



International Civil Aviation Organization

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Agenda Item 8: Preparation for World Radiocommunication Conference 2003 (WRC-2003)

WORLD RADIOCOMMUNICATION CONFERENCE (WRC) 2003

(Presented by the United States of America)

SUMMARY

This document presents international radio spectrum issues of critical importance to international civil aviation and the work required to prepare for WRC-2003

1. Introduction

1.1 The work to protect and allocate spectrum for civil aviation was 100% successful at WRC-2000. All existing aviation spectrum was protected.

1.1.1 The effort to create an allocation that would allow the Mobile Satellite Service (MSS) to share the Global Navigation Satellite System (GNSS) band, 1559-1610 MHz, was defeated. Extensive analysis demonstrated that the planned MSS operations were not compatible with safe GNSS operations.

1.1.2 The 1164-1215 MHz band was allocated for Radionavigation Satellite Service (RNSS – the civil aviation system is called GNSS) to accommodate the GPS L5 and Galileo E5 frequencies. These actions have allowed the U.S. to progress its plans for GPS modernization to provide new capabilities from this global system. This band is also planned to be used by the planned European satellite navigation system, Galileo.

1.1.3 Other radio spectrum bands allocated to RNSS – (GNSS) include, 1260-1300 and 5000-5030 MHz that are planned for use by the European Galileo system.

1.1.4 Use of the GNSS band 1559-1610 MHz for fixed links in some countries resulted in the inability of some States to implement GNSS with its attendant benefits. At WRC-2000, some countries stated their intention to immediately cease using fixed links in this band. The remainder agreed on a transition plan to remove these fixed links by 2015.

1.1.5 The Conference adopted a resolution that strengthens aeronautical access to Aeronautical Mobile Satellite (Route) Service (AMS(R)S) radio spectrum. The

resolution calls for studies to determine the feasibility of inter-system preemption. Technical and procedural issues will be studied to implement inter-system preemption, if feasible, and considered at a future WRC. It should be noted that civil aviation must show greater use of this radio spectrum or risk its loss at a future WRC.

1.1.6 The Conference adopted a resolution to initiate an ITU “education” program to emphasize the importance of not using aeronautical HF frequencies except for aeronautical requirements, and to study possible technical and regulatory solutions to mitigate radio frequency interference. The review of aeronautical use of the HF band was put off until at least 2006.

1.1.7 IMT-2000 is the ITU designation of the future cellular telephone system (also sometimes called “third generation wireless” or “3G”. Many bands were identified for possible IMT-2000 implementation at WRC-2000. The 2700-2900 MHz band used by many States, including the U.S., for airport surveillance radar was identified as a potential band for IMT-2000. However, a study to determine the feasibility of using this band was put off until after 2006. Civil aviation will need to provide thorough analysis of use of this band to ensure that the needs of aeronautical surveillance can be met in the future.

2. Discussion

2.1 WRC-2003 will include several international radio spectrum issues of critical importance to international civil aviation.

2.1.1 There was extensive discussion at WRC-2000 with regard to the need for a pfd limit and the value needed to protect aeronautical radionavigation service (ARNS) systems (including Distance Measuring Equipment (DME)). Resolution 605 (WRC-2000) requested the ITU-R to study the technical, operational, and regulatory aspects of compatibility between RNSS and ARNS in the band 960-1 215 MHz, including an assessment of the need for an aggregate pfd limit. If such a need exists, the ITU-R was requested to revise, if necessary the provisional pfd limit given in S5.328A concerning the operation of RNSS (space-to-Earth) systems in the frequency band 1 164 – 1 215 MHz. All full discussion of the U.S. approach to satisfy these requirements at WRC-2003 can be found in attachment 1, U.S. Draft Proposal for Resolution 605.

