INTERNATIONAL CIVIL AVIATION ORGANIZATION

FREQUENCY MANAGEMENT MEETING
(Dakar, Senegal, 1-2 October 2009)

REPORT

Prepared by: ICAO Eastern and Southern African Office

The Frequency Management Meeting is as a result of the AFI Planning and Implementation Regional Group (APIRG), Conclusion 16/32.

Its Reports are therefore submitted to APIRG through the CNS Sub-Group for review and action.

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PART I – HISTORY OF THE MEETING

INTRODUCTION

1.1 The Frequency Management Meeting was convened pursuant to APIRG/16 Meeting Conclusion 16/32 held in Rubavu, Rwanda, 19-23 November 2007.The meeting took place after the AFI Frequency Workshop 28 -30 September 2009.

1.3 The meeting nominated Mr. Patrick Jean Randrianasolo of ASECNA as the Rapporteur of the Group. The meeting expressed the need for the rapporteur to participate in both ACP-WG-F meetings and ITU meeting in order to give feed back to the group on the activities of ACP-WG-F and ITU meetings. The meeting also appealed to ASECNA to participate in those meetings. He thanked the participants for the confidence given to him and ASECNA and appealed for their full cooperation to come up with the expected conclusions and decisions.

2. OFFICERS AND SECRETARIAT

2.1 Mrs. Mary Obeng, Regional Officer, Communications, Navigation and Surveillance (CNS) from the ICAO ESAF Office, Nairobi, and Mr. Robert Witzen Consultant and Mr. Vaughn Mailla Technical Officer CNS/AIRS from Headquarters Montreal, were the secretaries of the meeting.

3. ATTENDANCE

3.1 The meeting was attended by 21 participants from10 States, 2 International Organisations namely ASECNA and Roberts FIR. The list of participants is given at **Appendix A** to this report.

4. WORKING LANGUAGE

4.1 The meeting was conducted in the English language.

5. AGENDA

5.1 The following Agenda was adopted:

Agenda Item	Subject
1	Election of Rapporteur for the group and review of the Terms of Reference
2	Introduction of the Hand book on Radio Frequency Spectrum Requirements for Civil Aviation Doc. 9718
3	Results of WRC-07
4	ICAO/ Position for WRC-12

Agenda Item	Subject
5	a) Developing Country's Positions for WRC-11 b) African Civil Aviation Position to ATU

5.2 The Draft list of /Conclusions and Decision made during the Frequency Management Workshop are formulated below**:**

DRAFT LIST OF CONCLUSIONS/DECISIONS

Number	Title	Action by	Target date
Conclusion 1/1	ICAO to analyze the current assignments in the ICAO frequency list 3 (VHF COM) in order to identify (potential harmful interference between COM assignments and submit these to the relevant ICAO contracting States for further consideration		
Conclusion 1/2	That from the planning criteria in COM list 3 references to a 50 NM buffer around area services be deleted as well as all references to SST operations.		
Conclusion 1/3	That the planning criteria for VDL, as contained in Appendix D of the workshop report be incorporated in COM list 3		
Conclusion 1/4	That COM list 3 should be updated with the identification of extended range facilities.		
Decision 1/1	That lack of participation of African States in ACP-WG-F meetings, and considering that ASECNA represent 13 African States, APIRG should consider the Group's nomination of ASECNA as its rapporteur		

PART II: REPORT ON AGENDA ITEMS

REPORT ON AGENDA ITEM 1: ELECTION OF RAPPORTEUR FOR THE GROUP AND REVIEW OF THE TERMS OF REFERENCE

1.1 The meeting was presented with the provisional Agenda for the Frequency Management Group Meeting. The provisional Agenda was adopted by the meeting.

1.2 The meeting expressed the need for close coordination with the ACP-WG-F and elected ASECNA to be the rapporteur of the Group. The meeting accordingly formulated the following Decision:

DECISION 1/1: COORDINATION WITH THE ACP-WG-F

That lack of participation of African States in ACP-WG-F meetings, and considering that ASECNA represent 13 African States, APIRG should consider the Group`s nomination of ASECNA as its rapporteur.

1.3 The terms of reference was amended as shown on **Appendix B** to this report.

REPORT ON AGENDA ITEM 2: INTRODUCTION OF THE HAND BOOK ON RADIO FREQUENCY SPECTRUM REQUIREMENTS FOR CIVIL AVIATION DOC. 9718

2.1 The meeting was presented with the Radio Frequency Spectrum handbook requirements for Civil Aviation (Doc 9718). The layout of the handbook was explained to the meeting. The procedure for developing ICAO position was also explained to the meeting. The preparation of ICAO to WRC meetings was also explained to the meeting. A brief discussion of chapter 7of Doc 9718 and how it could be used was presented to the meeting.

THE REPORT ON AGENDA ITEM 3: RESULTS OF WRC-07

3.1 The meeting was presented with the results of WRC-07 and its main effect on Civil Aviation. ICAO had the following six (6) major results:-

1a) Protection of the GNSS was improved due to the downgrading of fixed services operating in the band 1559 -1610 in 34 countries.

1b) By the end of 2009 the remaining 9 countries in Middle East and Africa will also downgrade their services in this band.

