the aeronautical mobile (R) service, subject to a satisfactory safety case (with special attention to interference into GNSS signals) and being technically and economically feasible.

The frequency band 108 – 117.975 is expected to meet the aeronautical requirements for ILS, VOR and GBAS until 2030 and beyond. Rationalization of GBAS technical characteristics may be necessary, in particular when being implemented in areas where VOR and ILS operations continue.

The frequency band 112 – 117.975 MHz can also be used for VDL Mode 4 under the allocation to the aeronautical mobile (R) service. The spectrum requirements for VDL Mode 4 until 2020 are expected to be minimal (up to a maximum of 2 to 4 channels) and can easily be implemented in most areas. This frequency band is also considered to accommodate VHF air/ground voice and data link systems, subject to spectrum availability.

Note: the Strategic Objectives for the frequency band 108 – 117.975 MHz foresee the need to retain this band for use by the localizer (as an element of the ILS) and for VOR for an undetermined period after 2035. Data link systems like GBAS/VDB and VDL Mode 4 are also foreseen to use this band for an undetermined period after 2035. The strategy includes the option for using this band for air/ground communications in case in the future the available spectrum capacity would permit, in case in some Regions or areas VOR and/or ILS-localizer are being withdrawn.

Band: 117.975–137 MHz
Service: AM(R)S (air-ground and air-air communications (VHF voice and data))

ICAO SPECTRUM STRATEGIC OBJECTIVE:

- Secure the continuing availability of the frequency band 117.975 – 137 MHz, which is allocated to the aeronautical mobile (R) service, for use by VHF air/ground voice and data link on a global basis for the long term.

ICAO POLICY:

- No change to the allocations to the aeronautical mobile (route) service in this band.
- No changes to Footnote 5.200.
- No changes to the provisions relating to the use of the emergency channels 121.5 and 123.1 MHz.
- Promote measures for the deletion of Footnotes 5.201 and 5.202.

The band 117.975 – 137 MHz is extensively used for VHF air/ground voice communications and VHF air/ground and air/air data. On a global basis this band is expected to satisfy the requirements for air / ground aeronautical communication, due to full implementation of 25 kHz and/or 8.33 kHz channel spacing where required. In Europe however, saturation of this band with 8.33 kHz channel spacing being used, is foreseen around 2025.

Note: the Strategic Objective for the frequency band 117.975 – 137 MHz foresees the need to retain this band for air/ground voice and data communications for the long term (for an undetermined period after 2035).

Band: 328.6–335.4 MHz
Service: Aeronautical radionavigation (ILS glide path)

ICAO STRATEGIC OBJECTIVE:

- Secure the continuing availability of the frequency band 328.6 – 335.4 MHz which is allocated to the aeronautical radionavigation service for use by ILS – Glide Path on a global basis for the long term.

ICAO POLICY:

- No change to current allocation to the aeronautical radionavigation service.
- No change to Footnote 5.258.
- Deletion of Footnote 5.259.

On a global basis, the frequency band 332.8 – 335.4 MHz is used for the ILS Glide Path, in conjunction with the ILS Localizer (see 5.2.4). This frequency band is expected to meet the aeronautical requirements for ILS Glide Path for the long term. In areas where GBAS is implemented to replace ILS systems, the use of this band for Glide Path systems may be reduced.

Note: the Strategic Objective for the frequency band 328.6 – 335.4 MHz foresees the need to retain this band for the glide path for the long term (for an undetermined period after 2035) in support to the continued use of the Instrument Landing System (ILS).

Band: 406–406.1 MHz
Service: Mobile-satellite (Earth-to-space) (search and rescue)

ICAO POLICY:

- No change to the allocation to the band 406–406.1 MHz and Footnotes Nos. 5.266 and 5.267.
- Secure protection of emergency locator transmitters (ELTs) which are used in aviation in this frequency band.

