



Agenda Item 3: Report of activities and deliverables of the GT - Interop and Subgroups

REPORT OF THE CNS/SUR SUBGROUP

(Presented by the Secretariat)

SUMMARY	
<p>This working paper presents the activities carried out in the CNS/SUR subgroup on the regional implementation of Space-based ADS-B in the SAM Region, using the REDDIG as a platform for the distribution of information to the States and the conclusions and recommendations of this group for said regional implementation.</p>	
References:	
<ul style="list-style-type: none"> - Final Report of the SAM/IG/22 Meeting (Lima-Peru, 19 to 23 November, 2018); - Final Report of the SAM/IG/24 Meeting (Lima-Peru, 4 to 8 November, 2019); - Letter to the States LT2/3.1.2–SA291 dated 21 September, 2020 Regional Implementation of Space-based ADS-B; - Letter to the States LN3/20.1-SA5269 RLA03901 dated 18 September, 2020 - Additional Node of REDDIG II; - Meetings (teleconferences) held. <ul style="list-style-type: none"> o 1° SG CNS/SUR Teleconference – 28 February, 2020 o 2° SG CNS/SUR Teleconference – 27 August, 2020 o 3° SG CNS/SUR Teleconference – 11 September, 2020 o 4° SG CNS/SUR Teleconference – 2 October, 2020 o 5° SG CNS / SUR Teleconference – 9 October, 2020 	
ICAO Strategic Objectives:	<p><i>A - Safety</i> <i>B - Air Navigation Capacity and Efficiency ASBU:</i> <i>ASUR-B0/1, ASUR-B0/3</i></p>

1. INTRODUCTION

1.1 The SAM Region Interoperability Task Group (GT Interop) was established at the SAM/IG/22 Meeting (Lima-Peru, from 19 to 23 November 2018) to support and promote initiatives to modernize the air navigation services and ensure interoperability between automated systems used by AIM, ATM, ATFM, CNS and MET users.

1.2 At the SAM/IG/24 Meeting (Lima-Peru, 4 to 8 November 2019) the CNS/SUR Subgroup of the Interop GT was activated, with the task of studying and proposing the necessary activities for a

regional implementation of Space-based ADS-B in the SAM Region, using REDDIG as a platform for information distribution, reducing the cost with contracting telecommunications services, within the framework of regional development.

1.3 The CNS/SUR Subgroup is currently made up of:

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2. DISCUSSION

2.1 In order to gather updated information on the progress of ADS-B implementations in the SAM Region and evaluate the feasibility of the regional implementation of Space-based ADS-B (Space-based ADS-B), the SAM Regional Office organized the teleconferences detailed in the reference, in which the focal points designated by the States and industry representatives participated.

2.2 In the first teleconference, held on 28 February 2020, the progress of the ADS-B implementations in the Region was discussed. The meeting had participants from Argentina, Bolivia, Brazil, Chile, Peru, Uruguay, AIREON, provider of the Space-based ADS-B service, and the CNS officer of the SAM Regional Office.

2.3 The States representatives reported the progress of the implementations, and the representative of Brazil reported that the implementation of terrestrial ADS-B was in operational status, for helicopter surveillance in an oil activity area in the Campos basin. Regarding the evaluation of a regional implementation of Space-based ADS-B using REDDIG II as a platform for the distribution of surveillance information, the Subgroup would continue studying, with the aim of addressing a conclusion proposal for presentation in the GT Interop group meeting and subsequently for consideration by the SAM/IG/25 Meeting. Likewise, the representative of Brazil informed that he would be evaluating the data from the tests carried out with Space-based ADS-B and that the results would be shared in a timely manner with the Subgroup.

2.4 The second teleconference held on 27 August 2020, aimed to initiate studies for a regional implementation of Space-based ADS-B using REDDIG II as a regional IP technology platform for the distribution of surveillance data, analyzing technical, administrative and contractual aspects. In this

teleconference, also organized by the SAM Regional Office, representatives of Argentina, Bolivia, Chile, Colombia, Ecuador, Panama, Peru, the CNS Regional Officer, the Technical Cooperation Assistant and the REDDIG Administrator, from the ICAO SAM Regional Office, participated, as well as representatives of AIREON.

