



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

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**Agenda Item 7:           Aeronautical electromagnetic spectrum utilization**

- 1) review outcome of WRC 2012
- 2) Initial preparations for WRC 2015
- 3) Radio spectrum management related issues

**WORLD RADIOCOMMUNICATION CONFERENCE – 2012 (WRC-12)  
OUTCOME & WRC-15 AGENDA ITEMS**

(Presented by the Secretariat)

**SUMMARY**

WRC-12 was held in Geneva from 23 January to 17 February, 2012. This paper presents Conference outcome on Agenda Items of critical interest to civil aviation.

This paper relates to: -

**Strategic Objective:**

**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 Initiative:**

GPI 23 - Aeronautical Radio Spectrum

**1. Introduction**

1.1 ITU World Radiocommunication Conference – 2012 (WRC-12) was held in Geneva, Switzerland from 23 January to 17 February 2012. Over 3,100 delegates from 165 ITU Member States and 45 international organizations participated in the conference. ICAO was represented in the conference by the Regional Officers from WACAF, ESAF Offices and two Technical Officers from ICAO Headquarters.

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1.2 About 75 aviation experts attended the three aviation coordination meetings, which were organized by the ICAO delegation during the conference. These meetings generally coordinated support for ICAO position on the agenda items of interest for civil aviation, taking into account the developments taking place during the conference.

**2. Background**

2.1 Frequency spectrum is a finite resource, which is being shared by many applications, including transportation in general and aviation in particular. ITU organizes WRCs every three to four years to review allocations amongst various competing applications and reviews and revises policies related to these allocations where required.

2.2 ICAO Assembly, through its Resolution A36-25 urged all the ICAO Contracting States to support aviation requirements for spectrum.

**3. ICAO Preparations for WRC-12**

3.1 The following significant steps were taken by ICAO to support the interest of civil aviation in WRC-12:

- a) initial ICAO position on the WRC agenda items of critical interest to civil aviation was developed by ACP and was approved by Council on 22 June 2009 based on the recommendation of Air Navigation Commission. The position was circulated through State Letter dated 30 June, 2009.
- b) the position was subsequently reviewed and revised based on the outcome of ITU-R studies and other developments and was circulated to the States after the approval of Council, through State Letter dated 22 July 2011.
- c) ICAO Position was submitted to ITU WRC-12 on 11 August 2011 and was also placed on the ICAO website.
- d) at the regional level, APANPIRG (September 2008) adopted Conclusion 19/41 urging the States to nominate a contact person in their administration responsible for the preparation of WRC-11 (later WRC-12) and inform ICAO Asia and Pacific Office about his contact details. The conclusion also urged the States to actively participate in all the national and regional level activities related to the preparation for WRC-11 (later WRC-12). Regional Preparatory Group meeting was held in Bangkok on 8 and 9 December, 2009, wherein Member States were informed once again about ICAO position and clarification was provided on the issues raised.

**4. WRC-12 Outcome on critical aviation related agenda items**

A comprehensive report on WRC-12 outcome on Agenda Items of interest to civil aviation is placed at **Attachment A** to this paper. Outcome on three most critical Agenda Items of interest to civil aviation are being discussed below.

4.1 WRC-12 Agenda Item 1.3

*To consider spectrum requirements and possible regulatory actions, including allocations, in order to support the safe operation of unmanned aircraft systems (UAS), based on the results of ITU-R studies, in accordance with Resolution 421 (WRC-07)*

This agenda item addressed the requirement to support operation of un-manned aircraft systems (UAS) in non-segregated airspace.

<b>Agenda Item 1.3</b>		
ICAO Position	WRC-12 Outcome	Remarks
<p>To support, based on the results of studies identified in Resolution 421, any modifications to existing allocations, or new allocations required to accommodate UAS operations in non-segregated airspace while maintaining the safety and regularity of flight of all types of aircraft.</p> <p>Accordingly, to ensure that allocations used, in particular, for UAS command and control, ATC relay and sense and avoid in non-segregated airspace are in the AM(R)S, AMS(R)S and/or ARNS and do not adversely affect existing aeronautical systems.</p> <p>To oppose the use of this agenda item to seek new spectrum allocation to meet payload requirements.</p>	<p>A new allocation to AM(R)S in support of UAS agreed in the band 5030-5091 MHz band, the core band for MLS. To protect civil aviation access to this band, use of this new AM(R)S allocation is limited to internationally standardized aeronautical systems.</p> <p>An existing allocation to the aeronautical mobile satellite (route) service (AMS(R)S) in the band 5 030-5 091 MHz was modified to be limited to internationally standardized aeronautical systems</p> <p>ITU-R instructed to conduct studies to develop technical, regulatory and operational recommendations for WRC-15. An agenda item was agreed for WRC-15, to consider possible regulatory actions to support the use of FSS bands for the safe operation of UAS.</p>	<p>The new AM(R)S and modified AMS(R)S allocations in the core MLS band provide for substantial bandwidth, essential for the safe implementation of UAS, while also ensuring continued aviation access to this previously underutilized frequency band.</p> <p>ITU-R and WRC-15 will explore whether the fixed satellite service (FSS) can be used to provide UAS command and control communications, consistent with aeronautical <i>safety of flight</i> requirements. It is essential that aviation safety regulators and other aviation interests participate.</p>

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4.2 WRC-12 Agenda Item 1.4

*To Consider, based on the results of ITU-R studies, any further regulatory measures to facilitate introduction of new aeronautical mobile (R) service (AM(R)S) systems in the band 112 – 117.975 MHz, 960 – 1164 MHz and 5000 – 5030 MHz in accordance with Resolution 413 (Rev. WRC-07), 417 (WRC-07) and 420(WRC-07)*

Under this agenda item, conference sought to finalize new allocations made in the aeronautical mobile (route) service during WRC-07.

