International Civil Aviation Organization

SEVENTEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION/SURVEILLANCE SUB-GROUP (CNS SG/17) OF APANPIRG

Bangkok, Thailand, 13 – 17 May 2013

Agenda Item 8: Aeronautical electromagnetic spectrum utilization

3) Regional actions to protect against interference to air navigation system including GNSS (AN-Conf/12 Rec. 6/7 & 6/8 refers)

SPECTRUM MANAGEMENT – 12TH AIR NAVIGATION CONFERENCE OUTCOME

(Presented by the Secretariat)

SUMMARY

Issues related to spectrum management of the frequency band used for aeronautical applications were discussed in the 12th Air Navigation Conference under Agenda Items 1 and 6. This paper reviews the outcome of the Conference related to these issues and invites the meeting to review the recommendations made by the AN-Conf/12.

1. Introduction

1.1 12th Air Navigation Conference (AN-Conf/12) held in November 2012 made fifty-six recommendations covering a variety of air navigation subjects.

2. Discussion

2.1 Fifty-six recommendations developed by the Conference were reviewed by the Air Navigation Commission (ANC) on 28 January 2013 in its 192nd session, 5th Meeting. Air Navigation Commission's recommendations on the AN-Conf/12 report were presented to the Council in its 198th Session on 8 Feb 2013.

2.2 The subject spectrum management was dealt under *Agenda Item 1: Strategic Issues that Address the Challenge of integration, interoperability and harmonization of systems in support of the concept of "One Sky" for international civil aviation and Agenda Item 6.1 Implementation plans and methodologies*. A number of Working and Information Papers were presented to the Conference on the subjects related to spectrum management/interference and ionospheric/space weather effects.

2.3 European Union through its WP31 traced the history of frequency spectrum allocations since 1947 and noted that in the past civil aviation was able to defend its exclusive spectrum allocation primarily on safety ground, but lately economic considerations have taken away some of exclusivity. **Agreed WRC-15 Agenda Item list clearly indicates that aviation spectrum will continue to be targeted by those seeking new spectrum**. Spectrum has become a valuable and

scarce resource which Governments view as a growth-enabler as well as a source of income. The paper noted that there is a growing trend for Governments to seek to identify spectrum that can be released for commercial applications such as mobile communications, in order to promote growth and raise capital. Government spectrum holders such as military and aviation are seen as spectrum rich and are therefore being pressured to release part of their spectrum. A question was raised about the proposal to use market mechanism to change demand behavior for scarce spectrum, since this may compromise safety level of aviation operation. The Paper opined that aeronautical spectrum managers have to deliver following strategic objectives in order to meet the radio regulatory processes:

a) Timely availability and appropriate protection of adequate spectrum to create a sustainable environment for growth and technology development to support safety and operational effectiveness for current and future CNS systems and allow for the transition between present and next generation technologies;

b) Demonstrate efficient use of spectrum allocated through efficient frequency management and use of best practices;

c) Develop credible arguments to support aeronautical spectrum use; and

d) Minimize the impact of market mechanism on aviation.

2.3.1 The paper further proposed that in order to ensure the delivery of the strategic objectives identified above, it will be essential that aviation, as a global sector, works together to ensure that aviation has a spectrum strategy that:

a) Resources spectrum management activities appropriately;

b) Coordinates within and across regions on spectrum management activities to present consistent and robust rationale;

c) Ensure that appropriate protection criteria are defined for aeronautical systems; and

d) With CNS strategies, clearly define the rationale for the introduction of new technologies, particularly where there is a perception of duplication, and ensure that sunset clauses are defined to remove needless redundancies and obsolescence.

2.3.2 In conclusion, paper proposed that in the longer term aviation needs to work towards an air traffic management system that is reliant on minimum number of globally harmonized CNS systems with the appropriate level of availability and reliability needed to meet operational requirements. These should be reinforced by cohesive ATM and spectrum strategies.

2.3.3 Through Working Paper 101, CANSO described the global mechanism used for the allocation of radio frequency for various applications and stressed that various global plans (including the roadmaps adopted by the Conference) for their successful implementation need to have adequate radio spectrum available. Paper stressed on the additional requirement of maintaining legendry and the new systems simultaneously during transition period. CANSO was of the opinion that a strategy should be worked out to meet this requirement and this strategy should include:

a) continued access to protected spectrum for legacy systems;

b) access to protected spectrum to expand legacy systems when required;

c) access to protected spectrum for future systems in line with ASBU CNS roadmaps;

d) special protection requirements of aeronautical safety services from interference;

e) ensure efficient spectrum management both for future and legacy CNS systems; and

f) transition strategy from legacy to future system including frequency demand during transition.

The paper proposed a recommendation on aeronautical radio frequency spectrum needs to mitigate spectrum constraints.

2.3.4 Working Paper 21 presented by the Secretariat, noted that GNSS signals are vulnerable to intentional and unintentional sources of interference and to other effects and highlighted the benefits of using new and enhanced core GNSS constellations.

2.3.5 AN-Conf12 Committee to the Conference on Agenda Item 6, while discussing *Mitigating GNSS vulnerabilities* noted that the very low strength of GNSS signals received from the satellites makes GNSS vulnerable to interference and other effects that have the potential to affect multiple aircraft over a wide area. The sources of GNSS vulnerabilities include unintentional interference, intentional interference, effects of the ionosphere and solar activity (space weather) and others. The Conference was of the opinion that intentional interference to GNSS fell into the category of cyber security issues and developed following Recommendation:

Recommendation 2/3 - Security of air navigation systems

That, ICAO

a) Seek the support of States and stakeholders to complete its work in developing a robust, secure aeronautical telecommunication network; and

b) Establish as a matter of urgency, an appropriate mechanism including States and industry to evaluate the extent of the cyber security issues and develop a global air traffic management architecture taking care of cyber security issues.