Note: No ICAO spectrum Strategic Objectives have been developed for this frequency band. The spectrum requirements for the COSPAS/SARSAT system are expected to satisfy those of international civil aviation

Band: 960–1 215 MHz
Service: Aeronautical radionavigation/radionavigation satellite (DME/SSR/ACAS/GNSS/1090ES/UAT)

ICAO STRATEGIC OBJECTIVES:

- Secure the continuing availability of the frequency band 960 – 1215 MHz, which is allocated to the aeronautical radionavigation service, for use by UAT, DME and SSR (including ADS-B) on a global basis for the long term
- To support the implementation of new systems in the aeronautical mobile (R) service in the band 960 – 1164 MHz and a potential associated rationalization of the use of the DME band .
- Secure the continuing availability of the frequency band 960 – 1164 MHz which is allocated to the aeronautical mobile (R) service for use by air/ground and air/air data link systems and UAT. Implementation of these data links must take place under the express condition that no interference is caused to the aeronautical radionavigation service (e.g. DME and SSR).
- Secure the continuing availability of the frequency band 1164 – 1215 MHz which is allocated to the radionavigation satellite service for use by GNSS systems on a global basis for the long term, taking into consideration the radio regulatory conditions for using this band

ICAO POLICY:

- No change to the current allocation to the aeronautical radionavigation service or to Footnote 5.328 in the band 960–1 215 MHz.
- No change to Footnote 5.328A.
- No change to the aeronautical mobile (route) service (AM(R)S) allocation or to Footnote 5.327A in the band 960–1 164 MHz with the exception of possible changes to remove the restrictions on the use of the AM(R)S due to non-ICAO standardized systems from ITU-R Resolution 417.

On a global basis, the band 960 – 1215 MHz is used for DME systems; this use is expected increase and to continue to well beyond 2030. In RNAV procedures, DME-DME navigation is planned to be one of the major navigation methods as an element of PBN. The band 960 – 1215 MHz is expected to satisfy on a global basis the future requirements for DME, taking into account the protection given to aeronautical radionavigation (DME) in the ITU Radio Regulations. In some areas, the frequency band is heavily congested with DME assignments. Rationalization in this band of frequency assignments to DME stations, including a review of the technical characteristics of DME may be necessary

Two sub-bands of about +/- 10 MHz around the frequencies 1030 MHz and 1090 MHz are reserved for SSR. SSR provides, in addition to secondary surveillance radar, major functionality for ACAS and ADS-B. SSR is expected to continue to be required for surveillance; the frequency bands used for SSR satisfy on a global basis the aeronautical requirements to well beyond 2030.

The band 1164 – 1215 MHz is also used for GNSS and provides GPS/Galileo/Beidu/Glonass L5 or E5 signals. In accordance with the Radio Regulations, the use of this band by GNSS systems needs to protect DME from interference and accept interference from DME. This frequency band is expected to meet the GNSS requirements on a global basis for L5/E5 signals to well beyond 2030.

The band 960 – 1164 MHz is planned to be used for air/ground (and air/air) data communications (e.g. LDACS). Although achieving compatibility with DME/SSR may be problematic, this band is expected to meet the future data link requirements. Rationalization of DME may assist in providing the necessary spectrum for the data link system.

The frequency 972 MHz is used for the Universal Access Transceiver (UAT), which provides for ADS-B and up-linking of data messages. UAS is not considered for implementation in Europe.

Note: the Strategic Objectives for the frequency band 960 - 1215 MHz foresee the need to retain this band for use by aviation for aeronautical radionavigation and surveillance systems (DME, SSR) as well as for in particular air/ground data link systems (LDACS) for the long term (for an undetermined period after 2035). DME is expected to continue to support both ILS/DME and VOR/DME systems. Also, for the long term, the aeronautical use of GNSS systems in the band 1164 – 1215 MHz is expected.

Band: 1 215–1 400 MHz
Service: Radionavigation/aeronautical radionavigation/radiolocation/radionavigation-satellite (RNSS/primary surveillance radar)

ICAO STRATEGIC OBJECTIVE:
Secure the continuing availability of the frequency band 1215 – 1350 MHz which is allocated to the radionavigation and aeronautical radionavigation service for use by Primary Surveillance Radar on a global basis for the long term

ICAO POLICY:

- No change to the status of the allocation to the radionavigation service in Footnotes 5.331 and 5.334.
- No change to Footnote 5.332.
- No change to the provisions of Footnotes 5.329 and 5.337A regarding the protection of radar stations from the radionavigation-satellite service
- Support further ITU-R studies relating to Resolution **608**.

On a global basis the band 1300 – 1350 MHz (and in many countries also the band 1215 – 1300 MHz) is extensively used for primary surveillance radar, mainly providing long range independent non-cooperative airspace surveillance. This use is expected to continue to be required for the long term.