1c) All fixed services in this band will be terminated by 2015

2) 9GHz bands used by Aeronautical Radionavigation Service (ARNS) will now share their primary allocation with the radiolocation service, the Earth Exploration Satellite service (active) and Space Research service (active).

3) New Allocations- New allocations to the Aeronautical Mobile (route) Service (AM®S) in support of future requirements.

3a) The band 108 -117.975 MHz was allocated to the AMR(S) with some limitations to the band below 112MHz

3b) The band 960-1164 MHz was allocated to AM®S

3c) The band 5090-5150 MHz was allocated to the AM®S limited to surface application at Airports

3d) The bands 112-117.975 MHz and 960 -1164 MHz can not be used until sharing studies with existing systems have been completed. Regulatory provisions for these bands should be reviewed at the next WRC.

4 The band 5000 -5030 MHz should be studied with respect to the possibility of assigning it to the aeronautical Mobile ® Service limited to surface applications at Airports and that these studies should be reviewed at the next WRC.

5 **In Support of infrastructure development in underdeveloped regio**ns:- Recognizes that VSAT networks operating in the fixed satellite service can be used to carry aeronautical safety related traffic.

6 Acceptance **of an agenda item for WRC -12 to ensure a long term spectrum availability for the Aeronautical Mobile Satellite (route) Service**,

3.2 At WRC -97 the exclusive AMS®S allocation in the L – band were replaced by a generic allocation to the Mobile Satellite Service (MSS) priority and pre –emption was accorded to AMS®S through a foot note. Studies have identified that these method are insufficient to ensure long term spectrum availability to Aviation .This a agenda item allows

Aviation the opportunity to conduct technical operational, and regulatory studies of existing and future spectrum requirements for Aviation.

REPORT ON AGENDA ITEM 4: ICAO POSITION FOR WRC-12

4.1 **ICAO** Position to WRC-12 was presented to the meeting as shown at **appendix C** to this report.

REPORT ON AGENDA ITEM 5: a) DEVELOPING COUNTRY POSITIONS FOR WRC-11
b) AFRICAN CIVIL AVIATION POSITION TO ATU

5.1 ICAO position which has relevant effects to AFI States was discussed in order to help States develop their country's position and to be submitted to their State regulatory Bodies. The work programme will be developed and will be submitted to States before the next meeting.

APPENDIX A

The first meeting of AFI Frequency Management Group
(Dakar, Senegal, 1 - 2 October 2009)

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APPENDIX B

TERMS OF REFERENCE

FREQUENCY MANAGEMENT GROUP (FMG/11) TASK LIST

The FMG works within the terms of reference of the APIRG, on the matters related to the aviation radio frequency spectrum which included the following task list in co-ordination with other relevant international organizations.

Composition of AFI State: Angola, Algeria , Benin, Burkina Faso, Burundi , Botswana, Democratic Republic of Congo, Cameroun, Cape Verde, Comoros, Congo, Cote d'Ivoire, Djibouti, Egypt, Eritrea , Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Guinée Equatoriale, Kenya, Lesotho, Liberia, Libya, Mali, Mauritiania, Morocco, Niger, ,Nigeria, Seychelles, South Africa, Tunisia, RCA Rwanda, Sao Tome et Principe, Senegal, Sierra Leone, Somalia, Sudan, Swaziland , Tanzania, Tchad, Togo, Uganda, Zambia, Zimbabwe**,** France, Britain, Spain

	Ref.	Title/Brief description	Deliverables	Action by	Target Date
1	GPI 23	Aviation Spectrum requirements	Monitor and report to APIRG the status of available capacity in the various aviation bands	FMG	On-going
2	GPI 23	Frequency planning	Ensure the effective operation of the coordination process for the necessary agreement to make new frequency assignments	FMG	On-going
3	GPI 23	Coordinate with other agencies to protect aviation spectrum	Coordinate activities for the conduct of the 'block planning' process to provide for new frequency requirements which can only be satisfied by the relocation of existing assignments	FMG	On-going
4	GPI 23	Table COM 3 maintenance	Maintain a parallel draft TABLE COM 3 until merging with the ICAO table is completed with refinement of COM3 Tables at the next stage	Study Group, ICAO	On-going
5	GP1 23	Support for ICAO Position at WRC meeting	Ensure AFI States support ICAO at ITU meetings	FMG	On-going

APPENDIX C

Position for the World Radiocommunication Conference (WRC) 2011

20 August 2009

Objectives of ICAO Position

The ICAO Position) for the World Radiocommunication Conference 2011 (WRC 11) seeks to guarantee appropriate, secure radio spectrum to support current and planned CNS technologies and systems essential to meeting future growth in a safe and efficient manner.

Due to the safety and global harmonization of airline operations, allocations for such radio spectrum are made at WRC's, the outcomes of which have international treaty status. IATA believes such international coordination is essential and opposes the application of new, more market driven, regulatory measures to the spectrum aviation uses.

The broad objectives of the ICAO Position are:

- to maintain protection for the spectrum used for aeronautical radiocommunication and radionavigation systems required for current and future safety-of-life applications;
- to ensure that spectrum is available for new technologies;
- to ensure that the application of new regulatory measures does not impact on global operations or result in social or economic penalty to aviation without providing benefit.