2.1.2 WRC-2000 agreed to additional allocations to the radionavigation-satellite service (RNSS) (space-to-Earth) in the 1 260-1 300 MHz band making the entire 1 215-1 300 MHz band available for RNSS. This band was also allocated to the RNSS (space-to-space). The band 1 240-1 300 MHz is also allocated on a co-primary basis to radiolocation and radionavigation services and is used for long-range primary radar systems. Studies were conducted pursuant to the provisions of Resolution **606 (WRC-2000)**. Among other things, Resolution **606 (WRC-2000)** called for studies on “the need for a power flux-density limit concerning the operation RNSS (space-to-Earth) systems in the frequency band 1 215–1 300 MHz in order to ensure that the radionavigation-satellite service (space-to-Earth) will not cause harmful interference to the radionavigation and radiolocation services.” Also in Resolution **606 (WRC-2000)**, WRC-2000 resolved that no additional constraints are to be placed on RNSS systems operating in the 1 215-

1 260 MHz band. All full discussion of the U.S. approach to satisfy these requirements at WRC-2003 can be found in attachment 2, U.S. Draft Proposal for Resolution 606.

2.1.3

An aviation requirement has emerged for the transmission of differential correction (augmentation) data for the Global Navigation Satellite System (GNSS), to be used by aircraft receivers to satisfy the stringent accuracy and integrity requirements for GNSS applications. The new ground-based augmentation systems (GBAS) are planned to operate in the band 108-117.975 MHz (initially, 112-117.975 MHz), which is currently used by Instrument Landing Systems (ILS) and VHF Omni-directional Ranging (VOR) systems. The band is currently allocated to the aeronautical radionavigation service. It has been argued that GBAS does not fall within the definition of a radionavigation service (i.e., using the property of the propagation characteristics of radio waves) and that an amendment to the allocation would therefore need to be made to allow for the transmission of GNSS augmentation data. ICAO is developing compatibility and frequency planning criteria between the VOR/ILS, and the new service. GBAS receiver performance will be compatible with FM broadcast services in the band 87.5-108 MHz, and compatibility will be assured without imposing further restrictions on broadcast stations. The U.S. is proposing a footnote in the Radio Regulations that will permit the use of the band 108-117.975 MHz, on a worldwide basis, for the transmission of radionavigation satellite differential correction signals by an international aeronautical standard ground-based system. The use of GBAS will increase the accuracy of satellite radionavigation systems and conform to the requirements for precision landing.

3. Conclusion

3.1 States are encouraged to participate in ICAO activities, such as the Aeronautical Mobile Communications Panel Working Group F, which are developing the ICAO position for WRC-2003.

United States of America
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE
Proposal for Resolution 605

Agenda Item 1.15a: to review the results of studies concerning the radionavigation-satellite service in accordance with Resolutions **604 (WRC-2000)**, **605 (WRC-2000)** and **606 (WRC-2000)**;

Background Information: WRC-2000 introduced new allocations in the band 1 164-1 215 MHz for use by the radionavigation-satellite service (RNSS) (space-to-space) and (space-to-Earth) with a provisional aggregate power-flux-density (pfd) limit of -115 dB (W/m²) in any 1 MHz band produced at the Earth's surface by all space stations within all RNSS systems and for all angles of arrival. It also stated in **S5.328A** of the Radio Regulations that the provisions of Resolution **605 (WRC-2000)** apply. There was extensive discussion at WRC-2000 with regard to the need for a pfd limit and the value needed to protect aeronautical radionavigation service (ARNS) systems (including Distance Measuring Equipment (DME)). Resolution **605 (WRC-2000)** requested the ITU-R to study the technical, operational, and regulatory aspects of compatibility between RNSS and ARNS in the band 9 60-1 215 MHz, including an assessment of the need for an aggregate pfd limit. If such a need exists, the ITU-R was requested to revise, if necessary the provisional pfd limit given in **S5.328A** concerning the operation of RNSS (space-to-Earth) systems in the frequency band 1 164 – 1 215 MHz.