<b>Agenda Item 1.4</b>		
<b>ICAO Position</b>	<b>WRC-12 Outcome</b>	<b>Remarks</b>
<p>To support as required, based on the results of studies identified in Resolution 413, the inclusion in the Radio Regulations further regulatory measures that will facilitate the introduction of future AM(R)S systems in the band 112-117.975 MHz.</p> <p>To support as required, based on the results of studies identified in Resolution 417, the inclusion in the Radio Regulations of further regulatory measures that will facilitate the introduction of future AM(R)S systems in the band 960-1164 MHz.</p>	<p>Further regulatory measures made to finalize provisional allocations to AM(R)S in bands 112-117.975 MHz and 960-1164 MHz.</p>	<p>New allocations pave way for more efficient and flexible aeronautical use of these frequency bands while adding a layer of protection for civil aviation by means of the new regulatory requirement.</p>
<p>If the spectrum requirements for surface applications at airports cannot be fully accommodated within 5091-5150 MHz band, and based on the results of successful compatibility studies identified in Resolution 420, support a new allocation to the AM(R)S in the band 5000-5030 MHz.</p>	<p>At WRC-07, a 59 MHz wide band was allocated to the new aeronautical air/ground airport surface communication system for use in 5 GHz band. Due to heavy pressure from affected users mainly from GNSS, conference could not come to an agreement on additional allocation and so no additional allocation was made support of the new aeronautical airport surface system.</p>	<p>No new allocations were approved.</p>

4.3 WRC-12 Agenda Item 1.7

*To consider the results of ITU-R studies in accordance with Resolution 222(Rev. WRC-07) in order to ensure long-term spectrum availability and access to spectrum necessary to meet requirements for the aeronautical mobile-satellite (R) service, and to take appropriate action on this subject, while retaining unchanged the generic allocation to the mobile-satellite service in the bands 1525-1559 MHz and 1626.5-1660.5 MHz.*

This agenda item addressed the long-standing issue of access to the bands 1545-1555 MHz and 1646.5-1656.5 MHz for AMS(R)S users. In these bands, AMS(R)S users should be given priority of access over other satellite users (land mobile and maritime mobile) through Radio Regulations, but the effectiveness of the procedures for application of these regulations are often questionable.

<b>Agenda Item 1.7</b>		
<b>ICAO Position</b>	<b>WRC-12 Outcome</b>	<b>Remarks</b>
Taking into account the results of ITU-R studies, support further regulatory provisions to strengthen AMS(R)S access to the bands 1545-1555 MHz and 1646.5-1656.5 MHz including if required changes to No. 5.357A, No. 5.362A and Resolution 222	Several provisions were approved in the Conference, that, taken together, achieve the purpose of strengthening AMS(R)S access, as highlighted in ICAO Position. Specifically, the conference introduced in the Radio Regulations a detailed Annex describing the procedures for the application of the AMS(R)S priority, and accepted optional involvement of ICAO in the validation of the AMS(R)S traffic requirements.	New provisions will provide transparency in the process of allocation in the AMS(R)S band.  Support provided for AMS(R)S operators' claims to spectrum and reinforces their position when claiming priority over other users.

4.4 WRC-15 Agenda Items

A number of aviation-relevant agenda items were included for WRC-15, including the following ones

4.4.1 Wireless Avionics Intra-Communication (WAIC)

WAIC systems have been identified by the aerospace industry as a means to increase cost-efficiency and environmental friendliness while maintaining required level of safety, through reduction of aircraft weight by using wireless technology and by the introduction of sensor/transducers on parts of the airframe. To achieve this, a spectrum needs to be identified on world-wide bases.

4.4.2 Use of FSS spectrum for UAS

WRC-12 approved ITU-R studies to identify technical, regulatory and operational recommendations to enable safe use of FSS spectrum by UAS, and an agenda item for WRC-15 was agreed; to consider, based on the result of the ITU-R studies, the possible regulatory actions to support the use of FSS frequency bands for the provision of UAS command and control links, while ensuring safe operation of UAS, consistent with the provision of a safety service, making reference to No. 4.10 in the Radio Regulations.

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**4.4.3 VSAT operations in AFI region**

WRC-12 approved a new Resolution, addressing the support of civil aviation VSAT communications in the 3.4 – 4.2 GHz band (C-band) in the AFI region. Meeting may consider to assess if a similar requirement exists for the APAC region also.

**4.4.4 Sharing of band with other applications**

The most critical and far-reaching item, as far as civil aviation is considered will probably be WRC-15 agenda items dealing with the spectrum requirements for new allocations for the mobile services, including broadband wireless access (BWA) and the international mobile telecommunication (IMT). It is expected that the proponents of many of these WRC-15 agenda items will consider and propose sharing or use of aeronautical spectrum in one or more bands.

**5. Conclusions**

5.1 In general, the Conference outcome particularly on the critical Agenda Items were in line with ICAO Position.

5.2 It is expected that Aeronautical Communication Panel Working Group F will develop preliminary ICAO Position on WRC-15 Agenda Items of critical interest to civil aviation by December, 2012. This preliminary position after reviewed by Air Navigation Commission is likely to be approved by the Council in 2013.

5.3 Availability of adequate frequency spectrum for communication, navigation and surveillance/air traffic management (CNS/ATM) is absolutely essential for safe and efficient movement of air traffic. However the demand for radio spectrum from other sectors is growing fast and aviation is now facing a serious competition particularly from mobile and broadband wireless access services. It has therefore become essential that aviation requirements for frequency spectrum be strongly supported by all ICAO Member States in all the national/international forums where issues related to spectrum allocation are addressed so as to ensure that aviation requirements for safety of life services are duly presented and understood by those who are responsible for the management of frequency spectrum in their administrations.

5.4 To protect ICAO Position on WRC-15 Agenda Items of interest to civil aviation in the WRC and other regional/national level forums, it is essential that the coordination activities are initiated well in advance. To facilitate this coordination like for earlier WRCs, nomination of Contact Focal Points by the States/Administrations will be required. The meeting is therefore invited to recommend following draft Conclusion for the consideration of APANPIRG.

**Draft Conclusion 16/xx – Nomination of Contact Focal Point**

That, States be urged to nominate/reconfirm Contact Focal Points in their administration for WRC-15 and inform ICAO APAC Office about their contact details.

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## APPENDIX

### WRC-12 RESULTS OF RELEVANCE TO INTERNATIONAL CIVIL AVIATION

**1. Agenda Item 1.1: To consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution 26 (Rev. WRC-07).**

1.1 Under this agenda item, the ICAO Position supported the deletion of footnote No. **5.72** which allowed for the use of the bands 283.5 - 490 and 510 - 526.5 kHz by Norwegian fixed stations located north of 60°. Aeronautical Non-directional Beacons (NDB) operate in these bands. This footnote was deleted by the conference.

1.2 Footnotes Nos. **5.181**, **5.197** and **5.259** were introduced in about twenty countries in 1987 in view of the foreseen global transition from ILS to MLS and were intended to enable the introduction of the mobile service in the ILS bands as and when these would no longer be required for ILS. However, it has been apparent for a while that a global transition to MLS is not taking place as originally foreseen and that ILS will continue to be used by aviation for the foreseeable future. Therefore the existence of these footnotes is no longer justified. Most administrations have already removed their name from these footnotes at previous conferences, and this trend continued further during this conference.

