



**International Civil Aviation Organization**  
**South American Regional Office - Regional Project RLA/03/901**  
*REDDIG Management System and Satellite Segment Administration*  
**Twentieth Meeting of the Coordination Committee (RCC/20)**  
 Lima, Peru, 21 to 23 March 2017

**Agenda Item 4: Work plan for 2017**

**SPACE-BASED ADS-B SURVEILLANCE DATA AND  
ITS DISTRIBUTION VIA REDDIG II**

(Working paper presented by AIREON)

<b>SUMMARY</b>	
The objective of this Working Paper is to present the analysis conducted by Aireon about the potential use of REDDIG network to distribute Space-based ADS-B data to SAM States.	
<b>REFERENCE</b>	
<ul style="list-style-type: none"> <li>• Meeting Report IG/18</li> </ul>	
<i>ICAO Strategic Objectives:</i>	<i>A - Safety</i> <i>B – Air navigation capacity and efficiency</i>

1. **Background**

**The Aireon program**

1.1. Aireon is the only ATS Surveillance provider that from 2018 will offer worldwide coverage of ADS-B data. The company has been created by 4 ANSPs (NavCanada, ENAV, IAA, Naviar) and Iridium as technological partner, that together have realized a quite simple and efficient idea: install on each of the new Iridium NEXT satellites, flying in Low Orbit altitude, a payload able to receive ADS-B messages sent on the frequency 1090Mhz. The constellation will be composed by 66 operational satellites, plus 6 spares on orbit and 9 spares on the ground; in January 2017 the first 10 satellites were launched and they are already receiving ADS-B messages, with brilliant results. Many ANSPs all around the world are now planning a V&V activity that will prove the quality of the Satellite ADS-B data, that is also deeply analyzed by EASA, that will certify Aireon as PanEuropean Surveillance Provider. From 2018, the worldwide airspace will have another layer of ATS Surveillance, totally independent from ground sensors. What will be translated on the fact that in oceanic and remote areas, currently not covered by any ATS Surveillance technology, the ATCOs will have a real-time position coming from aircrafts, with a drastic increase of safety and possibility to adopt more optimized Separation Minima. Plus, for continental airspace, already covered by ATS Surveillance technology and DCPC (e.g. VHF), the ability to have another layer of surveillance can unlock further operational optimization (such as moving to 5NM in en-route), as well as have a perfect solution for contingency in case of radar failures or problem on ground facilities.