The use of this band for GNSS signals (GPS L2, GLONASS L2, Galileo E6 and Beidu B6) is not for civil aircraft applications.

A new development in radar technology is the multi static primary surveillance radar (MSPSR). MSPSR may provide more spectrum efficient use of this band and better coverage at lower altitudes. However, the implementation of MSPSR is dependent on the cost and improved spectrum efficiency that can be obtained.

Note: the Strategic Objective for the frequency band 1200 – 1350 MHz foresees the need to retain this band for Primary Surveillance Radar (PSR) for the long term (for an undetermined period after 2035) in support to the continuing requirement for non-cooperative independent surveillance.

Bands: Mobile-satellite bands 1 525–1 559 MHz and 1 626.5–1 660.5 MHz
Service: AMS(R)S (satellite communications)

ICAO STRATEGIC OBJECTIVES:

- Secure sufficient access on a global basis by the aeronautical mobile satellite (R) service in the bands 1545 – 1555 MHz and 1646.5 – 1656.5 MHz for the long term to support the requirements for aeronautical satellite communications.
- Ensure that any new or existing uses of these bands will not cause harmful interference to the use of this band by the aeronautical mobile satellite (R) service.

Note: In the United States the bands 1555 – 1559 MHz and 1656.5 – 1660.5 MHz the aeronautical mobile satellite (R) service has priority and immediate access over other mobile-satellite communications within a network.

ICAO POLICY:

- Support the establishment of adequate technical and regulatory procedures to:
  a) guarantee access to spectrum in these bands for aeronautical communications as required; and
  b) ensure that aeronautical communications in categories 1 to 6 of Article 44 are given priority and immediate access at all times.
- If acceptable procedures cannot be established, recover the exclusive allocation of the bands 1 545–1 555 MHz and 1 646.5–1 656.5 MHz to the AMS(R)S.
- If required, modify Footnotes 5.357A and 5.362A to strengthen AMS(R)S access to the bands.
- No change to Footnotes 5.357 and 5.376.
- Support the deletion of Footnotes 5.355 and 5.359.
- Provide support to the procedure to implement Footnote 5.357A and Resolution 222 (Rev. WRC-12)
- Support studies with respect to Resolution COM 4/1 (WRC-12).

In the bands 1545 – 1555 MHz and 1646.5 – 1656.5 MHz, the provisions in ITU Radio Regulations stipulate that priority shall be given during the frequency coordination process to the spectrum requirements for the aeronautical mobile satellite (R) service. Over a long period of time (prior to WRC-12), these provisions did not provide for the required access for aeronautical mobile satellite (R) communications. In order to secure that the aeronautical requirements for in particular long distance communications using satellite technology are met the relevant radio regulatory provisions in Resolution 222 were amended at WRC-12 as an attempt improve and secure in all cases access by aviation to the bands 1545 – 1555 MHz and 1646.5 – 1656.5 MHz.

Note: the Strategic Objectives for the frequency bands 1525 - 1559 MHz and 1626.5 – 1660.5 MHz foresee the need to retain this band to support long distance aeronautical satellite communications (in particular for remote and oceanic areas) for the long term (for an undetermined period after 2035).

Band: 1 559–1 626.5 MHz
Service: Aeronautical radionavigation/Radionavigation satellite/Mobile satellite (GNSS)

ICAO STRATEGIC OBJECTIVES:

- Secure the continuing availability of the frequency band 1559 – 1610 MHz which is allocated to the aeronautical radionavigation and the radionavigation satellite services for use by aeronautical GNSS systems, including augmentation systems, on a global basis for the long term.
- Secure deletion of the fixed service from the band 1559 – 1610 MHz and cessation of operation of any station in the fixed service in this band by 1 January 2015.
- Support the development of regulatory measures to enforce prevention and removal of occurrences of in-band and out-of-band interference
- Support the continuing retention of the allocation to the aeronautical mobile satellite (R) service (E-s, s-E) in the frequency band 1610 – 1626.5 MHz as per 5.367

ICAO POLICY:

- No change to the allocation to the radionavigation-satellite service in the band 1 559–1 610 MHz.
- 1 559–1 610 MHz: No change to the use of this band for future GNSS elements, including GLONASS and GPS which must be protected.
- No new allocations to be made in the band 1 559–1 610 MHz.
- No change to Footnotes 5.364, 5.365, 5.366, 5.367 and 5.368.
- Delete Footnotes 5.362B and 5.362C from these bands on the grounds that the allocation to the fixed service is not compatible with the safe operation of ICAO GNSS services.
- Delete Footnote 5.371.