1.3 The band 1 215 - 1 300 MHz is used by civil aviation for the provision of radionavigation services (primary radar) through footnote No. **5.331**. Footnote No. **5.330** also allocates the band in a number of countries to the fixed and mobile service. Given the receiver sensitivity of aeronautical uses of the band, ICAO does not support the continued inclusion of an additional service through country footnotes. Some country names were removed from Footnote No. **5.330** as a result of the conference, but the names of Djibouti, Egypt and Oman were added.

1.4 The ICAO Position supported the deletion of footnotes **5.362B** and **5.362C** which allocate the GNSS band 1 559-1 610 MHz on a secondary basis to the (terrestrial) fixed service in certain countries until 1 January 2015, after which time this allocation to the fixed service shall no longer be valid. The continued use by the fixed service constitutes a severe constraint on the safe and effective use of GNSS in some areas of the world, as coordination distances of up to 400 km between the stations of the fixed service and the aircraft would be required. Ten countries removed their names from footnotes **5.362B** and **5.362C** during WRC-12. This was a significant step forward towards achieving better worldwide protection of GNSS.

1.5 The band 4 200-4 400 MHz is reserved for use by airborne radio altimeters. Footnote No. **5.439** allows the operation of the fixed service in this band on a secondary basis. Radio altimeters are a critical element in aircraft automatic landing systems and serve as a sensor in ground proximity warning systems. The ICAO Position recommended deletion of this footnote. As a result of this conference, only one country now remains in this footnote, Iran (Islamic Republic of).

**2 Agenda Item 1.2: Taking into account the ITU-R studies carried out in accordance with Resolution 951 (Rev. WRC-07), to take appropriate action with a view to enhancing the international regulatory framework.**

2.1 The ICAO Position on this agenda item was to support new provisions or modifications to existing provisions that improve the flexibility with which spectrum allocated to aeronautical safety services can be used by aviation and/or tighten regulatory provisions that enhance the protection of

aviation systems. Furthermore, the position was to ensure that any other measures taken at WRC-12 under this agenda item would not have an adverse impact on the use or protection of aeronautical systems.

2.2 No new radio regulatory measures were developed under this agenda item and Resolution **951**, which described the studies to be performed under this agenda item, was suppressed. This was fully in line with the ICAO position. Also, in line with ICAO proposals, the WRC continued the trend set by the last conference, towards increased flexibility of aeronautical spectrum allocations. This was mainly achieved under agenda items 1.3 and 1.4 of this conference, by enabling the sharing of spectrum between aeronautical mobile (route) allocations and aeronautical radionavigation allocations, while limiting the use of such shared allocations to systems which operate in accordance with ICAO SARPs.

**3 Agenda Item 1.3: To consider spectrum requirements and possible regulatory actions, including allocations, in order to support the safe operation of unmanned aircraft systems (UAS), based on the results of ITU-R studies, in accordance with Resolution 421 (WRC-07).**

3.1 The ICAO Position was to support, based on the results of studies identified in Resolution **421**, any modification to existing allocations, or new allocations required to accommodate UAS operations in non-segregated airspace while maintaining the safety and regularity of flight of all types of aircraft. Accordingly, the ICAO position was also to ensure that allocations used, in particular, for UAS command and control, ATC relay and sense and avoid in non-segregated airspace are in the aeronautical mobile (route) service (AM(R)S), aeronautical mobile satellite (route) service (AMS(R)S) and/or aeronautical radionavigation service (ARNS) and do not adversely affect existing aeronautical systems. Furthermore, the position was to oppose the use of this agenda item to seek new spectrum allocations to meet payload requirements.

3.2 In the preparations leading up to the conference, ITU-R studies, supported by ICAO, identified a requirement of 34 MHz of terrestrial spectrum and up to 56 MHz of satellite spectrum to support UAS line-of-sight (LOS) and beyond-line-of-sight (BLOS) command and control communications (C<sup>3</sup>) (the ITU equivalent terminology for C<sup>3</sup> is Control and Non-Payload Communications (CNPC)).

3.2.1 For LOS links, the studies prior to the conference concentrated mainly on three potential candidate aeronautical safety bands: 960 – 1 164 MHz (DME band), 5 030 – 5 091 MHz (MLS band) and 15.4 – 15.5 GHz (ARNS band).

3.2.2 For BLOS links the main focus was on the 5 030 – 5 091 MHz band, which already has an appropriate AMS(R)S allocation which could support such use, and existing allocations to the Fixed Satellite Service in the 11/12/14 GHz (Ku) 20/30 GHz (Ka) bands.

3.3 The methods addressed during the conference concentrated mainly on the 5 GHz band for both LOS and BLOS, as well as existing FSS allocations in the Ku and Ka bands in support of BLOS. In the light of the mounting pressures from other services (IMT and BWA in particular) and the very limited implementation of MLS to date, aviation supported the shared use of the 5 GHz MLS band for the provision of both LOS and BLOS services, while maintaining a priority to MLS use in this band. On the other hand, ICAO did strongly oppose the use of little modified FSS allocations, without additional special radio regulatory provisions to reflect the safety-of-life criticality of BLOS C<sup>3</sup> links in support of UAS.

3.3.1 In addition to safety through technically robust links as defined in relevant ICAO SARPs, the provision of aeronautical safety services relies on the use of AM(R)S and AMS(R)S allocations. AM(R)S and AMS(R)S are defined in the Radio Regulations as services *used permanently or temporarily*



*for the safeguarding of human life and property*, and as such, any frequency bands providing safety of life services enjoy special measures in the Radio Regulations to ensure freedom from interference and to mitigate any eventual interference through swift regulatory action by the responsible radio regulators. This is reflected in No. **4.10**.

3.4 On the other hand, FSS is not defined as a safety service, and, due to lack of existing and effective radio regulatory measures, FSS frequency coordination and interference mitigation relies today, to a large extent, on voluntary commercially motivated cooperation between FSS operators.

3.5 The results of the conference were:

3.5.1 LOS: While retaining priority to the MLS service in the 5 030 – 5 091 MHz band, this band was also allocated to the AM(R)S, limited to internationally standardized aeronautical systems. Unwanted emissions from the AM(R)S in this band shall be limited to protect RNSS system downlinks in the adjacent 5 010 – 5 030 MHz band (future GNSS service and user downlink band).

3.5.2 BLOS: An existing allocation to the AMS(R)S in the 5 000 – 5 150 MHz band was slightly modified. In the bands 5 000 – 5 030 MHz and 5 091 – 5 150 MHz, the allocation was limited to internationally standardized aeronautical systems. In the band 5 030 – 5 091 MHz, coordination procedures were modified from No. **9.21** to No. **9.11A** which is more appropriate for coordination with terrestrial services, and the allocation was limited to internationally standardized aeronautical systems.