### The Aireon concept

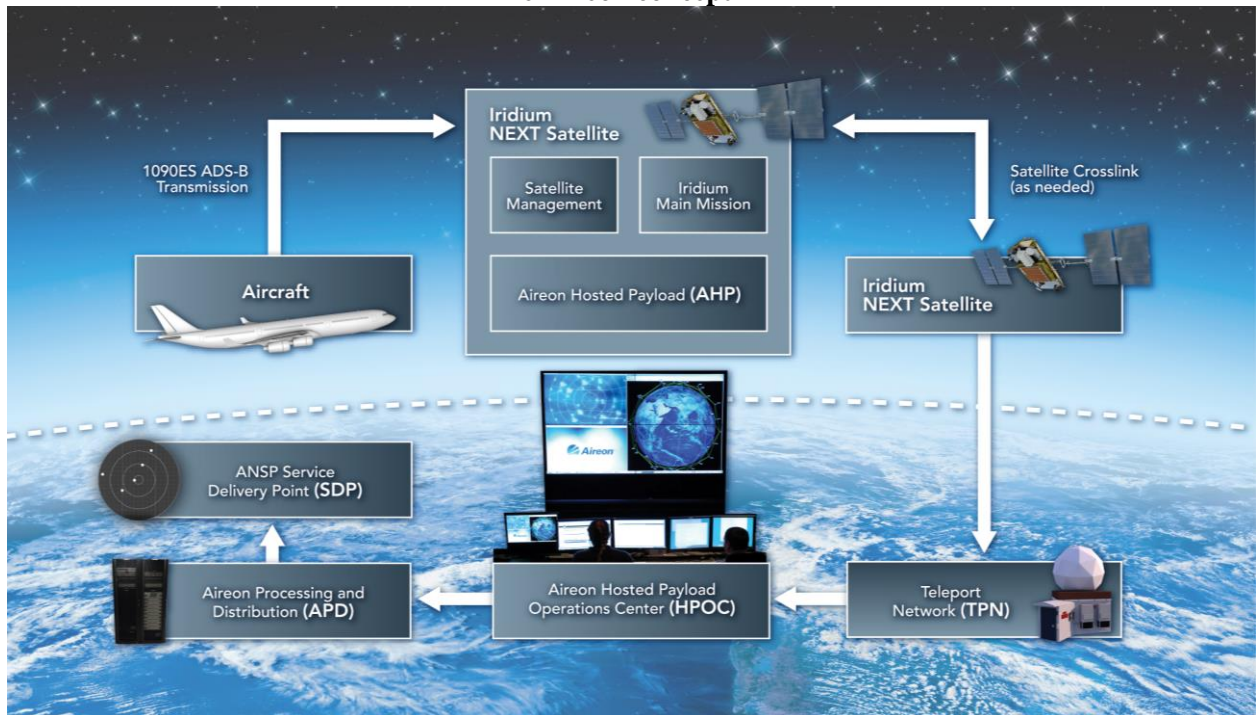


Figure 1 - The Aireon data flow

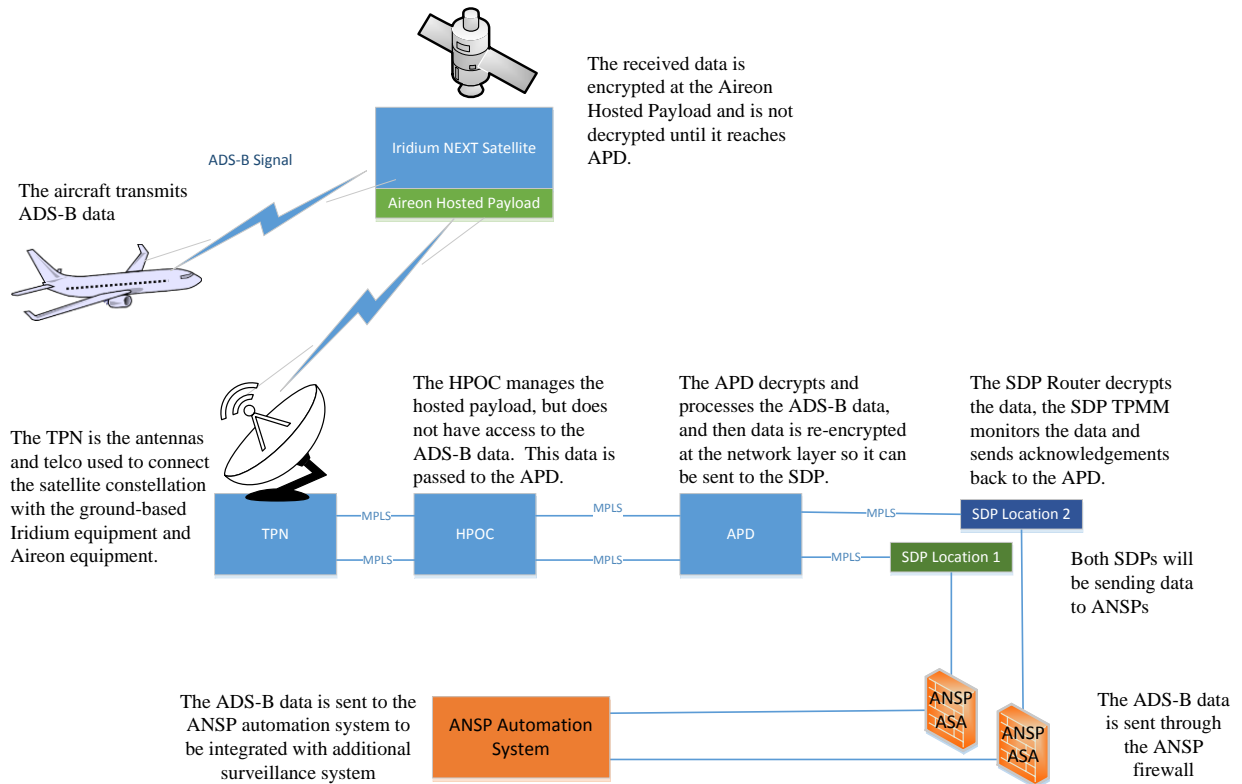
1.2. An aircraft that is equipped with ADS-B technology, mandated in many parts of the world and *de facto* a new surveillance standard, is having a diversity antenna (one on the bottom and one on the top of the aircraft) that twice a second is transmitting on 1090Mhz the aircraft position, as well as many parameters coming from the Flight Management System (such as speed, altitude, selected Flight Level, etc.). The antenna on the bottom is currently used for ground ADS-B and Secondary Radar, while the one on the top is used for TCAS (the anti-collision system). Aireon, with the network of low orbit satellites, will receive that information, transmitting them in real time to the ground.