The band 1559 – 1610 MHz is used by GNSS satellite systems as well as by GNSS satellite augmentation systems and is intensively used for aeronautical radionavigation applications. GNSS already plays a vital role in RNAV operations, ADS-B surveillance and the GLS/GBAS landing system. This band is used by GPS, GLONASS, Beidu and is planned to be used by Galileo.
The band 1559 – 1610 MHz is however subject to intentional interference (GPS jammers) and un-intentional interference (potentially caused by an inadequate regulatory framework to prevent the use of illegal jammers and improper implementation of pseudolites and GNSS repeaters). In addition, the proposed use of terrestrial cellular mobile systems in the (adjacent) band 1545 – 1559 MHz is expected to cause harmful interference to GNSS receivers (see also 5.2.9). Protection of GNSS signals is of paramount importance given the variety of GNSS applications for aeronautical navigation and surveillance. Radio regulatory authorities are responsible for securing the absence of harmful interference to GNSS signals, including when used by aviation.
Although this band is also shared with the fixed service, this use is expected to be terminated by 1 January 2015. Until such time the fixed service already operates as a secondary service (it cannot cause harmful interference to the radionavigation satellite service).

Note: the Strategic Objectives for the frequency band 1559 – 1626.5 MHz foresee the need to retain the band 1559 – 1610 MHz for the use of GNSS systems by aviation for the long term (for an undetermined period after 2035) in support to air navigation. The continued use of the band 1610 – 1626.5 MHz for aeronautical mobile satellite (R) communications for the long term to support satellite systems operating in accordance with ICAO SARPs (e.g. IRIDIUM).

Band: 2 700–3 300 MHz
Service: Aeronautical radionavigation/Radionavigation/Radiolocation (primary surveillance radar)

ICAO STRATEGIC OBJECTIVES:

- Secure the continuing availability of the frequency band 2700 – 2900 MHz which is allocated to the aeronautical radionavigation service for use by primary surveillance radar on a global basis for the long term.
- Where in adjacent frequency bands mobile systems are in use (e.g. WIMAX and LTE), secure protection of radar stations from harmful interference from mobile systems operating in adjacent bands
- Review the measures that were taken to protect primary surveillance radar from interference from cordless mobile cameras.

ICAO POLICY:

- No change to the frequency allocations to the aeronautical radionavigation service in these bands.
- No change to Footnotes 5.423, 5.424A, 5.426 and 5.427.
- Oppose any allocation that would endanger the operation of radar services including those potentially being considered for International Mobile Telecommunications/ mobile broadband under ITU-R Resolution [COM 6/8].
- Given the pressure on the use of this frequency band from non-aeronautical sources and in support of the ICAO Overall Policy Statement:
  a) insist that any sharing studies carried out encompass the total technical and operational aspects of radar use, including possible impact on the safety case; and
  b) oppose any proposal that places undue or unreasonable economic penalty on radar systems presently in use.

The band 2700 – 2900 MHz, and to a lesser extent the band 2900 – 3300 MHz, is heavily used for primary surveillance radar for civil aviation which is mainly providing medium range (to about 60 NM) independent non-cooperative surveillance radar. These radars typically provide surveillance in terminal and approach areas around major airports.

The band 2700 – 2900 MHz is also used for meteorological radar. This use is expected, on a global basis, to extend to well beyond 2030.

Radar stations are subject to interference from out-of-band emissions from cellular mobile systems (e.g WIMAX) operating in the adjacent band below 2700 MHz. This interference can be mitigated in principle by improving RF selectivity in the radar stations.

Another area of interference is by the use of the band 2700 – 2900 MHz for digital cordless cameras to support Electronic News Gathering (ENG). In Europe such use is permitted by some Administrations on the basis of CEPT/ECC Recommendation (02)09 and ECC Report 6. Co-frequency use of digital cordless cameras can cause interference to primary surveillance radar up to distances of about 250 NM and in a bandwidth of about +/- 10 MHz from the nominal frequency of the radar station. Such use may become globally harmonized. ECC Report 6 is based on an out-of-date version of ITU-R Recommendation ITU-R M1464 and should be revised to take into account proper protection of radar stations.