2.5 AIREON made a presentation exposing the general characteristics of the implanted system and three possibilities of connection with the member States of the regional IP network and an evaluation, indicating the pros and cons of each topology, as well as exposing the latest news in its development.

2.6 The CNS Regional Officer made a synthesis of the proposed configurations mentioned in the previous paragraph, in order to compare and evaluate the different technical options.

2.7 He also clarified that based on conclusion RCC/23-1 - Implementation of Additional Nodes of the Terrestrial Network (MPLS) of the REDDIG II, the Secretariat of the Coordination Committee of the Regional Project RLA/03/901 must analyze the requests from States/Organizations not participating in the project, requiring connection to the network through "additional nodes", not involving additional costs for the participants of the RLA/03/901 Project.

2.8 Regarding administrative aspects, it was mentioned that the mechanism for this regional implementation should be a Regional Technical Cooperation Project (new or an existing project), bringing together States interested in receiving surveillance data from the Space-based ADS-B system.

2.9 Finally, the AIREON representatives were requested to present, at the next meeting, a breakdown of all the costs involved in the implementation of the Space-based ADS-B data service, both recurring and non-recurring, in order to carry out a cost-benefit analysis of a possible regional implementation.

2.10 The following teleconference was held on 11 September 2020. In this teleconference -also organized by the SAM Regional Office- Representatives from Argentina, Bolivia, Chile, Colombia, Ecuador, Panama, Peru; the CNS Regional Officer, the Cooperation Assistant, the Technical Cooperation Assistant, and the REDDIG Administrator on behalf of e ICAO SAM Regional Office, participated, as well as AIREON representatives.

2.11 Continuing what was required in the previous teleconference, AIREON made a technical explanation of the Space-based ADS-B system; later, they detailed each proposed topology and a breakdown of the recurring and non-recurring cost structure for each one.

2.12 It was concluded that the topology proposal called option 3, is the most convenient considering technical, operational and financial aspects. The States requested AIREON to send a letter to ICAO expressing interest in the implementation of the additional REDDIG node to support the regional implementation of the Space-based ADS-B, for approval by the REDDIG members.

2.13 Regarding the cost for the implementation and use of the service under consideration, the company presented the non-recurring costs and the costs for data services, with a table indicating the values to be billed considering the flight hours, the service area, its traffic density and the existence of other surveillance systems. AIREON indicated that the most precise cost values will be sent by the company in a commercial proposal, based on the number of States interested in adopting the Regional implementation and on the service volumes to be contracted. For this reason, the States were asked to indicate their interest in the Space-based ADS-B services of and the volumes of the FIRs that would be contemplated by the Space-based ADS-B services provided by AIREON.

2.14 On 18 September 2020, the Regional Director sent letter LN3/20.1- SA5269, requesting the aeronautical authorities of the participating States of the Regional Project RLA/03/901, to express themselves regarding the implementation of an additional node in REDDIG II by AIREON, for its use as a platform for the exchange of surveillance data.

2.15 On 21 September 2020, the Regional Director sent letter LT2/3.1.2-SA291, requesting the aeronautical authorities of the States of the Region to state if they are interested in joining a potential implementation of the Space-based ADS-B data service.

2.16 During the teleconference held on 2 October 2020, an analysis of the breakdown of the cost structure was carried out, considering the topology of option 3, by virtue of having been considered the most convenient.

2.17 Regarding the cost of using the service, and expanding on what was mentioned in paragraph 2.13, the criteria and parameters to be considered by each State were clearly indicated, in order to determine them, according to the service area of interest.

2.18 On 9 October 2020, the fifth teleconference of the CNS/SUR Subgroup was held with the participation of representatives from Argentina, Brazil, Chile, Colombia, Ecuador, Panama, Paraguay, Peru and Venezuela. In the aforementioned teleconference, Eng. Roger Perez made a presentation on the implementation of Space-based ADS-B carried out by COCESNA, indicating that the performance parameters of the system are in accordance with the industry standards and that the system integration has already been carried out in its automated platform without incident.