Figure 2 - The satellite constellation

1.3. The satellites are talking each other, creating a mesh network around the globe. There are 5 teleports around the globe that will downstream the contents of those satellites, transmitting then the data to the Aireon facility, located in Virginia (USA). All ADS-B messages are collected into the Aireon Processing and Distribution (APD), that will process them, creating service volumes for ANSPs and providing to a specific ANSP the surveillance data for the area of interest, on the preferred Asterix data format.

## Aireon Global Surveillance System Overview



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1.4. All this in pure real time, following the maximum delay time considered by the Eurocontrol GEN-SUR document (less than 2 seconds from the reception of an ADS-B message to the delivery of it into the ANSP domain).

## 2. Analysis

### Aireon data distribution

2.1 As from Figure 1, the connection between the Aireon APD and the specific ANSP is typically done through a dual MPLS connection that will connect the APD with a Service Delivery Point (SDP) installed on the ANSP site.

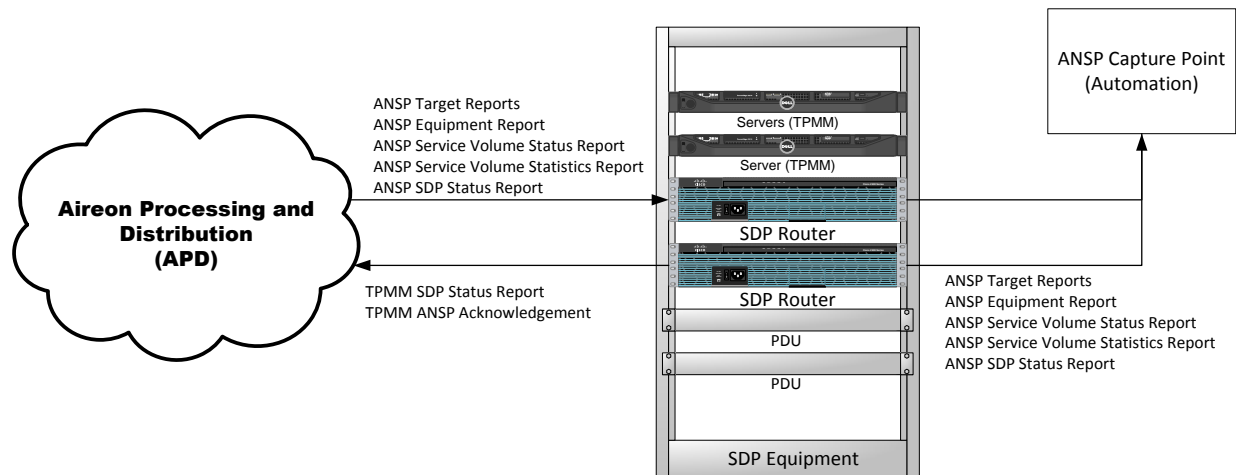


Figure 3 – Typical ANSP Service Delivery Point (SDP) hardware

2.2 The SDP is the real demarcation point between the Aireon domain and the ANSP domain: the outcome of the SDP is the surveillance data for that ANSP, ready to be integrated into the ATC automation platform (tracker).

2.3 Since ADS-B messages are small in terms of byte, the link between Aireon and the ANSPs does not require much bandwidth, but it is important to have a robust link. Since MPLS connections in some regions can be expensive and to optimize connections with APD, Aireon is investigating also the possibility to use regional networks already in place around the world, such as REDDIG, MEVA or PENS, for data distribution of the Aireon surveillance data in the region.