The frequency band 2700 – 2900 MHz may also be considered as one of the candidate bands under WRC-15 Agenda Item 1.1. The use of this band by aviation may also become subject to “Spectrum Pricing”.

Note: the Strategic Objectives for the frequency band 2700 – 2900 MHz foresee the need to retain this band for Primary Surveillance Radar (PSR) in particular for terminal areas.

Band: 4 200–4 400 MHz
Service: Aeronautical radionavigation (radio altimeter)

ICAO STRATEGIC OBJECTIVES:

- Secure the continuing availability of the frequency band 4200 – 4400 MHz which is allocated to the aeronautical radionavigation service for use by airborne radio altimeters on a global basis for the long term.

ICAO POLICY:

- No change to the allocation to the radionavigation service in the light of the continuing requirement for radio altimeters to operate in this band and of the results of ITU-R studies indicating that 200 MHz is required to meet the stringent operational requirements for accuracy and integrity for radio altimeters.
- No change to 5.438 which could constrain the operation of radio altimeters.
- Oppose any in-band or near-band allocation that would endanger the operation of the aeronautical radionavigation service including those potentially being considered for International Mobile Telecommunications/mobile broadband under ITU-R Resolution 233.
- Delete 5.439.

The whole of the band 4200 – 4400 MHz is globally used for radio altimeters on board aircraft. Radio altimeters provide an essential safety-of-life function for all phases of flight, including the final stages of landing where the aircraft has to be maneuvered into the flare position or attitude. [Use of this band for radio altimeters is expected to continue.]

The frequency band 4200 – 4400 MHz may also be considered as a potential candidate band for the "Spectrum Release" activities.

Note: the Strategic Objectives for the frequency band 4200 – 4400 MHz foresee the need to retain this band for airborne radio altimeters for the long term (for an undetermined period after 2035).

Band: 5 000–5 250 MHz
Service: Aeronautical radionavigation (MLS); Aeronautical Mobile (R) (surface applications and UAS) and Aeronautical Mobile Satellite (R) (Unmanned Aircraft Systems)

ICAO STRATEGIC OBJECTIVES:

- Secure the continuing availability of the frequency band 5030 – 5091 MHz which is allocated to the aeronautical radionavigation service for use by the Microwave Landing System (MLS) on a global basis for the long term to meet the spectrum requirements for the MLS.
- Assess, on a Regional basis, requirements for the long term implementation of MLS to establish the spectrum requirements for MLS
- Secure the continuing availability of the frequency band 5091 – 5150 MHz which is allocated to the aeronautical mobile (R) service for use by airport communications on a global basis for the long term.
- Secure future implementation of the aeronautical mobile (R) service and the aeronautical mobile satellite (R) service in the band 5030 – 5091 MHz to support air/ground communications for unmanned aircraft systems while satisfying the spectrum requirements for MLS.
- Consider the tuning range for AeroMACS to include the band 5000 – 5150 MHz, to support certain Regional or sub-Regional requirements

ICAO POLICY:

- No change to footnotes 5.444 and 5.444A.
- If necessary, support changes to Footnotes 5.367 and 5.444B in order to facilitate the implementation of aeronautical mobile (route) service (AM(R)S) and aeronautical mobile-satellite (route) service (AMS(R)S) systems.
- Apply the methodology contained in ITU-R Recommendation S.1342 on the coordination of microwave landing system (MLS) with fixed-satellite service (FSS) earth stations in the band 5 091–5 150 MHz.
- Support studies under ITU-R Resolution 114 in order that they can be completed by WRC-15.
- Ensure that in addressing the future use of the frequency band 5 091-5 150 MHz by the FSS current and intended future use by aeronautical systems are not adversely impacted.

Priority is given to the Microwave Landing System in the band 5030 – 5091 MHz.. Other applications for using this band (e.g. in the aeronautical mobile (R) service and aeronautical mobile satellite (R) service to support unmanned aircraft) are emerging.

