UNITED STATES OF AMERICA

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 9.0 *to consider and approve the Report of the Director of the Radiocommunications Bureau, in accordance with Article 7 of the Constitution.*

[9.1 *on the activities of the Radiocommunications Sector since WRC-12*

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

BACKGROUND:

Agenda item 9 considers the Report of the Director of the Radiocommunication Bureau with respect to issues of interest relating to activities of the Radiocommunications Sector since WRC-12 (Agenda Item 9.1), as well as difficulties or inconsistencies encountered in the application of the Radio Regulations (RR) (Agenda Item 9.2). Pursuant to Agenda Item 9.1, Administrations are invited to consider possible amendments to the RR to address issues studied by the Radiocommunication Sector.

An aeronautical surveillance technology has been developed and subsequently standardized by ICAO. The airborne system is known as Automatic Dependent Surveillance Broadcast (ADS-B)

ADS-B is the aircraft broadcast of its position (latitude and longitude), altitude, velocity, aircraft ID and other information obtained from on-board avionics systems. Every ADS-B position message includes an indication of the quality of the data which allows air traffic management to determine whether the data is of sufficient integrity to support the intended air navigation function.

DISCUSSION:

This proposal is to add an AMS(R)S allocation to the [freq/freq range] currently used by ADS-B pursuant to an AM(R)S allocation. The new AMS(R)S alocation would be for transmitting ADS-B data from the aircraft to a non-geostationary satellite equipped to receive 1090 MHz ADS-B signals, and would not present new interference scenarios, nor compatibility issues. As of this writing, ITU-R WP 5B is developing a Report on the global extension of ADS-B by satellite which will memorialize the benign – from technical, operational and interfence perspectives – nature of adding an AMS(R)S allocation at 1090 MHz.

Accurate surveillance can be used as the basis for automated alerting systems. The ability to accurately track aircraft enables ATC to be alerted when an aircraft is detected to deviate from its assigned altitude or route, or when the future positions of two or more aircraft are predicted to fall below minimum acceptable separation standards. Alerts may also be provided when the aircraft strays below the minimum safe altitude or enters a restricted area. Up to now such a capability has been based on interrogations from a ground based system which, necessarily is limited in range and coverage.

Since ADS-B messages are broadcast on 1 090 MHz, they can be received and processed by a standardized aeronautical receiver. As a result, ADS-B supports both ground-based and airborne surveillance applications. For ADS-B surveillance, ground stations are deployed to receive and process the ADS-B messages. In airborne applications, aircraft equipped with ADS-B receivers can also process the messages from other aircraft to determine the location of surrounding traffic in support of applications such as the cockpit display and traffic information (CDTI).