The ITU-R has determined that ARNS systems require protection from the aggregate of emissions from RNSS (space-to-Earth) systems and networks that collectively exceed -116.8 dB (W/m²) in any 1 MHz produced at the Earth's surface. There is, however, no reliable way for the Radiocommunication Bureau (BR) to validate compliance by all RNSS systems with an aggregate pfd limit. Studies within the ITU-R reveal that there are a number of profound technical and regulatory reasons why establishment of the regulatory device of a permanent aggregate pfd limit on RNSS emissions in the 1 164-1 215 MHz band would fail to provide the protection to ARNS systems that is required and intended under **No. S5.328A** of the Radio Regulations. It would significantly and unduly constrain the development and implementation of RNSS systems in this band.

Addressing Resolution **605 (WRC-2000)**, the United States has a strong need for both use of the RNSS spectrum and the continued operation of ARNS systems in the 1 164-1 215 MHz band. Furthermore, the U.S. is committed to protecting current and future ARNS systems operating in the same band as RNSS from harmful interference. This protection needs to be provided without unnecessarily delaying or hindering the implementation and provision of RNSS (space-to-Earth).

Based on its studies and studies within the ITU, the U.S. has identified a preferred regulatory approach for achieving the meaningful protection of the ARNS without unduly constraining RNSS development and operation. This approach is based on elements of Method B and Method C of the CPM report. It mandates the provision of aggregate interference protection at the level identified in ITU-R studies, but commits enforcement of the requirement to those administrations that actually operate and actually intend to operate RNSS systems. The approach manages the total amount of interference caused by these systems through the collaborative agreement on the part of administrations proposing and operating the RNSS systems. In this manner, there is no additional regulatory burden for the BR (which will not be tasked to validate compliance with the protection criterion); there will be a need for coordination among RNSS operators (both formal in an Article **S9** sense and informal thereafter pursuant to the provisions of the proposed new resolution and associated provisions in the Radio Regulations); and neither ARNS systems nor RNSS operators are faced with artificial or insufficient regulations that could leave them exposed to interference or forced to make unnecessary adjustments that inhibit the efficient use of the orbital/spectrum resource. The approach also takes account of the Radio Regulations Board (RRB) concern about having multiple inconsistent regulations applicable to the same band.

Proposals:

USA/ /1
(MOD)

960-1 215 MHz

Allocation to services		
Region 1	Region 2	Region 3
960-1 215	AERONAUTICAL RADIONAVIGATION S5.328 MOD S5.328A	

Reasons: Consequential change.

USA/ /2
NOC

S5.328

Reasons: The current text is adequate.

USA/ /3
MOD

S5.328A *Additional allocation:* the band 1 164-1 215 MHz is also allocated to the radionavigation-satellite service (space-to-Earth) (space-to-space) on a primary basis. ~~The aggregate power flux density produced by all the space stations of all radionavigation satellite systems at the Earth's surface shall not exceed the provisional value of $-115 \text{ dB(W/m}^2\text{)}$ in any 1 MHz band for all angles of arrival. Stations in the radionavigation-satellite service (space-to-Earth) in the band 1 164-1 215 MHz shall not cause harmful interference to, nor claim protection from, stations of the aeronautical radionavigation service operate in accordance with the provisions of Resolution **RNSS (WRC-03) 605 (WRC-2000)** and shall not claim protection from stations in the aeronautical-radionavigation service. **No. 5.43A** does not apply. Use of the band 1 164-1 215 MHz by the radionavigation-satellite service (space-to-Earth) is subject to the application of the provisions of Nos. **S9.12**, **S9.12A**, and **S9.13**. The provisions of **No. S21.18** apply.~~

Reasons: The suppression of the second and modification of the third sentence reflect the incorporation into new Resolution **RNSS (WRC-03)** and associated Radio Regulations (see below) of the mechanisms for ensuring the protection of ARNS against harmful interference from RNSS (space-to-Earth) systems.