The band 5091 – 5150 MHz is reserved for airport communication systems in the aeronautical mobile (R) service, which are currently being developed. A tuning range of 5000 – 50150 MHz for AeroMACS is being considered to support either Regional or sub-Regional requirements

The band 5000 – 5030 MHz is also planned for use by the radionavigation satellite service (GNSS) to provide both a feeder link to RNSS satellites as well as a service link, in particular for the Galileo system. However, such use is not expected to be implemented before 2030.

Note: the Strategic Objectives for the frequency band 5000 – 5250 MHz foresee the need to retain the band 5030 – 5091 MHz for the implementation of MLS for the long term (for an undetermined period after 2035). Also, the implementation and use, for the long term, of aeronautical communication systems to support surface communications as well as communications with UAS is expected. Special attention is requested to assess, on a Regional basis, the long term requirements for MLS.

Band: 5 350–5 470 MHz
Service: Aeronautical radionavigation (airborne weather and ground mapping radar)

ICAO STRATEGIC OBJECTIVE:

- Secure the continuing availability of the frequency band 5350 – 5470 MHz which is allocated to the aeronautical radionavigation service for use by airborne weather radar on a global basis for the long term.

ICAO POLICY:

- No change to footnotes 5.448B, 5.448C and 5.448D.
- These bands are used extensively, particularly for airborne weather radar, and are needed for the foreseeable future. No changes should be made which would restrict this aeronautical use.

The band 5350 – 5470 MHz is globally used for airborne weather radar. This use is expected to continue for the long term. The airborne weather radar is a safety critical instrument assisting pilots in deviating from potential hazardous weather conditions and detecting wind shear and microbursts.

Note: the Strategic Objective for the frequency band 5350 – 5470 MHz foresee the need to retain this band for Marker Beacons for the long term (for an undetermined period after 2035) in support to the continued use airborne weather radar systems.

Band: 8 750–8 850 MHz
Service: Aeronautical radionavigation/Radiolocation (airborne Doppler radar)

ICAO STRATEGIC OBJECTIVE:

- Secure the continuing availability of the frequency band 8750 – 8850 MHz which is allocated to the aeronautical radionavigation service for use by airborne Doppler radar and ground mapping radar on a global basis for the long term.

ICAO POLICY:

- No change since the requirement is a continuing one.
- No change to Footnote 5.470.

The band 8750 – 8850 MHz is extensively used for airborne Doppler radar and ground mapping radar. These systems are used to determine ground speed, drift and distance travelled as well as ground mapping. The use of these radar systems is expected to continue for the long term. The band 8750 – 8850 MHz is shared with the radiolocation service and the maritime radionavigation service.

Note: the Strategic Objective for the frequency band 8750 – 8850 MHz foresees the need to retain this band airborne Doppler (and other) radar system for the long term (for an undetermined period after 2035) to support air navigation.

Band: 9 000–9 500 MHz
Service: Aeronautical radionavigation/Radionavigation (precision approach radar, airborne weather and ground mapping radar)

ICAO STRATEGIC OBJECTIVES:

- Secure the continuing availability of the frequency band 9000 – 9200 MHz which is allocated to the aeronautical radionavigation service for use by ground based radar systems on a global basis for the long term.
- Secure the continuing availability of the frequency band 9300 – 9500 MHz which is allocated to the aeronautical radionavigation service for use by airborne weather radar and ground based radar on a global basis for the long term.

ICAO POLICY:

- Oppose any changes to the allocations that could adversely affect their use by aviation.
- No change to Footnotes 5.337, 5.427, 5.473A, 5.474, 5.475, 5.475A, 5.475B and 5.476A.
- Support studies under ITU-R Resolution 651 in order that they can be completed by WRC-15
- Ensure that proposals to extend the earth exploration satellite service into the frequency band 9 000-9 200 MHz do not adversely impact the use of the frequency band by airport surface movement radar.

The band 9000 – 9200 MHz is used for ground based primary surveillance radar systems including Precision Approach Radar (PAR) and airport surveillance detection equipment (ASDE). The main purpose of these systems is to provide surveillance to support precision approach to aircraft and to detect traffic at airports. This use is expected to continue to well beyond 2030. The use of the band is shared with the maritime radionavigation service and the radiolocation service.

The band 9300 – 9500 MHz is globally used for airborne weather radar and ground based radar. This use is expected to continue to well beyond 2030. The airborne weather radar is a safety critical instrument assisting pilots in deviating from potential hazardous weather conditions and detecting wind shear and microbursts. The use of this band by the ground based primary surveillance radar is similar to the use of the band 9000 – 9200 MHz. The use of this frequency band is shared with the Earth exploration satellite service and the space research service.