3.5.3 In line with WRC-07, and as reflected further under agenda item 1.4 during this conference; when making allocations to AM(R)S in bands already allocated to ARNS and used by ICAO standardized systems, it was acknowledged that compatibility between ICAO standardized systems would be taken care of within ICAO. Hence these new AM(R)S and AMS(R)S allocations are limited to internationally standardized aeronautical systems.

3.5.4 The conference did not support the allocation or use of FSS spectrum for the provision of BLOS C<sup>3</sup>, without substantive modifications to such allocations. Such required modifications were not identified at the conference. However, a study item was assigned to the upcoming ITU-R cycle; to identify technical, regulatory and operational recommendations, and an agenda item for WRC-15 was agreed; to consider, based on the result of the ITU-R studies, the possible regulatory actions to support the use of FSS frequency bands for the UAS C<sup>3</sup> links, while ensuring the safe operation of UAS C<sup>3</sup> links, consistent with the provision of a safety service, making reference to No. **4.10**. ICAO was invited to participate in the ITU-R studies.

3.5.5 As a consequence of the above, Resolution **421** (WRC-07) was suppressed. The above results are fully in line with the ICAO position.

**4 Agenda Item 1.4: To consider, based on the results of ITU-R studies, any further regulatory measures to facilitate introduction of new aeronautical mobile (R) service (AM(R)S) systems in the bands 112 - 117.975 MHz, 960 - 1 164 MHz and 5 000 - 5 030 MHz in accordance with Resolutions 413 (Rev. WRC-07), 417 (WRC-07) and 420 (WRC-07).**

4.1 Three separate issues were addressed under this item:

4.2 112 – 117.975 MHz

4.2.1 In order to support future requirements for air-ground communications, in particular to extend the current usage of the band 117.975-137 MHz in congested areas (e.g. Europe), WRC-07 made a provisional AM(R)S allocation in the 108 – 117.975 MHz band, pending further studies before WRC-12.

4.2.2 ITU-R, with the assistance of ICAO, has studied any potential compatibility issues between the analogue broadcasting and AM(R) services that may arise from the introduction of AM(R)S systems in the band 112 – 117.975 MHz. The result of these studies confirms that no harmful interference will arise from the introduction of AM(R)S in the band 112 – 117.975 MHz into analogue FM broadcasting receivers below 108 MHz and that both services can operate on a compatible basis. Regarding the compatibility with digital broadcasting service below 108 MHz, it was agreed to pursue this matter under traditional ITU-R activities and outside the WRC process.

4.2.3 Consequentially the allocation was confirmed and Resolution **413** was amended accordingly. It should be noted that this new AM(R)S allocation is shared with the ARNS in a manner that fully protects the ARNS. Furthermore, the allocation is limited to systems which meet ICAO SARPs published in Annex 10 to the ICAO Convention.

4.3 960 – 1 164 MHz

4.3.1 WRC-07 made a provisional AM(R)S allocation in the band 960 – 1 164 MHz to support the introduction of future applications and concepts in air traffic management requiring safety critical aeronautical communication. While recognizing that ICAO will take care of compatibility issues between ICAO standardized ARNS and AM(R)S systems sharing this allocation, ITU-R has conducted studies on operational and technical means to facilitate sharing between non-ICAO ARNS systems and the potential future AM(R)S systems identified to operate in the frequency band 960 – 1 164 MHz.

4.3.2 The results of the ITU-R studies provide separation distances below which site-specific compatibility studies should be performed in order to ensure that in particular the non-ICAO standardized ARNS systems operating in Armenia, Azerbaijan, Belarus, Bulgaria, China, the Russian Federation, Kazakhstan, Mongolia, Uzbekistan, Kyrgyzstan, Tajikistan and Ukraine remain protected.

4.3.3 Consequentially the allocation was confirmed and Resolution **417** was amended accordingly. It should be noted that this new AM(R)S allocation is shared with the ARNS in a manner that fully protects the existing and future use of ARNS in this frequency allocation. Furthermore, the allocation is limited to systems which meet ICAO SARPs published in Annex 10 to the ICAO Convention. Coordination procedures to protect the non-ICAO ARNS system identified above, were defined in a manner which ensures that affected countries respond to coordination requests, as a non-reply is considered as acknowledgement of being unaffected.

4.4 5 GHz air/ground aeronautical surface (WiMAX) system

4.4.1 Studies for WRC-07 indicated that 60 – 100 MHz were required for the new air/ground aeronautical surface (sometimes branded as AeroMACS) system planned in the 5 GHz band. WRC-07 allocated 5 091 – 5 150 MHz to the AM(R)S. This 59 MHz wide allocation is shared with the existing ARNS, fixed satellite service (FSS), aeronautical mobile telemetry, and an aeronautical security (AS) application which was pushed by some members of the aeronautical industry during WRC-07.

4.4.2 ITU-R studies in preparation for WRC-12 have focused on two issues; a) whether more spectrum was required for this service; b) compatibility studies to identify whether the this service could share the band 5 000 – 5 030 MHz, or parts of that band, without undue impact to other existing or planned services.

4.4.3 As regards a), the outcome of further studies in ITU-R and ICAO indicated that the 59 MHz shared allocation is not sufficient. ACP WG-F has concluded that about 90 MHz would be required to provide the necessary bandwidth for all the envisaged air/ground applications to be supported by the new service. The basis for these results is a method which satisfies the present sharing conditions with the existing low earth orbit (LEO) FSS, as specified in footnote No. **5.444A**. To satisfy these stringent sharing conditions, the methodology is based on a maximum of 500 airports being visible to the satellite footprint, and only 1 transmitter being active on each frequency, at each airport at any given instant in time. Recently a different methodology was introduced in ITU-R, this methodology proposing a *frequency reuse of one*, in essence multiple transmitters being active simultaneously on the same frequency at each airport. Frequency reuse of one is a new development in the mobile or broadband industry, its standards are still immature, and the technology is unproven as regards achievable quality of service performance. The IEEE 802.16(2009) standard, which the aeronautical SARPs currently under development are based on, is technically capable of using a frequency reuse of one methodology. A recent ITU-R report indicates that such frequency reuse requires 20 to 30 dB higher transmitting power per transmitter for appropriate signal/noise shaping. This method makes no attempt at trying to satisfy existing radio regulatory sharing conditions, to protect the FSS (earth-Space) feederlink present in the band.