By making non-geostationary (non-GSO) RNSS (space-to-Earth) systems subject to Article **S9** coordination obligations with respect to each other and with geostationary (GSO) RNSS (space-to-Earth) systems (**Nos. S9.12** and **S9.12A**), and by making GSO RNSS (space-to-Earth) systems coordinate with non-GSO RNSS (space-to-Earth) systems under **No. S9.13**, the Radio Regulations will provide an early start on discussions between administrations operating or planning to operate RNSS (space-to-Earth) systems. This will help ensure that the objective of assuring compliance with the aggregate protection criterion for ARNS in new Resolution **RNSS (WRC-03)** (see below) is met. GSO RNSS systems are already obliged to coordinate with each other under **No. S9.7**.

Discussions between RNSS administrations, both during formal coordination and after, are critical to the success of the regulatory determination to commit to administrations the obligation to ensure that the aggregate protection criterion of the ARNS is satisfied. Thus, the new provision in new **No. S21.18** (see below) is specifically referenced.

USA/ /4
ADD

Section VI – Protection of aeronautical radionavigation service systems from aggregate emissions of space stations of radionavigation-satellite service (space-to-Earth) systems in the 1 164-1 215 MHz band

S21.18 § 7 Administrations operating or planning to operate radionavigation-satellite service (space-to-Earth) systems or networks in the 1 164-1 215 MHz frequency band, for which complete coordination or notification information, as appropriate, was received by the Bureau after 2 June 2000, shall, in accordance with *resolves* 2 of Resolution **RNSS (WRC-03)**, take all necessary steps to ensure that the actual aggregate interference into aeronautical radionavigation service systems caused by such RNSS systems or networks operating co-frequency in these frequency bands does not exceed the aggregate power level shown in *resolves* 1 Resolution **RNSS (WRC-03)**.

Reasons: Article **S21** of the Radio Regulations addresses sharing between terrestrial and space services in frequency bands above 1 GHz. Placement of this provision in a new Section **VI** of Article **S21** brings into the Radio Regulations the critical elements from new Resolution **RNSS (WRC-03)** (see proposal below) that make mandatory the collective obligation of administrations operating RNSS systems at 1 164-1 215 MHz to ensure that the aggregate protection criterion from *resolves* 1 of Resolution **RNSS** is not exceeded, as well as the requirement to reduce emissions if administrations operating ARNS systems identify excess emission levels.

USA/ /5
ADD

RESOLUTION RNSS (WRC-2003)

Protection of aeronautical radionavigation service systems from the aggregate power flux-density produced by radionavigation-satellite service (space-to-Earth) networks and systems in the 1 164-1 215 MHz frequency band

The World Radiocommunication Conference (Caracas, 2003),

considering

- a) that the band 960-1 215 MHz is allocated on a primary basis to the aeronautical radionavigation service (ARNS) in all Regions;
- b) that the band 1 164-1 215 MHz is also allocated on a primary basis to the radionavigation-satellite service (RNSS), subject to the condition in **No. S5.328A** that operation of RNSS systems shall be in accordance with this Resolution;
- c) that protection of the ARNS from harmful interference can be achieved if the value of the aggregate power flux-density (pfd) produced by all the space stations of all RNSS (space-to-Earth) systems in the band referred to in *considering* a) does not exceed the level of $-[XXX] \text{ dB(W/m}^2\text{)}$ in any 1 MHz band for all angles of arrival;
- d) that WRC-2000 adopted Resolution **605 (WRC-2000)** to provide for implementation of a provisional aggregate power flux-density limit during the period between WRC-2000 and WRC-2003, and requested ITU-R studies on the need for an aggregate pfd limit, and revision, if necessary, of the provisional pfd limit given in **No. S5.328A**;
- e) that only a limited number of RNSS systems are expected to be deployed in the 1 164-1 215 MHz band, and only a few of these systems at most would have overlapping frequencies;