2.19 In order to present to this Meeting, a document summarizing the analysis carried out by the CNS/SUR Subgroup, as well as the conclusions and recommendations, an **Appendix** to this working paper is included.

3. SUGGESTED ACTION

3.1 The Meeting is invited to:

- a) Take note of the activities carried out; and
- b) Approve the analysis, conclusions and recommendations of the CNS/SUR Subgroup and draw up a conclusion on the regional implementation of Space-based ADS-B.

APPENDIX

REGIONAL IMPLEMENTATION OF ADS-B SATELLITAL

1. OBJECTIVE

1.1 This document aims to present a summary of the analysis carried out by the CNS/SUR Subgroup regarding a regional implementation of Space-based ADS-B (Space-based ADS-B), using the Digital Network of the SAM Region (REDDIG II) as a distribution platform for surveillance data and its respective recommendations.

1.2 Regional implementation is considered the initiative of a group of States to implement the service, through a Regional Technical Cooperation Project, using the IP regional network as a means of transmitting surveillance information.

2. BACKGROUND

2.1 The issue of Space-based ADS-B implementation was discussed for the first time during the SAM/IG/18 Meeting (Lima, 17 to 21 October 2016), having being prepared the following item in the Meeting Report:

4.20 The Meeting was informed by AIREON of the operation of space ADS-B and the use of the EUROCONTROL PENS network for the distribution of processed information from Space-based ADS-B to air navigation service providers interested in that service and that this distribution in the SAM Region could be done through REDDIG II.

2.2 As of this event, the matter was discussed within the framework of the SAM Region Implementation Group (SAM/IG) and the Coordination Committee of the Regional Project RLA/03/901 (REDDIG).

2.3 At the Eleventh Coordination Meeting of Project RLA/06/901, which supports the activities of the SAM Region Implementation Group (SAM/IG), a study was approved on the convenience and feasibility of the Space-based ADS-B proposed by AIREON at the regional level, given the benefits identified of this system by the States of the SAM Region:

- Coverage in existing gaps in the surveillance systems of the Region States.;
- Coverage in border areas as an alternative to the exchange of surveillance data between adjacent States;
- Coverage in oceanic areas beyond the reach of terrestrial surveillance systems;
- Surveillance solution for Non-FIR Space; and
- Constant update of the position of the targets, in contrast with the periodic update provided by the ADS-C.

2.4 The final study on the Convenience and Feasibility of the Space-based ADS-B Service was presented at the SAM/IG/22 Meeting (Lima, 19 to 23 November 2018). In Agenda Item 5, the following item of the Report was prepared:

5.56 *The study concludes that the use of the Space-based ADS-B system in the Region is feasible due to its coverage, response time in the information transfer process or latency, and availability of information, for en-route airspaces above 10,000 feet, which was the airspace analysed in this study.*

2.5 As of the SAM / IG / 24 Meeting (Lima, 04 to 08 November 2019), the matter was dealt with by the CNS/ UR Subgroup activated in this meeting, which has held seven teleconferences, with a view to presenting the result of the analysis and recommendations at the SAM/IG/25 (Virtual) Meeting, to be held in the period from 02 to 04 November 2020.

3. ADS-B SATELITAL

3.1 The Space-based ADS-B system was implemented by a group of air navigation service providers (IAA, ENAV, Nav Canada, NAVIAIR and UK NATS) that partnered with Iridium Communications to establish a service for the provision of aeronautical surveillance information with global coverage. Figure 1 illustrates the implementation of Satellite ADS-B with 66 Iridium Next low orbit satellites,