4.4.3.1 As regards b), the frequency band 5 000 – 5 010 MHz is used as a global navigation satellite service (GNSS) (earth-Space) feederlink for Galileo (Europe) and QZSS (Japan). 5 010 – 5 030 MHz is planned for GNSS service and user links (space-Earth). During the ITU-R studies which commenced after WRC-07, it was agreed, due to the current immaturity of GNSS user and service link requirements, to concentrate only the band 5 000 – 5 010 MHz as a potential additional frequency allocation to the new aeronautical surface service in the 5 GHz band. The agreed ITU-R studies confirm that sharing in the band 5 000 – 5 010 MHz is feasible, given similar conditions as were used to establish compatibility with the FSS in the band 5 091 – 5 150 MHz.

4.4.4 During the WRC it became apparent that an additional allocation of 10 MHz in the 5 GHz band was only supported by USA and African States, while there was very strong opposition from other Regions. Aviation in general did not appear to have a strong opinion on this issue, while the GNSS community was strongly represented. The allocation WRC-07 made to the AS within the 5 091 – 5 150 MHz band was revoked by this conference. This slightly improves the spectrum access available to the AM(R)S allocation for the air/ground aeronautical surface system in the band 5 091 – 5 150 MHz.

#### 4.5 Overall results

4.5.1 Overall, agenda item 1.4 can be declared a success. The new AM(R)S allocations in the 108 – 117.975 MHz and 960 – 1 164 MHz bands, will be shared with existing ARNS in a manner which does not burden existing and foreseen future implementations of the ARNS. These new allocations pave the way for more efficient and flexible aeronautical use of these frequency bands, and also add a radio regulatory requirement for ICAO standardized systems in these bands. While it was not possible to get a 10 MHz wide additional allocation for the 5 GHz air/ground airport surface system during this conference, indications are that States which require additional bandwidth to support very large airports will have access to additional spectrum through use of Article **4.4** of the Radio Regulations. Also, WRC-15 will re-examine the FSS allocation currently present in the 5 091 – 5 150 MHz band.

### **5 Agenda Item 1.5: To consider worldwide/regional harmonization of spectrum for electronic news gathering (ENG), taking into account the results of ITU-R studies, in accordance with Resolution 954 (WRC-07).**

5.1 This agenda item was to address spectrum needs associated with terrestrial portable radio equipment used by services ancillary to radio and television broadcasting. Despite considerable efforts made by the proponents for electronic news gathering, the conference did not agree to modifications to the Radio Regulations in support of this agenda item. The ICAO Position, to oppose any allocation which would adversely affect the interests of aviation, is fully covered by this outcome.

**6 Agenda Item 1.7: To consider the results of ITU-R studies in accordance with Resolution 222 (Rev. WRC-07) in order to ensure long-term spectrum availability and access to spectrum necessary to meet requirements for the aeronautical mobile-satellite (R) service, and to take appropriate action on this subject, while retaining unchanged the generic allocation to the mobile-satellite service in the bands 1 525 - 1 559 MHz and 1 626.5 - 1 660.5 MHz.**

6.1 The ICAO position on this agenda item was to support further regulatory provisions to strengthen AMS(R)S access to the bands 1 545 - 1 555 MHz and 1 646.5 -1 656.5 MHz including, if required, changes to No. 5.357A, No. 5.362A and Resolution 222 and taking into account the results of ITU-R studies.

6.2 Before WRC-97 the bands 1 545 - 1 555 MHz and 1 646.5 -1 656.5 MHz were allocated exclusively to the AMS(R)S, and therefore access by AMS(R)S users was intrinsically guaranteed by the Radio Regulations. Following the WRC-97 decision to replace the exclusive AMS(R)S allocation with a “generic” allocation to the mobile-satellite service (MSS), which forced sharing of the bands with maritime and land-mobile users, such guarantee was no longer available. Instead, an alternative footnote No 5.357A was introduced to partially compensate for the loss of the exclusive allocation by giving AMS(R)S users priority of access to the band. The wording of the footnote and of the associated Resolution 222 were subsequently (WRC-2000) strengthened to state explicitly that MSS operators carrying non-safety-related traffic must yield spectrum if necessary to accommodate the spectrum requirements for AMS(R)S communications.

6.3 Since WRC-2000, the effectiveness of those provisions to ensure that AMS(R)S spectrum requirements are consistently met was challenged several times by at least one AMS(R)S operator. WRC-07 therefore agreed that the matter should be on the agenda of WRC-12.

6.4 The studies conducted by the ITU-R in preparation of WRC-12 concentrated on two main issues.

6.4.1 The first was whether the 1 545 - 1 555 MHz and 1 646.5 -1 656.5 MHz bands (2 x 10 MHz in total) would be sufficient to accommodate the long-term spectrum requirements for the AMS(R)S. The conclusion was that the bands would be sufficient, as long as AMS(R)S users were granted priority access to the bands (if necessary by forcing other users to vacate them).

6.4.2 The second and closely related issue was whether the regulatory provisions of footnote No 5.357A and Resolution 222 were strong enough to ensure that AMS(R)S users were indeed granted priority access to the bands. The issue had arisen because, while those provisions unequivocally supported the priority access principle, there were doubts as to the effectiveness of the procedures for their application. The doubt were mainly related to the facts that such procedures were based on regional Memoranda of Understanding (MoU) governing the assignment of spectrum to MSS operators (including AMS(R)S), and that the content of the MoU was not in the public domain. Furthermore, the assignments agreed under the provisions of the MoU were not in the public domain either. This situation had led to conflicting claims as to whether AMS(R)S requirements were being met or not. Such claims could not be arbitrated by external parties, such as ICAO, due to the intrinsic lack of transparency of the process. On this second issue, the ITU-R studies did not reach a consensual conclusion. This divergence of views was

reflected in the proposals submitted to the conference. While some proposals claimed that the issue did not exist and therefore no action was required, others (in line with the ICAO position) disagreed and advocated the introduction of a more transparent process, and in particular the involvement of ICAO.

6.5 The outcome of the conference favoured the ICAO position. Specifically, the conference agreed a substantial modification of Resolution **222**, introducing the following changes:

- a) administrations, if they so desire, are invited to have their AMS(R)S traffic requirements submitted to ICAO before the yearly MoU meetings in which spectrum assignments in the band are agreed for the following year;
- b) ICAO is invited to evaluate and, as appropriate, comment on the AMS(R)S traffic requirements received from individual administrations, on the basis of the known global and regional aviation traffic requirements, including the time-scale of regional and global communication requirements;
- c) a new detailed Annex to the Resolution spells out the existing procedures in detail, with substantial modifications intended to ensure the transparency of the process, such as a requirement for administrations to make known the result of the spectrum assignment meetings, and the introduction of a “Reassessment Meeting” to be held if an administration claims that their AMS(R)S spectrum requirements have not been met (with a view assess the validity of the claim and subsequently redress the situation if required).