Note: the Strategic Objectives for the frequency band 9000 – 9500 MHz foresee the need to retain this band for ground based Primary Surveillance radar (in particular for airport surveillance applications) as well as for airborne weather radar for the long term (for an undetermined period after 2035).

Band: 13.25–13.4 GHz
Service: Aeronautical radionavigation (airborne Doppler radar)

ICAO STRATEGIC OBJECTIVE:

- Secure the continuing availability of the frequency band 13.25 – 13.4 GHz which is allocated to the aeronautical radionavigation service for use by airborne Doppler radar and ground mapping radar on a global basis for the long term.

ICAO POLICY:

- No change to the allocation as there is a continuing aeronautical requirement for this band.
- No change to 5.497.
- Oppose any changes to the allocations that could adversely affect their use by aviation as a result of studies undertaken in response to ITU Resolutions [COM 6/4] and [COM 6/5]

The band 13.25 – 13.4 GHz is extensively used for airborne Doppler radar and ground mapping radar. These systems are used to determine ground speed, drift and distance travelled as well as ground mapping. The use of these radar systems is expected to continue for the long term. The band is shared with the Earth exploration satellite service and the space research service.

Note: the Strategic Objective for the frequency band 13.25 – 13.4 GHz foresees the need to retain this band for airborne Doppler navigation aids for the long term (for an undetermined period after 2035).

Band: 15.4–15.7 GHz
Service: Aeronautical radionavigation (ASDE/airborne weather radar, other systems)

ICAO STRATEGIC OBJECTIVE:

- Secure the continuing availability of the frequency band 15.4 – 15.7 GHz which is allocated to the aeronautical radionavigation service for use by ground based radar systems on a global basis for the long term.

ICAO POLICY:

- No change to the allocation to the aeronautical radionavigation service.
- No change to Footnotes 5.511A, 5.511C and 5.511D which would introduce further restrictions to aeronautical use of this band.
- Oppose any changes to the allocations that could adversely affect their use by aviation as a result of studies undertaken in response to ITU Resolutions 151 and 152.

The band 15.4 – 15.7 GHz is used for ground based primary surveillance radar systems including Precision Approach Radar (PAR) and airport surveillance detection equipment (ASDE) The main purpose of these systems is to provide surveillance to support precision approach to aircraft and to detect traffic at airports. This use is expected to continue to well beyond 2030. The use of the band is shared with the fixed satellite service (Earth-to-space and space-to-Earth) and the Radio Location Service (RLS. No FSS use has been registered with the ITU within this band.

Note: the Strategic Objective for the frequency band 15.4 – 15.7 GHz foresees the need to retain this band for primary surveillance radar, in particular at airports, for the long term (for an undetermined period after 2035). This frequency band is also used for a variety of airborne weather radar and ground mapping radar systems.

Band: 24.25–24.65 GHz
Service: Radionavigation (ASDE)

ICAO POLICY:

No change to the radionavigation allocations in Region 2 and Region 3.

Note: Due to the non-global nature of the allocation to the Radionavigation Service in this band, no ICAO Spectrum Strategic Objective has been developed

Band: 31.8–33.4 GHz
Service: Radionavigation (ASDE)
Allocation:

ICAO STRATEGIC OBJECTIVE:

- Secure the continuing availability of the frequency band 31.8 – 33.4 GHz which is allocated to the radionavigation service and used by primary surveillance radar to support airport surveillance detection equipment (ASDE radar) on a global basis for the long term.
- Re-assess the need for using this band for ground based airport surface detection equipment (ASDE) radar systems.

ICAO POLICY:

No change to the radionavigation allocations.

The band 31.8 – 33.4 GHz is used by aviation to support ground based airport surface detection equipment (ASDE) radar, mainly to detect traffic at airports. The band is shared with the mobile, the fixed and the space research service.

Note: the Strategic Objective for the frequency band 31.8 – 33.4 GHz foresees the need to retain this band for airport surface surveillance radar systems for the long term (for an undetermined period after 2035). The need for this Strategic Objective needs to be re-confirmed, taking into account Regional requirements. This frequency band is also used for airborne radionavigation systems.

— END —