IATA has 226 member airlines carrying 93% of world's international scheduled traffic (Available Seat Kilometres). In 2008, IATA's members carried 1.6 billion passengers (scheduled) of which 708 million were international and 42.3 million tones of freight of which 28 million tonnes were international

Introduction

Aviation uses globally harmonised spectrum allocations for communications, navigation and surveillance in order to provide a safe and efficient global transport system. Hence the spectrum used by aviation must be free from harmful interference to guarantee the integrity of its systems.

WRC 11 includes several issues of importance to aviation including:

- Spectrum requirements to support safe operation of unmanned aircraft systems.
- Further regulatory measures to facilitate introduction of new aeronautical mobile route services (AM(R)S
- Assurance of long-term spectrum availability and access to spectrum to meet requirements for aeronautical mobile satellite route services AMS(R)S while retaining the generic allocation to mobile-satellite unchanged.

The evolution of new CNS/ATM provisions is dependent upon the availability
of radio frequency spectrum that can support the high integrity and availability requirements associated with aeronautical safety systems, and demands special conditions to avoid harmful interference to these systems.. It is therefore essential to ensure that International radio regulation reflects this need.

Currently available spectrum for CNS/ATM systems may need to be supplemented with new allocations to enable the introduction of new systems in aviation while the requirements for spectrum for current systems are to be maintained until a future undetermined period.

Article 4.10 of the Radio Regulations states that ITU Member States recognize that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference. These factors need to be taken into consideration in the allocation, assignment and use of frequencies for aeronautical systems. In particular, the sharing of aeronautical safety services with other aeronautical services or non-aeronautical services must be considered with extreme care. Where sharing conditions cannot meet the above requirements, exclusive aeronautical allocations need to be secured to preserve the integrity of aeronautical services.

Radio spectrum underpins growth

The demand for access to airspace is continuously increasing. Total world airline scheduled passenger traffic in terms of passenger-kilometres is expected to grow at an average annual rate of 4.6 per cent up to the year 2025. with [Ref: ICAO *"Outlook for Air Transport to the Year 2025* (Circular 313)*"*].

The continuous increase in air traffic movements as well as the additional requirement for new and emerging applications such as unmanned aircraft systems are placing increased demands on both the aviation regulatory and air traffic management mechanisms. As a result the airspace is becoming more complex and the demand for frequency assignments and hence spectrum allocations is increasing. Whilst some of this demand can be met through the improved spectral efficiency of new radio systems, it is inevitable that existing allocations may need to be broadened or additional aviation spectrum allocations sought to meet this demand. Whilst it is expected that WRC-11 will be able to address a majority of these requirements, consideration by future conferences (WRC-15 and beyond) will be necessary to fully meet the future aviation requirements.

The Single European Sky implementation (SESAR) in Europe and Next Gen in the U.S are examples of next generation of air traffic systems as envisaged in the ICAO Global Air Navigation Plan. These will require new technology of air to air and air to ground communication, conflict management tools, sequencing and spacing tools, net centric information management, weather detection systems and will generate a more efficient air traffic system.

Appropriate available radio spectrum is essential to support these initiatives and realize the efficiency benefits of the programmes.

WRC Agenda Items Affecting Aeronautical Spectrum Allocations

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).

Discussion:

Allocations to the aeronautical services are generally made for all ITU Regions and normally on an exclusive basis. This supports the global interoperability of radiocommunication and radionavigation equipment used in civil aircraft necessary for safe and efficient flight. Certain States, however, add footnotes to the ITU allocations to indicate alternate usage of the subject band in different countries.

The use of country footnote allocations to non-aeronautical services in aeronautical bands is generally not desirable as such use may result in harmful interference to safety services. Furthermore, this practice generally leads to an inefficient use of available spectrum to aeronautical services, particularly when the radio systems sharing the band have differing technical characteristics. It also

may result in undesirable (sub)-regional variations with respect to the technical conditions under which the aeronautical allocations can be used. This can have a serious impact on the safety of aviation.

There is a general effort within ITU to delete such footnotes. The footnotes of concern to IATA members are:

No **5.72** that allows the use of some of the band for non-directional beacons (NDB), (255 - 526.5 kHz) by certain Norwegian fixed service stations. Use of NDBs in these bands is expected to continue for the foreseeable future. (NB 5.72 Norway)

Instrument landing system (ILS) uses 74.8 – 75.2 MHz for market beacons; 108 - 112 MHz for localizer and 328.6 - 335.4 MHz for glide path, and the VHF omni-directional radio range system (VOR) uses.108 - 117.975 MHz,. Footnote Nos. **5.181**, **5.197** and **5.259** allow for the introduction of the mobile service on a secondary basis and subject to agreement obtained under the Radio Regulations when these bands are no longer required for the aeronautical radionavigation service. The use of both ILS and VOR is expected to continue. In addition, the band 108 - 117.975 MHz is also allocated on a primary basis to the aeronautical mobile (R) service, limited to systems operating in accordance with recognized international aeronautical standards. As a result, access to these bands by the mobile service as proposed by Nos 5.181, 5.197 and 5.259 is not feasible, in particular since no acceptable sharing criteria that secure the protection of aeronautical systems have been established to date. (Egypt, Israel, Syria) (Pakistan, Syria) Egypt, Israel, Syria)