6.6 Taken together, the changes achieve the purpose of strengthening AMS(R)S access, as required by the ICAO position. The introduction of the detailed Annex effectively addresses the long-standing issue of transparency. The optional involvement of ICAO in the validation of the AMS(R)S traffic requirements provides additional support for AMS(R)S operators’ claims to spectrum and reinforces their position in the MoU meeting

**7 Agenda Item 1.9: To revise frequencies and channelling arrangements of Appendix 17 to the Radio Regulations, in accordance with Resolution 351 (Rev. WRC-07), in order to implement new digital technologies for the maritime mobile service.**

7.1 This agenda item sought to facilitate the introduction of new digital technologies in the HF frequency bands, as contained within Appendix **17** of the Radio Regulations. The ICAO Position was to ensure that the introduction of new modulation techniques and/or changes to the table contained in Appendix **17**, does not cause harmful interference to the AM(R)S operating according to the table contained in Appendix **27**, and operating in frequency bands adjacent to those operated by the maritime service.

7.2 Modifications were made to Appendix **17**, to accommodate wide band digital transmissions, using multiples of 3 kHz channels, in accordance with Recommendation ITU-R M.1798. Updates were also made to Article **52** *Special rules relating to the use of frequencies*, accordingly. These modifications do not affect AM(R)S spectrum, hence the updates are in line with the ICAO position.

**8 Agenda Item 1.12: To protect the primary services in the band 37 - 38 GHz from interference resulting from aeronautical mobile service operations, taking into account the results of ITU-R studies, in accordance with Resolution 754 (WRC-07).**

8.1 Prior to WRC-12, the frequency band 37 – 38 GHz contained a generic mobile allocation, shared with the fixed service as well as space research and fixed-satellite services. There has not been

any aeronautical use of this band to date, however, prior to WRC-07, some concerns were raised about the potential incompatibility of aeronautical mobile use with other users in this band.

8.2 In 2007 the aerospace industry started developing a new concept, involving very low power point-to-point transmissions onboard aircraft to replace wiring and/or add sensors/transducers in locations on the airframe hitherto difficult to reach. During this early development phase, this frequency band was seen as a potential candidate band to support wireless avionics intra-communications (WAIC) systems. See also discussion on agenda item 8.2

8.3 Later, interest in this band was dropped by the aerospace industry, as preliminary R&D efforts indicated that lower frequency bands would have more favourable characteristics for WAIC use. Furthermore, the outcome of these studies indicated no realistic possibility of aeronautical mobile applications sharing this band with other users. As a result, WRC-12 modified the 37 – 38 GHz mobile allocation to exclude aeronautical mobile. Although the ICAO position was to support the use of technical protection limits to protect other services rather than excluding the band from aeronautical mobile, this outcome is not perceived as a substantive loss of aviation spectrum.

**9 Agenda Item 1.14: To consider requirements for new applications in the radiolocation service and review allocations or regulatory provisions for implementation of the radiolocation service in the range 30 - 300 MHz, in accordance with Resolution 611 (WRC-07).**

9.1 Under this agenda item, WRC-12 made an additional allocation to the Radiolocation service in the frequency band 154 – 156 MHz, by footnote. This frequency band is used by the fixed and mobile services, except aeronautical mobile. Aviation is not affected by this allocation.

**10 Agenda Item 1.15: To consider possible allocations in the range 3 - 50 MHz to the radiolocation service for oceanographic radar applications, taking into account the results of ITU-R studies, in accordance with Resolution 612 (WRC-07).**

10.1 WRC-12 allocated certain frequency ranges in the band 3 – 50 MHz for the use of oceanographic radars, on a secondary basis, allowing this technology to be used in a uniform manner, while not interfering with existing fixed and mobile services in those frequency ranges. The frequency ranges allocated are not used by the AM(R)S, hence there is no impact on aviation by these new allocations.

**11 Agenda Item 1.19: To consider regulatory measures and their relevance, in order to enable the introduction of software-defined radio and cognitive radio systems, based on the results of ITU-R studies, in accordance with Resolution 956 (WRC-07).**

11.1 The ICAO position was one of concern, that the new technologies, software-defined radio (SDR) and cognitive radio systems (CRS) may cause undue interference to other users, if appropriate regulatory measures were not taken. SDR is a radio using software as building blocks rather than hardware, and could potentially be modified with relatively little effort, to work outside its intended operational parameters. CRS operate by automatically adapting their transmission or reception parameters to communicate efficiently, avoiding interference with licensed or unlicensed users. For this technology to work in practice, CRS need to be able to detect all transmitters. Many aeronautical systems however are based on ground based transmitters providing service to airborne receivers. In such a case it is very possible for a cognitive radio to be beyond the line-of-sight of the transmitter, while still being within the line-of-sight of the airborne receiver, resulting in interference to that receiver.

11.2 The conference was of the firm view that SDR is a technology and not a service. Hence the conference did not consider any changes to the Radio Regulations to support the introduction of SDR. It is expected that national type approvals and licensing conditions for transmitters will cover this issue adequately.

11.3 While being of a similar view about CRS, the conference developed a new Recommendation **COM6/1** on the deployment and use of cognitive radio systems. This Recommendation asks administrations to actively participate in ITU-R studies on the implementation of CRS systems, as described in Resolution **ITU-R 58**, developed at the Radiocommunication Assembly, 16-20 January 2012 (RA-12).

11.4 These results satisfactorily cover the concerns addressed in the ICAO position.

**12 Agenda Item 1.21: To consider a primary allocation to the radiolocation service in the band 15.4 - 15.7 GHz, taking into account the results of ITU-R studies, in accordance with Resolution 614 (WRC-07).**

12.1 The frequency band 15.4 – 15.7 GHz is used by a variety of civil and military radionavigation and radar systems, including weather radars and airport surface detection equipment (ASDE) for operational control of aircraft and ground vehicle movements at airports.

12.2 The results of ITU-R studies in preparation for WRC-12 indicated that the addition of an allocation to the Radiolocation service to this frequency band was feasible, given that existing services were protected with adequate separation distances.

12.3 The conference allocated the frequency band 15.4 – 15.7 GHz to the radiolocation service on a primary basis, shared with the existing allocation to the aeronautical radionavigation, as well as fixed satellite service in portions of the band. This new allocation to the radiolocation service fully protects the aeronautical radionavigation service, as it is not to cause harmful interference to, or claim protection from, stations operating in the aeronautical radionavigation service. This result is fully in line with the ICAO position.