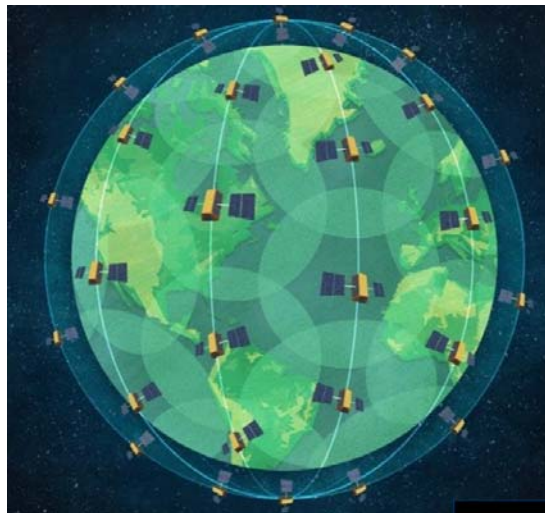


Figure 1 – Constellation Iridium Next

3.2 This service provides surveillance information of properly equipped aircraft, with ADS-B transponders of any version, to air navigation service providers (ANSP) that provide air traffic control in a specific area.

3.3 The same signal emitted by the aircraft (1090 MHz ES), which can be captured by ground-based sensors, is also captured by sensors installed in a constellation of low-orbit satellites (Iridium), which transmit all the emissions to a center that processes them and it can distribute the surveillance data to the air traffic control centers of the ANSPs that contract the service. Figure 2 illustrates the concept of operation of the Space-based ADS-B service.

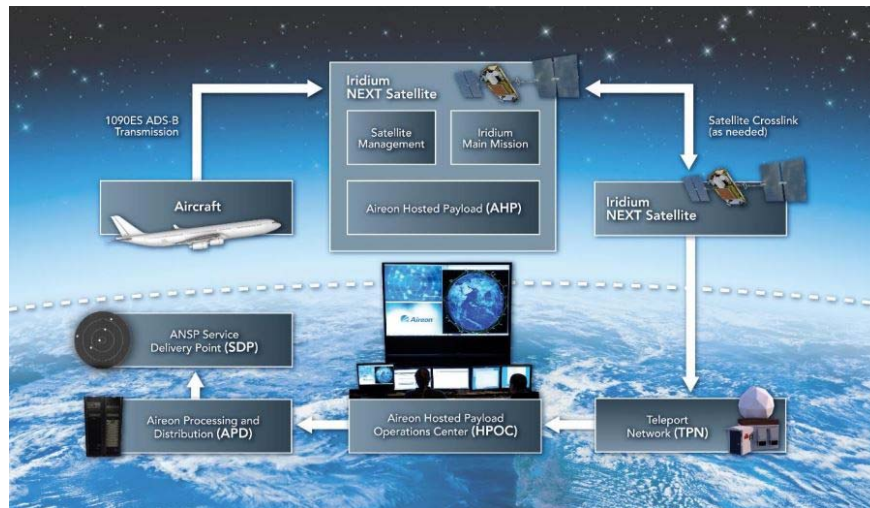


Figure 2 – Space-based ADS-B operation concept

4. IDENTIFIED BENEFITS

4.1 **Safety** - Effective surveillance in areas where there is currently no coverage, definitely contributes to increasing safety.

4.2 **Flight efficiency** - The effective surveillance capacity of ADS-B information provides means to optimize flights and increase the capacity to use airspaces.

4.3 **Flexibility** - Allows the ANSP to contract specific areas or volumes, at flight levels of operational interest, as the sole means of surveillance or as an augmentation of an existing surveillance infrastructure, as well as redundancy in areas of critical operational interest.

4.4 **Homogeneity** - In a regional implementation, with the States obtaining information from the same source, with the same levels of parameters, it enables the homogenization of air navigation services throughout the Region, as well as the sharing of surveillance data in an efficient and safe way.

4.5 **Environment** - Better flight management, increasing capacity, providing more direct flights and reducing waiting times, contribute to reducing the adverse impacts of aviation on the environment.

4.6 **Profitability** - With more efficient and economical flights profitability for aircraft operators becomes sustainable, with positive impacts for the final user. From the point of view of the ANSPs, the decrease in the infrastructure implemented and the maintenance required have a significant impact on this aspect.