**Aireon and REDDIG network**

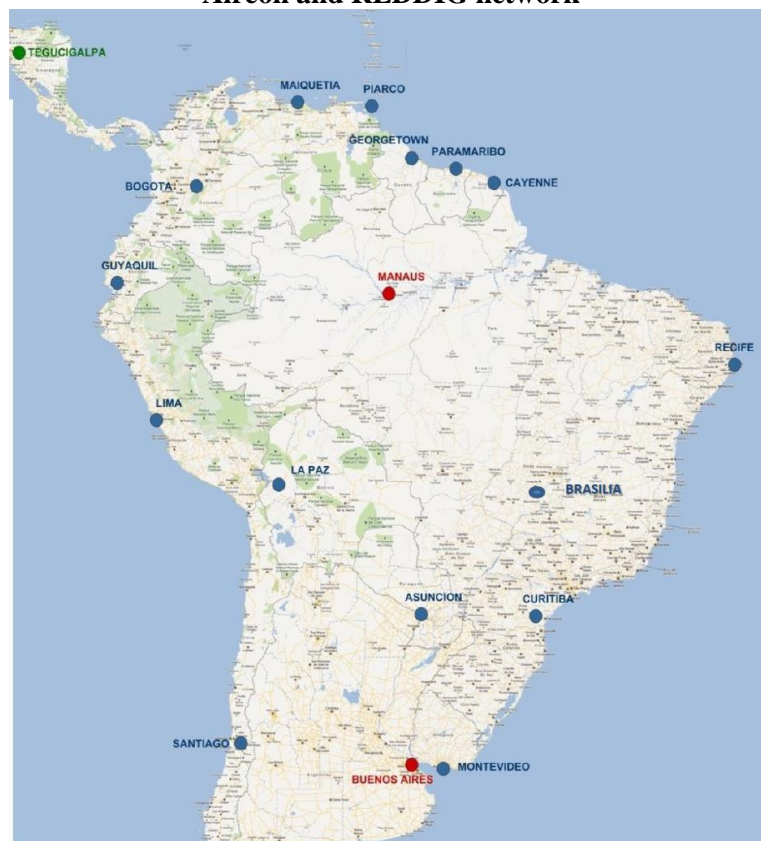


Figure 4 - REDDIG nodes

2.4 REDDIG is the Regional data distribution that ANSPs are using in South America. It is a combination of VSAT and MPLS connections; it is providing a very solid link and all the ANSPs are already interconnected with this network.