**13 Agenda Item 1.22: To examine the effect of emissions from short-range devices on radiocommunication services, in accordance with Resolution 953 (WRC-07).**

13.1 Short range devices (SRD) are very low power emitters used for a variety of applications, such as radio frequency identification (RFID) tags. SRDs normally operate on a license exempt basis, and per definition should not interfere with other spectrum users. However, the conclusion of ITU studies is that without constraints, SRDs have the potential to cause harmful interference.

13.2 The view of the conference was that while the decision on frequency bands for use by SRDs is a national matter, there would be significant advantages in international harmonizing of band usage. ITU-R Resolution **54-1**, agreed during the RA-12 in the week prior to the WRC-12, assigns further studies on this issue to the ITU-R. No frequency bands were allocated to SRD. This outcome satisfactorily covers the concerns addressed in the ICAO position.

**14 Agenda Item 1.23: To consider an allocation of about 15 kHz in parts of the band 415 - 526.5 kHz to the amateur service on a secondary basis, taking into account the need to protect existing services.**

14.1 Aeronautical non-directional beacons (NDB) mainly operate in the frequency band up to 435 kHz in ITU Region 1 and 415 kHz in Regions 2 and 3. Above these frequencies and within the frequency band addressed under this agenda item, aeronautical radionavigation has a secondary allocation. Whilst the long-term goal is to remove NDB from use, this is unlikely to be achieved in the near future. However, NDB operations are on a slow demise, no growth in NDB use is foreseen.

14.2 While upgrading the aeronautical radionavigation service to a primary allocation in a number of countries, the amateur service was given a secondary allocation in the frequency band 472 – 479 kHz. The amateur service shall not transmit more than 5W EIRP in this frequency allocation, and not more than 1W EIRP if closer than 800km to the borders of certain concerned countries. Certain concerned countries do not allow the amateur service within their borders.

14.3 This allocation is in line with the ICAO position. The allocation of this new secondary allocation to the amateur service fully protects the current and projected NDB use.

**15 Agenda Item 1.25: To consider possible additional allocations to the mobile-satellite service, in accordance with Resolution 231 (WRC-07).**

15.1 Under this agenda item, the mobile satellite service scrutinized possible sharing with services in the frequency range 4 – 16 GHz, including a number of aeronautical bands. Despite considerable efforts made by the proponents of this agenda item, in the end the conference did not agree to any modifications to the Radio Regulations. The ICAO Position, to oppose any allocation which would adversely affect the interests of aviation, is fully covered by this outcome.

**16 Agenda Item 4: In accordance with Resolution 95 (Rev. WRC-03), to review the resolutions and recommendations of previous conferences with a view of possible revision, replacement or abrogation.**

16.1 The following Resolutions were addressed in a manner different from the ICAO Position:

16.1.1 Resolution **18** relates to the procedure for identifying and announcing the position of ships and aircraft of States which are not party to an armed conflict. A minor update was made to this Resolution, not affecting aviation.

16.1.2 Resolution **27** addresses the application of incorporation by reference in the Radio Regulations. Minor updates were made to this Resolution, mainly to clarify its application. This does not affect aviation.

16.1.3 Resolution **63** addresses the protection of radiocommunication services against interference caused by radiation from industrial, scientific and medical (ISM) equipment. Updates were made to this Resolution to better protect other users of the spectrum against ISM equipment. These updates do not negatively affect aviation.

16.1.4 Resolution **114** addresses the compatibility between the ARNS and the FSS, limited to feeder links of the non-geostationary mobile-satellite systems in the mobile-satellite service in the frequency band 5 091 – 5 150 MHz. An editorial update was made to this resolution to reflect a similar editorial update made to footnote No. **5.444**, exchanging the word “precedence” with “priority”.

16.1.5 Resolution **205** addresses the protection of systems operating in the mobile-satellite service in the band 406 – 406.1 MHz, limited to the use of low-power satellite emergency position-indicating radiobeacons (EPIRBs). Modifications to this Resolution address interference concerns from



adjacent frequency band users, and are aimed at improving/defending the continued use of EPIRBs in this frequency band.

16.1.6 Resolution **225** addresses the study of additional frequency bands for the satellite component of IMT. Some minor changes were made to this resolution, describing the use of the frequency bands 2 500 – 2 520 and 2 670 – 2 690 MHz as being limited to Region 3. Neither of these bands is used by aviation.

16.1.7 Resolution **418** addresses the use of the band 5 091 – 5 250 MHz by the aeronautical mobile service for telemetry applications. This Resolution was modified to reflect the deletion of Resolution 419. This has no negative effect on aviation.

16.1.8 Resolution **419** addressed the use of the band 5 091 – 5 150 MHz by the aeronautical mobile service for aeronautical security (AS) applications. Consequential to the deletion of the AS from footnote No. **5.444B**, this Resolution has now been deleted. This is in line with the ICAO position as it improves access to the aeronautical air/ground surface AM(R)S in this frequency band, see discussion on agenda item 1.4.

16.1.9 Resolution **644** addresses telecommunication resources for disaster mitigation and relief operations. This Resolution was updated to accurately reflect dated references. Updates are in line with the ICAO Position.

16.1.10 Resolution **748** addresses compatibility between the aeronautical mobile (R) Service and the fixed satellite service (Earth-to-space) in the band 5 091 - 5 150 MHz. This Resolution was modified to reflect the deletion of Resolution **419**. This has no negative effect on aviation.

16.1.11 Resolution **953** addressed protection of radiocommunication services from emissions by short range devices. This Resolution defined the problem statement to be addressed under agenda item 1.22 of WRC-12 and was suppressed in line with the outcome of the conference. RA-12 developed Resolution ITU-R **51-1** to address continuing studies of this subject within the ITU-R. This outcome satisfactorily covers the concerns addressed in the ICAO position.

16.1.12 Resolution **956** addressed regulatory measures and their relevance to enable the introduction of software-defined radio (SDR) and cognitive radio systems (CRS). This Resolution described the problem statement to be addressed under agenda item 1.19 of WRC-12, and was suppressed in line with the outcome of the conference. ITU-R Resolution **58-1** as agreed by RA-12 and ITU Recommendation **Com6/1** describe further studies to be performed on the subject of CRS. This outcome satisfactorily covers the concerns addressed in the ICAO position.

**17 Agenda Item 8.2: To recommend to the Council items for inclusion in the agenda for the next WRC and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, taking into account Resolution 806 (WRC-07).**

17.1 Wireless avionics intra-communications (WAIC) systems.

17.1.1 In line with the ICAO position, the WRC approved a new Resolution, to consider regulatory actions, including allocations, to support WAIC, and a new supporting agenda item at WRC-15.