4.7 **Situational awareness and ATFM** - Improved situational awareness by the controller through 100% vigilance in all sectors, FIR and beyond FIR limits. In agreement with the adjacent FIRs, surveillance information up to 50 NM beyond the border of the contracted area, is provided free of charge.

4.8 **Search and Rescue Services** - It is possible to meet the requirements for an effective SAR service, by having precision in the search for a lost aircraft.

4.9 **Optimization of the surveillance infrastructure** - Being a flexible and cost-effective system, the ANSP can perform a better optimization of the surveillance infrastructure, combining systems to guarantee aviation security and have better operational and economic efficiencies in the provision of air navigation services.

4.10 **Effectiveness in the surveillance infrastructure cost** - AIREON's way of charging to provide the Space-based ADS-B service is based on the hours actually flown within the contracted airspace, so that, with a lower or higher volume of operations, the charge is lower or higher, but at the same time the revenue from air navigation charges for the ANSP is lower or higher.

5. NECESSARY INFRASTRUCTURE

5.1 Classically, for the provision of the service, it is necessary to install a service delivery point (SDP) with redundant equipment (1+1) and redundant communication links, through two MPLS telecommunications service providers. Figure 3 presents the basic configuration of the service provision.

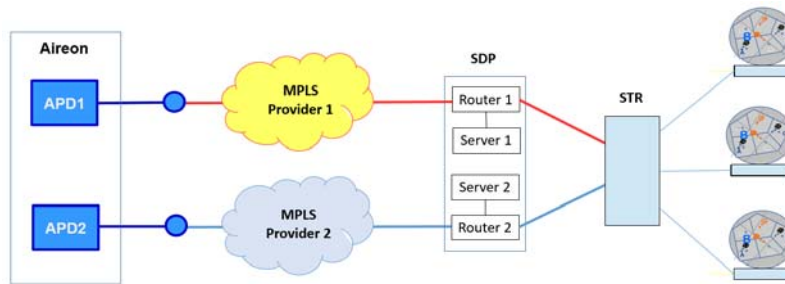


Figure 3 - Basic configuration

5.2 Once the States of the SAM Region have a regional IP network capable of distributing surveillance information, said infrastructure can be used, lowering the costs of contracting a telecommunications provider.

5.3 In this sense, it is sufficient for the Space-based ADS-B service provider, to implement an “additional node” REDDIG II, contracting directly the same telecommunications provider (CenturyLink) of the regional network. Since AIREON is already a CenturyLink customer, it is only necessary to make the configuration to enable communication between the AIREON node and the other nodes on the network interested in receiving surveillance information. Figure 4 illustrates this possibility.

5.4 The topology illustrated in Figure 4 shows the following technical advantages:

- Low latency in the two communication links;
- High availability of the service; and
- Scalability.

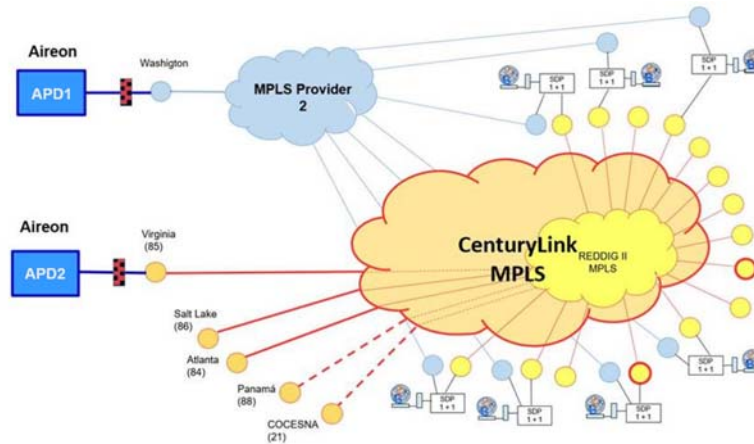


Figure 4 - Regional IP network (REDDIG II) as distribution link of Space-based ADS-B

6. ASSOCIATED COSTS

6.1 NON-RECURRING COSTS

6.1.1 From the information obtained from the company, the participants of the CNS/SUR Subgroup have identified the following estimated non-recurring costs:

- Installation of the direct communication link between AIREON and the States - USD 2,000.00;
- Installation of the service delivery point (SDP) - USD 175,000.00;
- In-Service Acceptance Tests (ISAT) - USD 100,000.00

6.1.2 For the implementation of the second communication link, a value of USD 2,000.00 is estimated for the installation of the point of presence (PoP) of the telecommunications provider (MPLS). However, this cost varies from one State to another depending on the structure of the national backbone networks of the Telecommunications Providers and the installation costs of the last mile circuits.