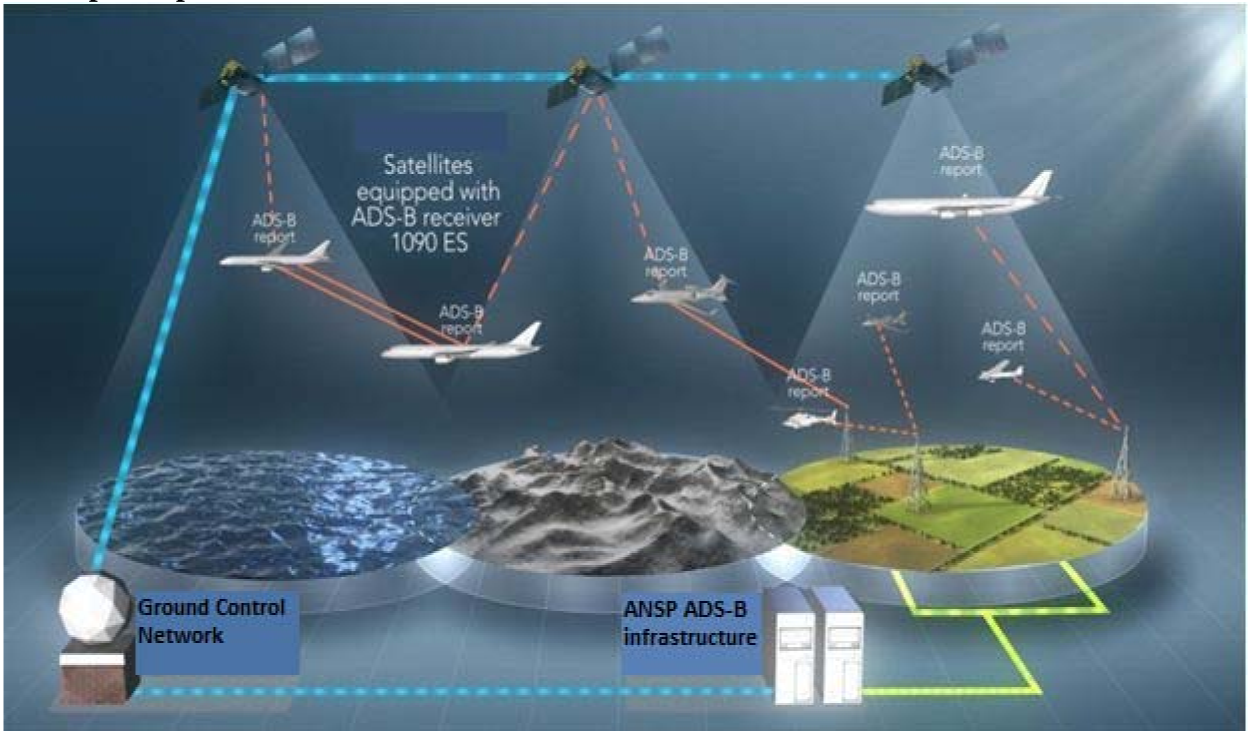
A limitation of ADS-B is that aircraft transmissions cannot be received beyond line of sight from a terrestrial station for processing and use by air traffic management. The propagation constraints with a terrestrial system prohibit coverage to much of the oceanic airspace, and makes coverage impractical for transpolar and other remote or underdeveloped regions. Therefore it can be seen that many areas of the world cannot be practically covered using terrestrial ADS-B stations to receive aircraft transmissions and provide the data to air traffic management. There are vast regions of the world that can be reached only by using satellite communications. The concept of ADS-B via satellite has been considered and is the only communications mechanism that has the capability to provide complete global coverage to support ADS-B beyond the present terrestrial limitations.

The proposed implementation of the satellite-based ADS-B capability over the HIBLEO-2 system is described in Figure 2. ADS-B receivers located on each satellite would receive the signals broadcast from each aircraft within line of sight (the low-Earth orbit enables the satellites to reliably detect the ADS-B signals with no modification to the aircraft equipment). The ADS-B data from all aircraft would be routed and down-linked to a Hosted Payload Operations Center (HPOC) and aggregated. The pre-processed data from the HPOC could be integrated into existing ADS-B ground infrastructure for further processing and analysis, and then forwarded on to the appropriate ATC/ATM centres and airlines.

Figure 1 below provides a summary of how the satellite ADS-B system could integrate with a typical terrestrial ADS-B system.

FIGURE 1

Concept of operations



Implementation of the polar orbiting LEO satellite-based ADS-B capability as shown in the above figure will provide total global communications coverage to all points on the earth.).

The Table 1 below sets forth the spectrum structure for the provision of the ADS-B service on a fully global basis. It indicates the frequencies utilized by the HIBLEO-2 non-GSO MSS satellite system and the frequency used for the implementation of ADS-B which would have equipment on-board the satellites for its reception.
All of the frequencies in this table are supported by appropriate allocations in Article **5** of the Radio Regulations. The ADS-B transmissions are in the Aeronautical Mobile (route) Service.

The transmissions require approximately 2 MHz of bandwidth within the indicated allocation, and centred on 1 090 MHz. The feeder links and Cross links are in the fixed-satellite (FSS), and inter-satellite (ISS) services, respectively. They are presently being used to support the MSS satellite service links which have an AMS(R)S allocation status under RR No. **5.367**. Consistent with that application, and FSS links used at 4/6 GHz and 11/14 GHz to support feeder-links to safety services, those ISS and FSS feeder-link frequencies do not require any special status. As such, ADS-B traffic carried in ISS, MSS or FSS bands would have the same regulatory status as those currently afforded by the MSS, FSS or ISS allocations regarding priority in transmission or protection from interference from other services. However, since satellite reception of ADS-B has not been done before, and considering that the aircraft to satellite uplink would be a safety service, the ADS-B satellite receiver requires some clarification regarding its regulatory status.

