International Civil Aviation Organization

Fourth Meeting of Spectrum Review Working Group (SRWG/4)

Bangkok, Thailand, 9 - 10 June 2020

Agenda Item 5: Next meeting and any other business

UPDATE ON SPACE-BASED VHF VOICE COMMUNICATIONS SERVICE

(Presented by Singapore)

SUMMARY

The space-based VHF concept was first endorsed in 2018 by ICAO Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) and supported by ICAO Communications and Frequency Spectrum Management Panels. Singapore has since embarked on design studies with various communications vendors and satellites service providers. This paper updates the meeting on Singapore's technical studies and encourages States and Administrations to support the potential development of space-based VHF.

1. BACKGROUND

1.1 The frequency for space-based Automatic Dependent Surveillance – Broadcast (ADS-B) services was allocated at the World Radiocommunication Conference 2015 (WRC-15). Following the frequency allocation, space-based ADS-B has since been implemented via a satellite constellation and overcame the terrestrial ADS-B sensors line-of-sight (LOS) limitations, extending surveillance coverage over remote and oceanic airspace, without the need for aircraft avionics modification.

1.2 However, to apply radar like separation for civil aircraft, surveillance must be supplemented with effective communications. That is, space-based ADS-B has to be complemented with VHF voice communication means, which is still lacking in oceanic and remote areas. A potential solution using VHF radio relay installed onboard satellites (space-based VHF) was presented at the 2018 Data Communications Infrastructure Working Group (DCIWG) and Operational Data Link Working Group (OPDLWG).

1.3 It was noted that in remote airspace where VHF voice communications is not available, the separation minima from the ICAO Separation Airspace Safety Panel (SASP) applies[1]. The proposed solution of space-based VHF voice communications that could fulfill the role of VHF direct controller-pilot communications (DCPC) in oceanic areas or remote regions where effective communications means is unavailable, can potentially enable radar-like separation minima and enhancement of airspace safety and efficiency.

[1] For the case of Controller Pilot Data Link Communications (CPDLC) with appropriate surveillance mean, the longitudinal separation minima can be up to 14 Nm.

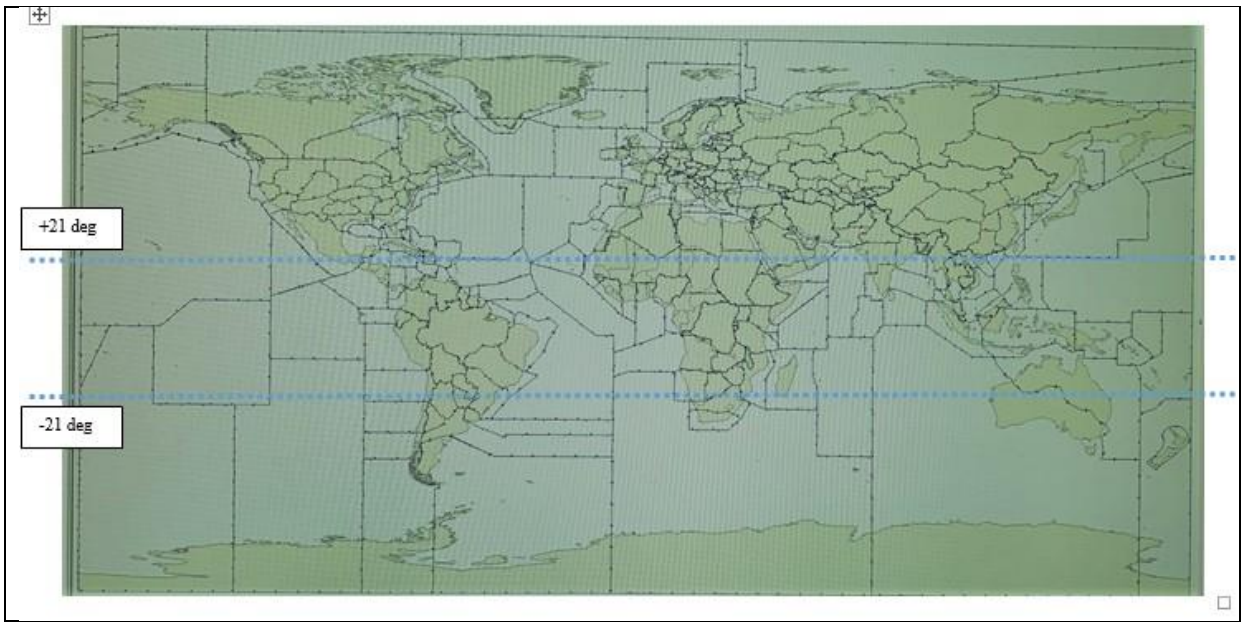
1.4 At present, there is no viable solution to provide VHF voice services over oceanic and some remote areas. Although High Frequency (HF) voice, satellite voice (SATVOICE) and Controller Pilot Data Link Communications (CPDLC) may be used in lieu of VHF voice, these technologies are currently not supporting radar-like or other similar reduced separation minima (e.g. 5 or 10 NM). Moreover, not all aircraft are equipped with SATVOICE and/or CPDLC. Whereas, space-based VHF voice communications relay, when paired with appropriate surveillance mean, should be able to meet the ICAO standards for radar-like separation minima, without aircraft equipage being an issue.