The band 1 215 - 1 300 MHz, is used by civil aviation for the provision of radionavigation services. Footnote No. **5.330** allocates the band in a number of countries to the fixed and mobile service. Given the receiver sensitivity of aeronautical uses of the band, IATA does not support the continued inclusion of an additional service through country footnotes. (Mid-East, Africa, India, Philippines)

The band 1 559 - 1 610 MHz is allocated, on a worldwide, primary basis, to the aeronautical radionavigation service (ARNS) and to the radionavigation-satellite service (RNSS). It supports elements of the global navigation satellite system i.e. GLONASS and GPS defined in ICAO SARPs and SARPs for the European Galileo System are under development. Nos. **5.362B** and **5.362C** allow the operation of the fixed service in some countries on a primary basis until 1 January 2010 and on a secondary basis until 1 January 2015. Harmful interference situations could arise leading to disruption to GNSS, affecting the safety of aircraft in flight. Thus the possibility of allowing fixed services use of this band until 2015 constitutes a severe and unacceptable constraint on the safe and effective use of GNSS in some areas of the world. It is, therefore, recommended that deletion of these allocations be effective from 2011. (Africa, Mid-East)

In the band 4 200 - 4 400 MHz, which is reserved for use by airborne radio altimeters, No. **5.439** allows the operation of the fixed service on a secondary basis in some countries. . Radio altimeters are a critical element in aircraft automatic landing systems and serve as sensor in ground proximity warning systems. Interference from the fixed service has the potential to affect the safety of all weather operations. Deletion of this footnote is recommended. (Libya, Iran)

ICAO Position 1.1:
To support the deletion of No **5.72** as access to these bands by the fixed service could create the potential for harmful interference to important radionavigation systems used by aircraft to navigate especially in the North Sea.

To support deletion of Nos. **5.181, 5.197** and **5.259**, as access to these bands by the mobile service is not feasible and could create the potential for harmful interference to important radionavigation systems used by aircraft at final approach and landing as well as the aeronautical mobile service introduced as a result of WRC-03 and 07.

To support deletion of No. **5.330** .as access to the band by the fixed and mobile services could potentially cause harmful interference to services used to support aircraft operations.

To support the deletion of Nos. **5.362B** and **5.362C** as of 2011 in order to remove harmful interference that can be caused by the fixed service to essential aeronautical radionavigation satellite functions in the band 1 559 - 1 610 MHz and to permit the full utilization of GNSS services to aircraft on a global basis.

To support deletion of No. **5.439** as a measure to protect safety critical operation of radio altimeters in the band4 200 - 4 400 MHz.

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.

Discussion:

There is a growing interest to review current spectrum management practices due to the trend towards convergence and the increasing use of digital technologies. It is therefore important that spectrum regulation also keeps pace with this trend, whilst ensuring the effective and efficient use of spectrum and ensuring that the operation of radio systems, especially those associated with safety of life, are free from harmful interference.

There is a view within a number of administrations that the current ITU processes for addressing additional spectrum needs are not flexible enough to meet the timescales demanded by industry. Resolution 951 seeks to review the way in which spectrum at the global level is managed with a view to adopting best practices to enhance the international regulatory framework to enable even greater efficiencies to be achieved in the way spectrum is assigned and used

Resolution 951 potentially offers aviation an opportunity to improve the flexibility with which spectrum internationally allocated to aeronautical services can be used as well as potentially tighten the regulatory provisions that ensure the protection of aviation systems. Conversely it also has the potential to reduce the protection afforded to aviation systems if the appropriate action is not taken to ensure that greater flexibility does not lead to greater risk of interference.

It is inappropriate for a State to use the argument of improving efficient spectrum use through the application of market methods to spectrum that has been given a specific international allocation. Such discussions and decisions need to be part of an international process (ITU defined).

An additional concern is that States or regions might unilaterally apply market methods such as pricing of aeronautical spectrum that could have safety and economic impacts without providing any benefit for aviation.

ICAO Position 1.2:

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 support the strengthening of regulatory provisions that enhance the protection of aviation systems.

Ensure that any other measures taken at WRC-11 with regard to Agenda Item 1.2 do not have an adverse impact on the protection of aeronautical systems or become financial burdens without any associated efficiency benefit for aviation.

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).

Discussion:

Unmanned aircraft systems (UAS) enable an Unmanned Aircraft (UA) to be piloted remotely over significant distances, as well as work at shorter ranges either within or out-of-sight of the remote pilot. UAS are meeting a number of national requirements; however their operations are currently limited to segregated airspace where separation from other users can be guaranteed.

Based on the potential for UASs to operate reliably, a number of commercial applications have been identified from emergency services to high altitude communications platforms. Additionally, applications have been identified where UAS technology could provide a commercial and/or safety benefit by replacing either the pilot or co-pilot onboard a manned aircraft. As a result, the deployment of UAS is expected to be significant, with a requirement for operation throughout the airspace structure. The current provisions of segregated airspace will therefore become impractical and hence a way must be found to allow these aircraft to integrate with the current airspace users in a safe and seamless manner.

In order to allow this technology to be developed further and maximise the potential benefits, UASs will need access to all airspace. Specifically it must be ensured that UAS

- integrate seamlessly into current ATC procedures
- maintain safey-of-flight levels.