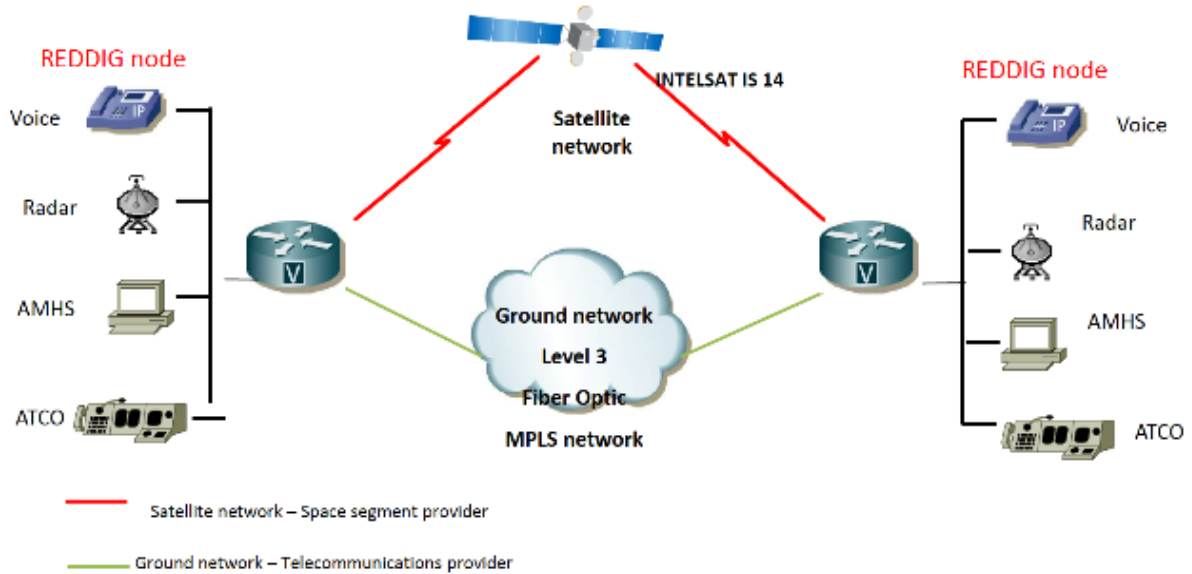
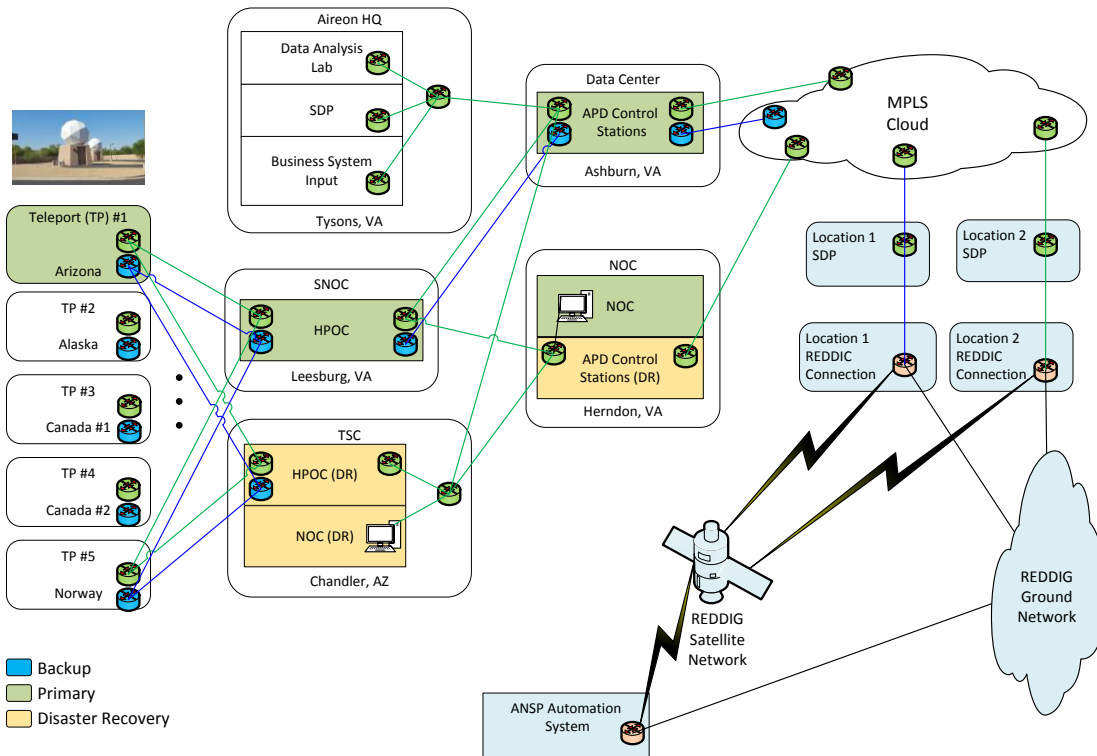


Figure 5 - REDDIG architecture

The network is owned by the States, and managed under the supervision of ICAO South America regional office.

2.5 Aireon with this paper would like to further investigate the possibility to enter in the REDDIG network in 1 or 2 nodes, for then using REDDIG as data distributor of the last mile.

### Aireon Global Surveillance Network Overview



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2.6 We can imagine for example to have 2 SDPs, both connected with an MPLS connection to the APD in Virginia (USA).