2.3.6 Annex 17 – *Security – Safeguarding International Civil Aviation against Acts of Unlawful Interference*, Chapter 4, 4.9 also supports protection from intentional interference. Meeting considered a number of measures that can be used to reduce likelihood of GNSS signal getting disrupted, for example introduction of new constellations and frequencies for GNSS will significantly reduce the probability of loss of service caused by unintentional interference, by virtue of diversity of frequencies and increased number of satellites in view.

2.3.7 The meeting recognized that the primary means to reduce the likelihood of both intentional and unintentional interference is effective spectrum management. This involves creation of a strong regulatory framework controlling the allocation and use of spectrum in such a way as to secure protection of GNSS frequencies. At the national level, this is the responsibility of the radio

regulatory authorities in each State. At the international level, International Telecommunication Union (ITU) provides such a framework through its Radio Regulations. The meeting acknowledged that, even though the likelihood of GNSS signal disruption can be significantly reduced, disruption cannot be completely ruled out, and therefore ANSPs must be prepared to deal with potential loss of GNSS signals. This comprises of a risk assessment that will determine the residual likelihood of service outages and the impact of an outage in specific airspace, and the application of realistic and effective mitigation strategies to ensure the safety and regularity of air services and to discourage those seeking to disrupt operations. Some States were of the opinion that an alternative position, navigation and timing (PNT) strategy should be developed with the goal of maintaining air navigation services to the maximum extent possible in the event of a GNSS signal outage, by taking advantage of the current systems, and defining a realistic evolution path. On the basis of the discussions, following recommendations were developed by the Committee and adopted by the Conference:

Recommendation 6/7 – Assistance to States in mitigating global navigation satellite system vulnerability

That ICAO:

a) Continue technical evaluation of known threats to the global navigation satellite system, including space weather issues, and make the information available to States;

b) Compile and publish more detailed guidance for States to use in the assessment of global navigation satellite system vulnerabilities;

c) Develop a formal mechanism with the International Telecommunication Union and other appropriate UN bodies to address specific cases of harmful interference to the global navigation satellite system reported by States to ICAO; and

d) Assess the need for, and feasibility of, an alternate position, navigation and timing system.

Recommendation 6/8 – Planning for mitigation of global navigation satellite system vulnerabilities

That States:

a) Assess the likelihood and effects of global navigation satellite system vulnerabilities in their airspace and apply, as necessary, recognized and available mitigation methods;

b) Provide effective spectrum management and protection of global navigation satellite system (GNSS) frequencies to reduce the likelihood of unintentional interference or degradation of GNSS performance;

c) Report to ICAO cases of harmful interference to global navigation satellite system that may have an impact on international civil aviation operations;

d) Develop and enforce a strong regulatory framework governing the use of global navigation satellite system repeaters, pseudolites, spoofers and jammers;

e) Allow for realization of the full advantages of on-board mitigation techniques, particularly inertial navigation system; and

f) Where it is determined that terrestrial aids are needed as part of a mitigation strategy, give priority to retention of distance measuring equipment (DME) in support of inertial navigation system (INS)/DME or DME/DME area navigation, and of instrument landing system at selected runways.

2.4 Japan through Working Paper 111 (*Approach to Globally Harmonized GNSS Implementation – Ionospheric Threat and Space Weather Perspectives)* reminded the meeting about the significance of proper assessment of and measure against ionospheric issues and other space weather matters to support globally harmonized GNSS implementation, a core infrastructure requirement to enable performance-based navigation (PBN) operations, trajectory-based operation (TBO) and other advanced ATM improvements through the evolution of GNSS technology. The paper addressed ionospheric and space weather issues affecting GNSS implementation and operation over the envisaged timeframe of aviation system block upgrades (ASBUs) and suggested actions to complement those relating to GNSS vulnerabilities as proposed in WP/21 *"GNSS Implementation Issues".* Conference was reminded that though Multiple Frequency and Multiple Constellation (MF-MC) operation is expected to mitigate ionospheric effect, but these systems are expected in the second half of Block 1(2018-22) and first half of Block 2 (2023-27) and hence something needs to be done until MF-MC GNSS is available. The Paper expressed that GNSS should be developed and deployed with adequate assessment of the solar disturbance to the ionosphere without missing the once-in-ten year chance.

2.5 WP126 presented by South Africa expressed that whereas non-aviation users are sharing aviation bands, aviation also is sharing non-aviation frequency band for the provision of safety of life services. In Africa, VSAT technology has provided a platform in eliminating communication deficiencies between the neighboring States. It is also used to provide VHF, radar, DME and VOR links between remote sites and control units and there are plans to use same VSAT services for the data-link operations. Fixed satellite services (FSS) C-band is a non-aeronautical spectrum and hence is not protected to the same extent as the safety of life services are, although remote sites connected to VSAT network offer aviation industry with the safety of life services. In fact, several African countries reported interference on their VSAT ground stations, probably due to the fact that FSS band is allocated to mobile services also in many countries. South Africa was of the view that regulatory measures need to be taken to protect FSS C-band spectrum which is used to augment terrestrial communication network through the use of VSAT technology.

3. Action Required by the Meeting

3.1 The meeting is invited to note the outcome of 12th Air Navigation Conference on the issues related to interference over aeronautical band of frequencies and spectrum management. The meeting may also consider reviewing the recommendations made by the Conference.

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