UAS will require high integrity communications link(s) between the UA and remote control centres capable of relaying the necessary air traffic control (ATC) messages as well as flight critical aircraft information. In addition, sense and avoid (S&A) functions may require new sensors on the UA to provide situational awareness.

Initial estimates show that UAS will need 34 MHz for terrestrial links between the UA and the control station (CS) and 49 MHz for satellite links. UAS Spectrum for safety and regularity of flight, and in particular when the UAS operates in civil airspace, needs to be accommodated under an allocation to the aeronautical mobile route service (AM(R) S), aeronautical mobile satellite route service (AMS(R)S) or the aeronautical radionavigation service (ARNS), in order to receive the sufficient status and protection from harmful interference.

This agenda item therefore seeks to identify the spectrum requirements necessary to support the safe operation of UASs in current and future airspace structures.

Payload

The spectrum requirements to support the functionality of a payload are not critical to the safe operation of that aircraft. Therefore this agenda item, whilst recognizing the need for spectrum to support the payload, specifically excludes the allocation of payload spectrum at WRC-11.

Command and Control (C^2)

For UASs to safely integrate into non-segregated airspace, the remote pilot must be able to reliably monitor the status of the UA, pass control instructions to that UA, and also interact with the relevant air traffic controller. For UAs operating in a localized area this might be provided by a line-of-sight link. However, for UAs intending to operate beyond terrestrial radio line-of-sight may require the use of a combination of a terrestrial radio network and/or a satellite network.

Relay of Air Traffic Control (ATC) Communications

Safe operation of all aircraft depends on communication with ATC. If the pilot in command is not in the aircraft, this means for the ATC system operated today, that a voice channel has to be maintained to relay information from radio in the aircraft to the pilot on ground and back.

Sense and Avoid (S&A)

UA will need advanced techniques to detect and track nearby aircraft, terrain and obstacles to navigation in order to avoid these to the same degree as that achieved by manned aircraft. These advance techniques may require spectrum. The remote pilot will need to be aware of the environment within which the aircraft is operating and be able to identify the potential threats to the continued safe operation of the aircraft and take the relevant action. Given the scarcity of spectrum, care must be taken to ensure that the spectrum requirements identified to meet such applications are kept to a minimum.

It should be noted that the aeronautical future communications system might be able to prove some capacity to meet the requirements for both command and control including the relaying of ATC communications as well as sense and avoid applications. However, care must be taken when dimensioning both systems to avoid double accounting. A number of existing allocations to the aeronautical mobile satellite (route) service such as the allocation in the frequency range 5 000 - 5 150 MHz might provide some of the capacity required although issues with existing and planned systems will need to be resolved.

Existing AM(R)S, AMS(R)S and ARNS allocations should be examined to check whether they can provide suitable bandwidth without compromising non-UAS aeronautical systems before new allocations to these services are considered.

ICAO Position 1.3:

To support, based on the results of studies, 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, to ensure that any AM(R)S, AMS(R)S and ARNS allocations made for UAS command and control, ATC relay and sense and avoid in non-segregated airspace do not adversely affect existing aeronautical systems

To ensure safe and seamless integration of UA in non-segregated airspace, support the agreed requirement for terrestrial and satellite safety spectrum for the provision of ATC relay, command and control and sense and avoid.

To oppose any use of this agenda item to seek new spectrum allocations to meet payload requirements.

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).

Discussion:

As a result of WRC-07, allocations for (AM(R)S) were either made or modified to support the aeronautical future communications infrastructure. The Resolutions, in part, specify regulatory restrictions on the operation of AM(R)S in those bands, limiting such to "systems operating in accordance with international aeronautical (ICAO) standards".

WRC-11, Agenda Item 1.4 allows aviation the opportunity to complete the studies necessary and propose to WRC-11 any additional regulatory measures that might be required to facilitate the introduction of new AM(R)S systems in the subject bands 112 - 117.975 and 960 - 1 164 MHz. Additionally it allows aviation to seek a new allocation to AM(R)S in the frequency band 5 000 - 5 030 MHz for surface applications at airports provided that requirements for that system cannot be satisfied in the 5 091 - 5 150 MHz band that was also allocated, and that it is compatible with RNSS in the 5 000 - 5 030 MHz band and the radio astronomy service (RAS) in the adjacent 4 990 - 5 000 MHz band.

It should be noted that the existing AM(R)S allocation in the 5 000 - 5 030 MHz band may be considered for unmanned aircraft systems as part of WRC-11, Agenda Item 1.3 studies.

ICAO Position 1.4:

To support as required, based on the results of studies, the inclusion in the Radio Regulations of further regulatory measures that will facilitate the introduction of

- future AM(R)S systems in the band 112 - 117.975 MHz.
- future AM(R)S systems in the band 960 - 1 164 MHz.

If the spectrum requirements for surface applications at airports cannot be fully accommodated within the 5 091 - 5 150 MHz band, and based on the results of successful compatibility studies, support a new allocation to the AM(R)S in portions of the band 5 000 - 5 030 MHz subject to technical compatibility.

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).

Discussion:

Electronic News Gathering (ENG) supplements normal broadcasting services and is particularly important in the coverage of breaking news events, especially disasters or potential disasters affecting public safety.

There is increasing demand from audiences for the quantity and quality of coverage of sound and television ENG

This agenda item seeks to address the spectrum needs associated with such equipment. As the scope of this agenda item is not limited in terms of frequency bands within which studies can take place. aeronautical bands could be targeted, particularly the band 2.7 – 2.9 GHz (10cm radar band).