2. DISCUSSION

2.1 Technical Studies on Space-Based VHF

2.1.1 CAAS has completed the technical study with Gomspace and Singapore Technologies Engineering Electronics (GS-STEE) in early 2019 and concluded that this proposed solution may be limited by the payload. However, it is too premature to conclude as some of the assumptions in the studies need further verification. A technically feasible design could be set up for trials, by mounting VHF radio voice communications system on a constellation of nanosatellites (e.g. 25kg class) orbiting at about 600km altitude, potentially cover up to +/- 10 degree latitude.

2.1.2 Separately, a 2nd technical study with Rohde & Schwarz GmbH & Co.KG (R&S) was conducted and a preliminary assessment completed in Sep 2019. The technical study concluded that a space-based VHF radio voice communications system using at least 100kg class satellites, can have an effective coverage of up to +/- 21 degree latitudes. However, it was noted that a more thorough technical study into VHF radios and antennae had to be carried out in order to minimise the technology risks.



2.1.3 As part of a multi-pronged approach to source for a feasible and cost-effective solution for a space-based VHF radio voice communications system, CAAS has commenced on a 3rd space-based VHF technical study with Thales Solutions Asia in Dec 19. The technical study is expected to conclude by end 2020.

2.1.4 All the above VHF radio relay solutions will work with all existing civil aircraft equipped with VHF radio voice communications equipment, without any requirement for avionics modification. There is also no change to existing terrestrial VHF voice communications, hence it is expected that there will be no major amendments for ICAO Standards and Recommended Practices (SARPs).

2.2 Space-based VHF Frequency

2.2.1 Amendments to the ITU Radio Regulations ("RR") is necessary as the space-based VHF project will require the ITU to harmonise and allocate the VHF frequency spectrum for aeronautical mobile communications services between satellite and aircraft. This approach is similar to the spectrum allocation to space-based ADS-B at the ITU WRC-15. The ICAO Frequency Spectrum Management Panel (FSMP) presented an ICAO position to support a future agenda item under Agenda Item 10 (AI 10) on allocating VHF frequency band for space-based VHF services at World Radiocommunication Conference 2019 (WRC-19). With the support from ICAO and the different Regional Groups of the ITU, the above space-based VHF frequency allocation AI 10 was formally accepted as an agenda item for WRC-23, where the approval of such frequency allocation will be discussed and sought.

2.3 ATS Benefits

2.3.1 The space-based VHF voice communications would have similar performance and operations as the existing terrestrial VHF voice communications. The possibility of having all civil aircraft communicate directly with Air Traffic Control (ATC) officers using space-based VHF communications in parallel with space-based ADS-B surveillance in remote continental as well as oceanic regions, would contribute significantly to airspace efficiency through the dynamic availability of optimised direct air routes, preferred altitudes, reduced separation minima, as well as enhancing aviation safety. The concept of a space-based VHF voice communications would also support other ICAO initiatives like FF-ICE, SWIM, TBO.

2.4 Next Steps of Space-based VHF Project

2.4.1 CAAS will continue with the technical studies, with the primary focus on the design of the satellite constellation, coverage optimisation and other technical parameters (e.g. the VHF radios and antennae). The Proof-of-Concept (POC) trials and verification tests may take place following the completion of all the technical studies. For such trials/tests, coordination will be made with the ICAO Asia Pacific Regional Office for the required frequencies.

3. ACTION BY THE MEETING

3.1 The Meeting is invited to:

a) note the on-going design studies of space-based VHF voice communications;

b) note the potential coverage of the proposed satellite constellation that will benefit a large number of States and the aviation community;

c) invite interested States to join Singapore in the space-based VHF technical studies and POC trials;

d) urge States to actively participate in the relevant ICAO and ITU WP5B meetings, in particular for the space-based VHF agenda item;

e) urge States to actively support the ICAO positions, in particular for the space-based VHF agenda item, at relevant ITU meetings; and

f) discuss any relevant matters as appropriate.

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