The Table 1 below sets forth the spectrum structure for the provision of the ADS-B service on a fully global basis. It indicates the frequencies utilized by the HIBLEO-2 non-GSO MSS satellite system and the frequency used for the implementation of ADS-B which would have equipment on-board the satellites for its reception.

All of the frequencies in this table are supported by appropriate allocations in Article **5** of the Radio Regulations. The ADS-B transmissions are in the Aeronautical Mobile (route) Service.

TABLE 1

Satellite system spectrum utilization

Link	**Purpose**	**Frequency**
ADS-B Uplink	Aircraft to satellite ADS-B signal	1 090 MHz +/- 1 MHz
Satellite Ka-Band Downlink	Satellite to ground for downlink of ADS-B data and payload telemetry	19.4-19.6 GHz (FSS primary allocation)
Satellite Ka-Band Crosslink	Satellite to satellite for relay of ADS-B data, payload telemetry, and command and control of the ADS-B payload	23.18-23.38 GHz (ISS primary allocation)

Considering that there is currently no AMS(R)S allocation in the 960–1 164 MHz band it would seem reasonable to propose a regulatory option in a footnote authorizing AMS(R)S for the operation of ADS-B aircraft transmissions in the uplink direction to the satellite receiver at 1 090 MHz.

SUMMARY:

Considering that there are no compatibility issues with any other services, that an ITU-R Report on this matter will be completed prior to WRC-15, and that ADS-B will provide for global, real-time aircraft surveillance for air navigation service providers (ANSP), it is proposed that WRC-15 provide for the reception of 1090 MHz ADS-B signals by non-geostationary satellite systems. The Conference consideration of this issue would allow the aviation community all over the world to take advantage of the many benefits offered by global extension of the ADS-B system via satellite as early as 2017. Benefits to air navigation (and consequently to air travelers) include:

- Extension of land-based ADS-B aircraft surveillence and tracking systems to global coverage, including oceanic and polar regions; thereby providing for the *continuous* tracking of aircraft *anywhere* in the world;[1]
- The ability to take advantage of ADS-B equipment already installed on aircraft (i.e., no new equipment on the sircraft itself);[2]
- The ability, through extended tracking of aircraft, to more efficiently space and route aircraft – regardless of location – resulting in:
    - Operational cost-savings through optimal routing and increased capacity;[3]
    - Lower environmental impact; again due to the ability to optimally route aircraft, planes will be able to climb more rapidly to efficient altitudes, and fly in better weather conditions – potentially reducing carbon emissions to the equivalent of removing two million automobiles off of roads annually
    - Extended operational safety by extending ADS-B capability to regions of the world that have yet to implement terrestrial ADS-B; thus providing for continuous global surveillence and assiting ANSPs in providing safe travel in airspace globally.

Administrations are encouraged to consider the advantages of the global space-based ADS-B system, including its many operational benefits, and are kindly invited to support this proposal, and increased air travel safety.

[1] This new capability will extend the benefits of current radar-based surveillence systems – which cover less than ten percent of the planet – to the entire earth.

[2] In fact, in the United States, the Federal Aviation Administration's NextGen initiative requires all aircraft to be equipped with ADS-B avionics by the year 2020. Similar mandates exist outside of the United States.

[3] One operator estimates $6-8 billion if fuels cost over North Atlantic, and North and Central Pacific routes over an initial 12-year perios once satellite ADS-B becomes operational around 2017.

Proposal

Allocation to services		
Region 1	**Region 2**	**Region 3**
960-1 164 MHz AERONAUTICAL MOBILE (R) 5.327A **5.328X** AERONAUTICAL RADIONAVIGATION 5.328		

ADD 5.328X**.** Transmissions in accordance with international aeronautical standards on the frequency 1 090 MHz from aircraft stations to satellite receivers in the aeronautical mobile satellite (R) service are authorized when such transmissions are used to extend or supplement the aircraft links

Reason: To extend ADS-B to global coverage by providing for reception of the ADS-B signal by satellites satisfying both ITU and ICAO requirements, thereby ensuring safe operation of the airspace.