ICAO Position 1.5

To oppose any allocation in aeronautical bands.

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.

Discussion

AMS(R)S, as safety services, must have appropriate spectrum to guarantee system integrity and, should AMS(R)S operate in the same bands as Mobile Satellite Service (MSS), they must be protected.

One option that was studied by the ITU was prioritization and real-time pre-emptive access between different networks: the idea being that AMS(R)S would have priority in the spectrum bands when it needed such.

The study concluded, *inter alia*, that "prioritization and intersystem real-time *pre-emptive access between different networks* " is not practical and, without significant advance in technology, it is unlikely to be feasible for technical, operational and economical reasons. As a consequence such an approach cannot be used as an effective method to ensure long-term spectrum availability and protection for the AMS(R)S communications in these bands.

Although AMS(R)S does have priority versus other MSS, in practice the current application of the regulatory conditions governing such priority status does not satisfy spectrum requirements for AMS(R)S. This situation has raised some strong concerns for the civil aviation community.

WRC 11 Agenda Item 1.7 was adopted and Resolution 222 modified calling for:

a) studies on existing and future AMS(R)S spectrum requirements
b) an assessment of whether long-term AMS(R)S requirements can be met within existing allocations while retaining unchanged the generic MSS allocation in 1.525-1.559 and 11.626.5 – 1.660 MHz
c) completion of studies to determine the feasibility and practicality of technical or regulatory means, in order to ensure adequate access to AMS(R)S spectrum, other than the coordination process
d) studies of existing MSS allocations, or identification of new allocations "only for satisfying the requirements of the AMS(R)S if these requirements (referred to above in (a) and (b) cannot be met."

It is extremely important that the studies under Agenda Item 1.7 take into account the number of aircraft already equipped with standardized AMS(R)S technology, the life cycle of the AMS(R)S

systems spread over several decades and the technical and operational advantages of using the bands. Every effort should be made to ensure the long-term spectrum availability and access for AMS(R)S in these bands. If the long-term needs cannot be satisfied in those bands, then additional spectrum should be made available in other frequency bands.

It should be noted that the existing AMS(R)S service allocation in the 5 000-5 150 MHz band may be considered for Unmanned Aircraft Systems as part of WRC 11 A.I. 1.3

ICAO Position 1.7:

Taking into account the results of ITU-R studies, support further regulatory provisions to strengthen AMS(R))S access to the bands 1 545- 1 555 and 1 646.5 and 1 656.5 MHz.

Support long term requirements of AMS(R)S in these bands without placing undue constraints on the existing systems operating in accordance with the Radio Regulations, in order to take advantage of the existing usage of these frequency bands for AMS(R)S onboard aircraft.

If the studies identified by Res. **222** (**Rev. WRC-07**) indicate that the long term needs of AMS(R)S cannot be satisfied in the bands 1 545 - 1 555 MHz and 1 646.5 - 1 656.5 MHz, then support appropriate AMS(R)S allocations in other frequency bands through appropriate regulatory provisions.

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.

Discussion:

Within the frequency range 4 - 10 MHz, various frequency bands are allocated to AM(R)S and the allotment plan for these frequency bands is in Appendix 27 to the Radio Regulations. Aviation must be satisfied that the introduction by the maritime mobile service of any new digital techniques, and or changes to the table contained in Appendix 17 must not cause harmful interference to the aeronautical mobile (R) service.

ICAO Position 1.9:

Ensure that the introduction by the maritime mobile service of any new digital techniques, and or changes to the table contained in **Appendix 17**, does not cause harmful interference to the aeronautical mobile (R) service.

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).

Discussion:

The frequency band 37 - 38 GHz is currently allocated on a primary basis to the fixed, mobile, space research (space-to-Earth) and the fixed-satellite (space-to-Earth) services. Aeronautical mobile services, which are not excluded from the mobile service allocation, have the potential to cause interference to other systems operating in this band.

Aeronautical mobile service systems are currently neither deployed nor planned in the band 37-38 GHz. However, the aviation community would like to investigate the possibility to use the band for applications such as Wireless Avionic Intra-aircraft Communications (WAIC) and studies are being carried out. Such a system, as planned, could be implemented in a manner that will be fully compatible with other co-primary users of the band 37 - 38 GHz.

Therefore until those studies have shown that the band is not suitable for such a use IATA opposes excluding the aeronautical mobile service from the existing mobile service allocation in this band. Alternatively technical protection limits for existing co-primary systems should be introduced such that AMS can be developed in a manner that ensures compatibility with those existing systems.

ICAO Position 1.12:

To oppose excluding aeronautical use of the existing mobile service allocation in the band 37-38 GHz.

To support the use of technical protection limits to ensure that any future AMS system in the band 37 - 38 GHz will be compatible with other co-primary services.

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).

Discussion:

The radiolocation service operating in the VHF frequency range is coming under increased pressure from co-frequency fixed and mobile services. There is therefore a need to allocate spectrum within the frequency range 30 - 300 MHz that can accommodate radars displaced by the fixed and mobile service and also meet emerging requirements for greater resolution and range for various space object detection applications. This agenda item seeks to identify a suitable spectrum allocation in the frequency range 30 - 300 MHz that can support the needs of the radiolocation service.