17.1.2 The aerospace industry is developing new commercial aircraft to provide airlines and the flying public with more cost-efficient and environmentally friendly air transportation while maintaining required levels of safety and reliability. One important means of accomplishing these aims is to reduce overall aircraft weight, e.g. by reducing wiring, while providing multiple and redundant methods to transmit safety-related information within and on an aircraft. The utilization of wireless technologies may accomplish these goals while providing environmental benefits such as reduction of carbon footprints as well as cost savings to manufacturers and operators.

17.1.3 WAIC systems are envisaged to consist of point-to-point radio communications between transmitters and receivers installed on a single aircraft, the transmitters and receivers being integrated with the aircraft. In all cases, communication is part of a closed, exclusive network required for aircraft operation. WAIC systems will not provide air-to-ground or air-to-air communications. WAIC systems will be limited to safety and regularity-of-flight related applications.

## 17.2 Fixed Satellite Service spectrum for Unmanned Aircraft Systems

17.2.1 WRC-12 approved ITU-R studies to identify technical, regulatory and operational recommendations to enable safe use of FSS spectrum by UAS, and an agenda item for WRC-15 was agreed; to consider, based on the result of the ITU-R studies, the possible regulatory actions to support the use of FSS frequency bands for provision of UAS C<sup>3</sup> links, while ensuring the safe operation of UAS C<sup>3</sup> links, consistent with the provision of a safety service, making reference to No. **4.10**. ICAO was invited to participate in the ITU-R studies. See also discussion on Agenda Item 1.3 in this Appendix.

## 17.3 VSAT issues

17.3.1 The WRC approved a new Resolution, addressing the support of VSAT communications in the 3.4 – 4.2 GHz band (C-band) in the AFI region. The result originated from a proposal presented by the ATU in response to concerns expressed by African civil aviation entities, and coordinated by the ICAO AFI Regional Offices.

17.3.2 The concerns were related to the increasing demand from mobile system operators and other parties for access to the bands used by civil aviation VSAT communications in the region. Such VSAT communications are typically employed to replace or complement terrestrial communication infrastructure where it is lacking or inadequate. Applications include ground/ground point-to-point connectivity for ATC to ATC center communications as well as for ground/air communications (extended VHF coverage). The C-band is the most appropriate band for this purpose in the tropical regions due to excessive rain attenuation in higher frequency bands. The introduction of new non-aeronautical systems in the bands, such as BWA and IMT systems, could potentially threaten the continued availability of VSAT frequencies for civil aviation use.

17.3.3 The Resolution approved by the WRC is intended to address those concerns. It calls for ITU-R studies on technical and regulatory measures in the region to support the existing and future aeronautical and meteorological use of VSAT in the C-band. While there is no specific agenda item at WRC-15 for this issue, the Resolution calls for a review of the results of the studies and an action by WRC-15 as appropriate. The results of the studies will be reported to the WRC-15 through the report of the Director of the ITU Radiocommunication Bureau.

17.4 The conference agreed to include the following items of interest to aviation on the draft agenda for the WRC-15:

- 1.1** to consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for International Mobile

Telecommunications (IMT) and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications, in accordance with Resolution **COM6/8 (WRC-12)**;

**1.3** to review and revise Resolution **646 (Rev.WRC-12)** for broadband public protection and disaster relief (PPDR), in accordance with Resolution **COM6/11 (WRC-12)**;

**1.4** to consider possible new allocation to the amateur service on a secondary basis within the band 5 250-5 450 kHz in accordance with Resolution **COM6/12 (WRC-12)**;

**1.5** to consider the use of frequency bands allocated to the fixed-satellite service not subject to Appendices **30, 30A** and **30B** for the control and non-payload communications of unmanned aircraft systems (UAS) in non-segregated airspaces, in accordance with Resolution **COM6/13 (WRC-12)**;

**1.6** to consider possible additional primary allocations:

**1.6.1** to the fixed-satellite service (Earth-to-space and space-to-Earth) of 250 MHz in the range between 10 GHz and 17 GHz in Region 1;

**1.6.2** to the fixed-satellite service (Earth-to-space) of 250 MHz in Region 2 and 300 MHz in Region 3 within the range 13-17 GHz;

and review the regulatory provisions on the current allocations to the fixed-satellite service within each range, taking into account the results of ITU-R studies, in accordance with Resolutions **COM6/4 (WRC-12)** and **COM6/5 (WRC-12)**, respectively;

**1.7** to review the use of the band 5 091-5 150 MHz by the fixed-satellite service (Earth-to-space) (limited to feeder links of the non-geostationary mobile-satellite systems in the mobile-satellite service) in accordance with Resolution **114 (Rev.WRC-12)**;

**1.12** to consider an extension of the current worldwide allocation to the Earth exploration-satellite (active) service in the frequency band 9 300-9 900 MHz by up to 600 MHz within the frequency bands 8 700-9 300 MHz and/or 9 900-10 500 MHz, in accordance with Resolution **COM6/18 (WRC-12)**;

**1.14** to consider the feasibility of achieving a continuous reference time-scale, whether by the modification of coordinated universal time (UTC) or some other method, and take appropriate action, in accordance with Resolution **COM6/20 (WRC-12)**;

**1.16** to consider regulatory provisions and spectrum allocations to enable possible new Automatic Identification System (AIS) technology applications and possible new applications to improve maritime radiocommunication in accordance with Resolution **COM6/21 (WRC-12)**;

**1.17** to consider possible spectrum requirements and regulatory actions, including appropriate aeronautical allocations, to support wireless avionics intra-communications (WAIC), in accordance with Resolution **COM6/22 (WRC-12)**;

**2** to examine the revised ITU-R Recommendations incorporated by reference in the Radio Regulations communicated by the Radiocommunication Assembly, in accordance with Resolution **28 (Rev.WRC-03)**, and to decide whether or not to update the corresponding references in the Radio Regulations, in accordance with the principles contained in Annex 1 to Resolution **27 (Rev.WRC-12)**;

**4** in accordance with Resolution **95 (Rev.WRC-07)**, to review the resolutions and recommendations of previous conferences with a view to their possible revision, replacement or abrogation;

**8** to consider and take appropriate action on requests from administrations to delete their country footnotes or to have their country name deleted from footnotes, if no longer required, taking into account Resolution **26 (Rev.WRC-07)**;

**9** to consider and approve the Report of the Director of the Radiocommunication Bureau, in accordance with Article 7 of the Convention:

**9.1** on the activities of the Radiocommunication Sector since WRC-12;

**9.2** on any difficulties or inconsistencies encountered in the application of the Radio Regulations; and

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