6.1.3 The cost of USD 175,000.00 for the implementation of the SDP includes the design of the installation site, the acquisition of the necessary equipment (1 rack, 2 routers, 3 servers, 1 maintenance terminal and accessories), software licenses, the installation of all equipment, the configuration of the equipment, the training of technical personnel and travel expenses.

6.1.4 The ISAT (In-service Site Acceptance Test) has a cost of USD 100,000.00 per site and includes the verification of the communication links, execution of tests, delivery of the test plan and procedures, preparation activities for the tests, conducting the tests, analyzing the tests, preparing the test report and travel expenses.

6.2 RECURRING COSTS

6.2.1 The recurring costs are the contracting of the redundant 2 Mbps MPLS link between AIREON and the States, estimating an average monthly value of USD 1,250.00 (or USD 15,000.00 per year). The use of the topology using REDDIG allows the States to save on the installation of the direct MPLS main line between AIREON and the States.

6.2.2 According to the information from the ICAO convenience and feasibility study (see paragraphs 2.3 and 2.4), the costs for Space-based ADS-B data services are better in most cases than the costs for radar or ADS- infrastructure. B terrestrial and competitive. However, each State will carry out its own cost-benefit analysis concerning using this technology based on its existing processes and air navigation projects to determine the viability and desire to implement these services in its airspace.

7. CONCLUSIONS

7.1 The CNS / SUR subgroup, based on the analysis of the information, concludes the following:

- The Space-based ADS-B service has benefits for the States of the SAM Region regarding air safety, increased situational awareness, improvement in flight planning and management, SAR, and optimization of installation and operation costs. In a regional implementation, the benefits would be exponential since there would be airspace without borders, in which States can improve ATFM by having the same surveillance data, eliminating bottlenecks, and providing direct routes to the operators of the air space.
- The use of the REDDIG network represents an important benefit for the States in a Space-based ADS-B implementation, since significant savings can be made in telecommunications costs, without degrading the availability or performance of the service. Topology 3 presented by AIREON, in which it would install an additional network node in its facilities, is the option with the greatest operational and economic advantage for the States, both for a regional implementation and for a direct implementation of each State with AIREON .
- Not all States are in the same operational and economic situation to be able to join a regional implementation at the same time. However, for those countries that have already confirmed their interest in participating, as well as those that want to join this initiative, it is important as a region to advance in this solution, and that the States that wish to do so can join at the most convenient time for them.
- Considering that Trinidad and Tobago, although it is not a member State of the SAM Region, but a member of REDDIG and has indicated its interest in acquiring the Space-based ADS-B system, it is deemed appropriate to invite this State to participate in the regional implementation .
- Considering the existence of the regional REDDIG project and that the regional implementation of Space-based ADS-B contains the use of the regional IP network as a basis for telecommunications, it is convenient to carry out the regional implementation within the Regional Project RLA/03/901 (REDDIG).

8. RECOMENDATIONS

8.1 Considering the aforesaid information, the CNS/SUR subgroup recommends the following:

- Continue with the regional implementation of Space-based ADS-B, through a regional project, with those States interested in its implementation in their airspaces;
- The adoption of the Regional Project RLA/03/901 (REDDIG), for the regional implementation of Space-based ADS-B;
- Invitation to Trinidad and Tobago to participate in the regional implementation of Space-based ADS-B; and
- Promote agreements with the provider of this service, for operational and technical tests, in states of the SAM region to evaluate the behavior concerning integrating this technology with other existing ones.