Aviation operates a number of services in various bands within the frequency range 30 - 300 MHz including the instrument landing system (ILS), VHF omni-directional ranging (VOR) and air-ground communications. It is essential that these systems continue to be afforded the protection that they need to meet the demanding requirements of a safety of life service. In general, IATA does not support the shared use of spectrum between aeronautical safety services like ARNS, AM(R)S and AMS(R)S and other non-aeronautical services. The frequency bands listed below are already heavily used and will continue to be heavily used with the implementation of new aeronautical systems:

74.8 - 75.2 MHz	Marker beacons	
108 - 112 MHz	ILS localizers, GBAS, VOR	
112 - 117.975	VOR, GBAS, 117.975 - 137 MHz	Air-ground communications

In addition, due to the potential for high-powered transmitters in the radiolocation service, compatibility studies should consider adjacent aeronautical bands, as well as those that could be impacted by spurious and harmonic emissions.

ICAO Position 1.14:

Strongly oppose any change to the allocations in the 74.8 - 75.2 MHz or 108 - 137 MHz bands.

Ensure that any allocation in adjacent bands, made as a result of this agenda item, does not adversely affect the operation of existing and planned aeronautical systems.

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).

Discussion:

There is an increasing interest, on a global basis, in the operation of high-frequency oceanographic radars for the measurement of coastal sea surface conditions to support environmental, oceanographic, meteorological, climatologically, maritime and disaster mitigation operations. Currently there are no HF radiolocation allocations in which to operate such radars. This agenda seeks to address this shortfall by making a suitable allocation in the frequency band 3 - 50 MHz that can operate in harmony with current services within the stated frequency range.

Within the frequency range 3 - 50 MHz there are a number of allocations to the aeronautical mobile (R) service. These allocations are used to provide long range, over the horizon air traffic control, flight information and operational control services over the oceans and remote areas of the world. Any new allocation must ensure that the protection currently afforded to the AM(R)S is not compromised.

ICAO Position 1.15:

Ensure that any allocation made as a result of this agenda item does not adversely affect the operation of existing and planned aeronautical systems that operate in or adjacent to the frequency band 3 - 50 MHz.

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).

Discussion:

The advantages and disadvantages of software-defined and cognitive radio systems for aviation are discussed below:

Software-Defined Radios

Although aviation has a long history with multi-mode radios where several functions (e.g. ILS, DME, MLS, VOR) are combined in a single unit, a software-defined radio system is a radiocommunications system where components that have typically been implemented in hardware (i.e. mixers, filters, amplifiers, modulators/demodulators, detectors. etc.) are instead implemented using software on a computer or other embedded computing devices. This gives the capability for the radio to tune over a large frequency range and use any modulation scheme that can be implemented via software. Once produced a change of frequency or modulation scheme can be achieved through a simple software upload.

The flexibility these radios have means that they offer significant benefits to radio users as changes to the radio system can be achieved in a short space of time without having to purchase new hardware and is being studied as part of the flexible airborne architecture concept. However as a change in radio parameters can be achieved through a software upload, if the regulation of the use of these radios is not sufficiently robust they could be prone to misuse or computer viruses causing them to operate on frequencies that they were not originally intended to. It is therefore essential that the relevant measures are put in place to ensure that a software-defined radio cannot operate in an aeronautical band unless certified and installed by a qualified manufacturer and similarly that aeronautical software defined radios cannot unintentionally change characteristics from those for which they have been certified.

Cognitive Radio Systems

Cognitive radio systems are software-defined radios that operate by automatically changing their transmission or reception parameters to communicate efficiently avoiding interference with licensed or unlicensed users. This alteration of parameters is based on the active monitoring of several factors in the external and internal radio environment, such as radio frequency spectrum, user behaviour and network state. These systems rely on being able to detect all transmitters. Many aeronautical systems however are based on a ground-based transmitter providing a service to airborne receivers. In that case it is very possible for a cognitive radio to be beyond the line-of-sight of the transmitter but still within line-of-sight of the airborne receiver. This can result in interference to that receiver. It is therefore essential to ensure that the correct regulatory provisions are put in place to protect aeronautical services.

ICAO Position 1.19

To support the inclusion of regulatory measures in the Radio Regulations that preclude the operation of software defined radios in the bands allocated to aeronautical services unless they are intended and have been properly certified for use in an aeronautical application.

To support the inclusion of regulatory measures in the Radio Regulations that preclude the operation of cognitive radio systems in bands allocated to aeronautical services.

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).

Discussion:

Radars in the radiolocation service operate on a primary basis worldwide in the band 15.7 - 17.3 GHz. Emerging requirements for increased resolution and range accuracy necessitate wider emission bandwidths. This agenda item seeks to provide adequate spectrum for new radar systems by considering that the band 15.4 - 15.7 GHz be additionally allocated on a primary basis worldwide for the radiolocation service.

This band is used by aeronautical radar systems (ground and airborne) operating under the ARNS allocation. These systems cater for short-range surveillance and precision functions. In aviation, they find considerable application in precision monitoring, approach and surface detection functions as well as for airborne weather radar (AWR) systems where their shorter wavelength is suitable for the detection of storm clouds. One of the vital safety functions of AWR is to give warning of hazardous weather and ensure safe separation of aircraft from hazardous weather conditions. In most countries the carriage of AWR by aircraft is a mandatory requirement.