- f) that ARNS systems can be protected without placing undue constraints on the development and operation of RNSS systems in this band;
- g) that to achieve the objectives in *considering* f), administrations operating RNSS systems will need to agree cooperatively to achieve the level of protection for ARNS systems that is stated in *considering* c);
- h) that it may be appropriate for representatives of administrations operating ARNS systems to be involved in determinations made pursuant to *considering* g);

resolves

- 1 that, in order to protect ARNS systems, administrations shall ensure, without validation by the Radiocommunication Bureau pursuant either to **No. S11.31** or **S9.35** of the Radio Regulations, that the aggregate pfd level produced by all space stations of all RNSS (space-to-Earth) systems at the Earth's surface does not exceed the level, $-[XXX] \text{ dB(W/m}^2\text{)}$ in any 1 MHz band for all angles of arrival;
- 2 that administrations operating or planning to operate in the 1 164-1 215 MHz frequency band RNSS (space-to-Earth) systems or networks for which complete coordination or notification information, as appropriate, was received by Radiocommunication Bureau after 2 June 2000, in collaboration, shall take all necessary steps, including by means of appropriate modifications to their systems or networks, to ensure that the aggregate interference into ARNS systems caused by such RNSS systems or networks operating co-frequency in these frequency bands does not exceed the level of the aggregate protection criterion given in *resolves* 1 above;
- 3 that administrations, in carrying out their obligations under *resolves* 1 and 2 above, shall take into account only those RNSS (space-to-Earth) systems with frequency assignments in the band 1 164-1 215 MHz that have met all of the milestones listed in the Annex to this Resolution;
- 4 that administrations shall communicate to the Bureau the results of any aggregate sharing determinations made in application of *resolves* 2 above, without regard to whether such determinations result in any modifications to the published characteristics of their respective systems or networks;
- 5 that administrations operating ARNS systems in the 1 164-1 215 MHz band should participate, as appropriate, in discussions and determinations relating to the resolves above,

invites the ITU-R

to continue to develop, as a matter of urgency a suitable methodology for calculating the aggregate pfd produced by all RNSS (space-to-Earth) systems operating or planning to operate co-frequency in the 1 164-1 215 MHz frequency band into ARNS systems, which may be used by administrations to determine whether the systems are in compliance with the aggregate pfd levels given in *resolves* 1 above.

ANNEX

Milestone Criteria for Application of Resolution RNSS

1. Submission of appropriate ITU Advance Publication, and Coordination or Notification documentation.
2. Entry into satellite manufacturing or procurement agreement:

The RNSS system or network operator should possess clear evidence of a binding agreement for the manufacture or procurement of its satellites. The agreement should identify the contract milestones leading to the completion of manufacture or procurement of satellites required for the service provision. The Notifying Administration is responsible for authenticating the evidence of agreement and providing such evidence to other interested administrations in furtherance of its obligations under this Resolution.

3. Entry into satellite launch agreement:

The RNSS system or network operator should possess clear evidence of a binding agreement to launch its satellites. The agreement should identify the launch date, launch site, and launch service provider. The Notifying Administration is responsible for authenticating the evidence of agreement and providing such evidence to other interested administrations in furtherance of its obligations under this Resolution.

Reasons: This resolution and annex, along with incorporating provisions in Articles S5 (MOD S5.328A) and S21 (ADD Section VI), provides the mechanism by which administrations operating or planning to operate RNSS systems, all of which also operate co-frequency ARNS systems, will undertake the responsibility for ensuring the protection of ARNS systems. The resolution recognizes that there is a need for discussions between and among administrations operating RNSS systems to ensure compliance with the obligation to protect ARNS systems, and that such discussions may involve administrations operating ARNS systems. Resolution **RNSS** thus provides a basis for managing the total aggregate interference caused to ARNS systems by real RNSS systems. *Note: The value $-XXX$ dB ($W/m^2/MHz$) used in Resolution **RNSS** remains to be determined within the ITU-R, and will be replaced with an appropriate numerical value following the conclusion of the May 2002 meeting of ITU-R Working Party 8D.*

USA/ /6
SUP

~~RESOLUTION 605 (WRC 2000)~~

Reasons: This resolution is no longer needed because of the changes made to S5.328A, the addition of Section VI to Article S21 and the addition of Resolution **RNSS**.