These aeronautical radars are to remain in service for many years into the future. The allocation of the radiolocation service in these bands needs to be based upon the results of studies in ITU-R, demonstrating that sharing with the radionavigation service on a primary basis is feasible. These studies should also result in ITU-R regulatory provisions and recommendations where necessary stipulating the conditions of the use of these bands by the radiolocation service. Any allocation to the radiolocation service on a primary basis should be considered with a condition indicating that the radiolocation service shall not cause harmful interference to nor claim protection from the (aeronautical) radionavigation service.

The band is also used for existing aircraft landing systems. Systems used for aircraft landing require special protection as the receivers are located onboard aircraft. Variable or temporary service requirements for aeronautical radionavigation service require that the ground stations of this service are relocatable and used at unspecified points. The existing sharing study between aeronautical raidionavigation service (ARNS) and satellite Earth stations shows that sharing with ARNS is very difficult leading to very large separations distances.

ICAO Position 1.21:

Accept the primary allocation of the radiolocation service in the band 15.4 - 15.7 GHz, on the basis of agreed studies showing compatibility, which take into account the protection of the use of this band by aviation.

Any allocation to the radiolocation service in this band shall be made with the condition that no harmful interference is caused to the aeronautical radionavigation service and that no protection is required to the radiolocation service from the aeronautical radionavigation service.

Agenda Item 1.22:

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

Discussion:

This agenda item seeks to study emissions from short-range devices (SRD)s, in particular radio frequency identification (RFID), inside and outside the frequency bands designated in the radio regulations for industrial, scientific and medical (ISM) applications to ensure adequate protection of radiocommunication services.

The effect of some short-range devices, such as ultra wideband technology, on existing radiocommunication systems has been studied by the ITU and various regional radio regulatory bodies. The conclusion of that study is that without constraints, those short-range devices have the potential to cause harmful interference to certain aviation systems.

SRDs normally operate on a licence exempt basis. Considering the mobility of aircraft and the large "viewing" area to which aircraft are exposed, together with the variability and uncertainty of a significant number of factors (such as SRD emitter density, signal characteristics, activity factors) necessary for the interference analysis of such devices, SRD devices should in general not be operated in frequency bands allocated to safety services. In those cases where such use cannot be avoided, administrations should take all steps necessary to ensure that SRD devices do not cause harmful interference to the reception by stations operating under a safety service allocation. A safety analysis would be required to assess the use being made of the safety system and demonstrate that the required levels of integrity, reliability, and availability are still maintained under all operational conditions.

Given the safety nature of the services provided by aeronautical systems, the broad scope of the agenda item, and based on studies currently conducted, it is essential that relevant regulatory provisions are included in the Radio Regulations to ensure that short-range devices cannot cause harmful interference to aeronautical systems.

ICAO Position 1.22:

Oppose operation of short-range devices in any bands allocated to aeronautical services.

Support the inclusion in the Radio Regulations of appropriate regulatory provisions, or the development of ITU-R Recommendations, to ensure that short-range devices, operating outside of aeronautical bands, do not cause harmful interference to aeronautical systems operating in allocated aeronautical bands.

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.

Discussion:

Aeronautical non-directional beacons (NDB) operate in parts of the band prescribed for study under this agenda item. Whilst the long-term goal may be to remove NDBs from use, this is unlikely to be achieved in the near future. It is therefore essential to ensure that whatever action is taken under this agenda item does not adversely affect NDB operations.

ICAO Position 1.23

To ensure that any allocation made to the amateur service cannot adversely affect the operation of aeronautical systems operating under allocations to the aeronautical radionavigation service.

Agenda Item 1.25

To consider possible additional allocations to the mobile-satellite service, in accordance with Resolution 231 (WRC-07).

Discussion:
This agenda item seeks to identify new allocations that can be made to the mobile satellite service in both the Earth-to-space and space-to-Earth directions with particular focus on the frequency range 4 - 16 GHz.

Report **M.2077** already indicates a shortfall of spectrum available for the satellite component of IMT, however studies need to be done to identify additional spectrum for MSS systems which are not part of the satellite component of IMT.

It should be noted that WRC-11, Agenda Item 1.7 will include studies for AMS(R)S spectrum requirements, including those which may be required as a result of Agenda Item 1.3. If those requirements for AMS(R)S cannot be satisfied with the existing 1 545 - 1 555 MHz and 1 646.5 - 1 656.5 MHz bands, then it authorizes the study of existing MSS allocations, or identification of new allocations, limited to satisfying those AMS(R)S requirements. As a result, it is not expected that AMS(R)S allocations will be addressed under this agenda item.

Care must be taken however to ensure any regulatory action taken as a part of this agenda item does not impact existing AMS(R)S allocations, or any new allocations that may come as a result of studies under Agenda Item 1.3 or 1.7.

Additionally, work within the ITU-R to address this agenda item has identified a number of frequency bands currently used by the radionavigation service for such systems as radio altimeters, MLS and radars. It is essential that these systems remain fully protected and that no allocations are made that adversely affect their operation.

ICAO Position1.25:

To oppose any allocation that would adversely affect the interests of aviation.