United States of America

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Proposal for Resolution 606

Agenda Item 1.15b: to review the results of studies concerning the radionavigation-satellite service in accordance with Resolutions **604 (WRC-2000)**, **605 (WRC-2000)** and **606 (WRC-2000)**;

Background Information: WRC-2000 agreed to additional allocations to the radionavigation-satellite service (RNSS) (space-to-Earth) in the 1 260-1 300 MHz band making the entire 1 215-1 300 MHz band available for RNSS. This band was also allocated to the RNSS (space-to-space). The band 1 240-1 300 MHz is also allocated on a co-primary basis to radiolocation and radionavigation services and is used for long-range primary radar systems. Studies were conducted pursuant to the provisions of Resolution **606 (WRC-2000)**. Among other things, Resolution **606 (WRC-2000)** called for studies on “the need for a power flux-density limit concerning the operation RNSS (space-to-Earth) systems in the frequency band 1 215–1 300 MHz in order to ensure that the radionavigation-satellite service (space-to-Earth) will not cause harmful interference to the radionavigation and radiolocation services.” Also in Resolution **606 (WRC-2000)**, WRC-2000 resolved that no additional constraints are to be placed on RNSS systems operating in the 1 215-1 260 MHz band.

The Global Positioning System (GPS), an RNSS system which operates on 1 227.6 MHz (24 MHz bandwidth). Currently, this signal is used for high precision GPS in high productivity applications, such as machine guidance in survey, construction, agriculture, and mining. This signal has been transmitted at its current power level since 1978 and there has been no reported harmful interference to other users of the band. This has been accomplished without the need for power flux-density (pfd) limits in the Radio Regulations (see also Recommendation ITU-R M.1088). There are large numbers of GPS receivers operating in the band 1 215-1 260 MHz.

It is noted that the GLONASS RNSS system has also operated successfully in the 1 215-1 260 MHz band for many years without causing harmful interference to other co-frequency systems. This is accomplished on the basis given in Recommendation ITU-R M.1317 and includes a signal of up to $-133 \text{ dB W/m}^2/\text{MHz}$. Operational experience with current GPS and GLONASS system characteristics in the 1 215-1 260 MHz band, has not led to any reports of harmful interference being caused to existing radar systems.

As RNSS system characteristics are expected to evolve and new systems are planned, analyses are being conducted to determine the impact of a more powerful RNSS (space-to-Earth) signal on radar systems in the 1 215-1 300 MHz band. Some administrations have planned RNSS systems that have a future requirement to produce a pfd level higher than $-133 \text{ dB (W/m}^2/\text{MHz)}$ in the 1 215-1 260 MHz band.

Users of radars in the band will be protected in accordance with the provision of **No. S5.329**.

Proposals:

1 215-1 240 MHz

Allocation to services		
Region 1	Region 2	Region 3
1 215-1 240	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) (MOD) S5.329 S5.329A SPACE RESEARCH (active) S5.330 S5.331 S5.332	
1 240-1 260	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) (MOD) S5.329 S5.329A SPACE RESEARCH (active) Amateur S5.330 S5.331 S5.332 S5.334 S5.335	
1 260-1 300	EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) (MOD)S5.329 S5.329A SPACE RESEARCH (active) Amateur S5.282 S5.330 S5.331 S5.334 S5.335 S5.335A	

Reasons: Noting **No. S5.329**, there is no need for a pfd limit to be imposed in 1 215-1 300 MHz band. Some administrations have successfully operated RNSS and radar systems in the 1 215-1 260 MHz band for more than 23 years with no reported harmful interference.

USA/ /2
MOD

S5.329 Use of the radionavigation-satellite service in the band 1 215-1 300 MHz shall be subject to the condition that no harmful interference is caused to, and no protection is claimed from, the radionavigation service authorized under No. **S5.331**. ~~See also Resolution 606 (WRC 2000).~~

Reasons: Consequential to the determination that there is no need for a pfd limit to be imposed in the 1 215-1 300 MHz band.

USA/ /3
SUP

~~RESOLUTION 606 (WRC 2000)~~

Reasons: Consequential to the determination that there is no need for a pfd limit to be imposed in the 1 215-1 300 MHz band.