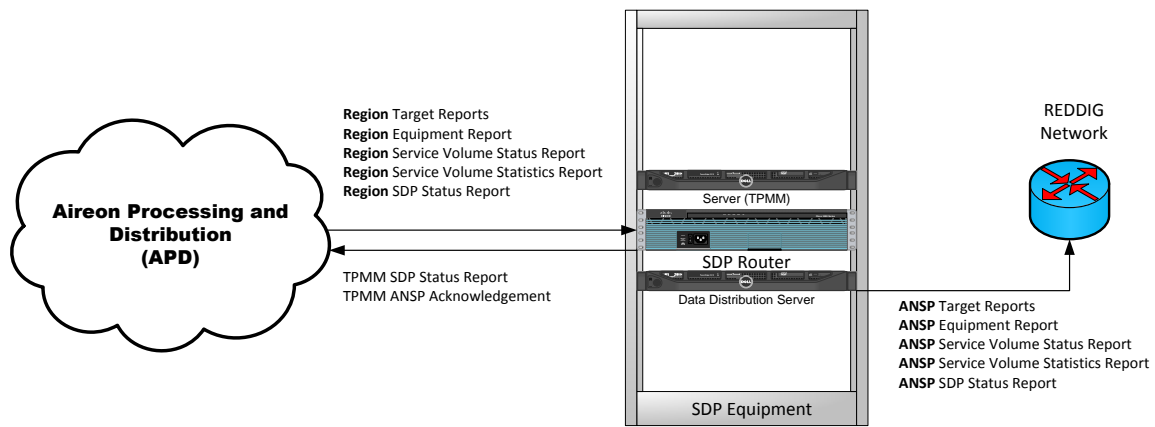
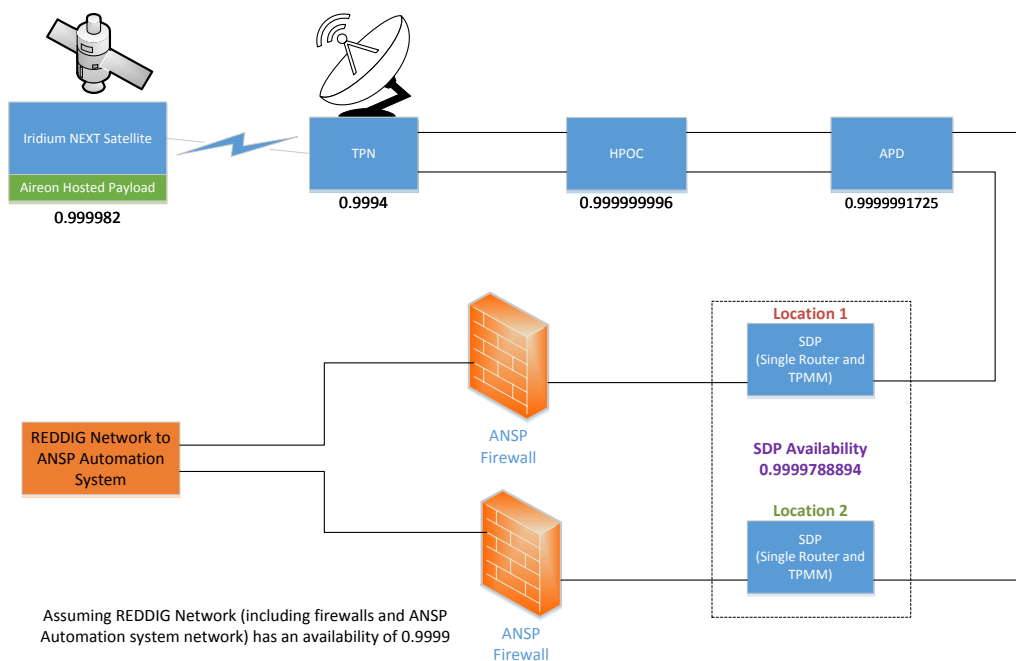


Figure 6 – Regional Service Delivery Point (SDP) hardware

2.7 Each of the SDP will be able to inject, as separate VPNs, the Satellite ADS-B data of each ANSP that would like to get those data. The demarcation point for Aireon will then be at the entrance of the REDDIG network, after which the REDDIG network manager will care about the data distribution. In this way, there will be only 2 solid MPLS connections between Aireon APD and REDDIG network, optimizing so costs and performances. This approach also provides geographical diversity of the SDPs in case of localized disaster.

2.8 With this configuration, the availability of the complete network from data reception at the satellites to the ANSP automation system will be greater than 0.999 assuming the REDDIG Network availability is greater than 0.9999 and the MPLS connection from APD to the SDP are at least 0.997.

Availability using two single string SDPs that feed a single Automations Systems



**System Availability is 0.99925**

## 2.9 REDDIG Network Requirements

- System Availability > 0.999
- Accepts Multicast Data
- Delivery to Automation system in low latency
- Surveillance data segregation for each of the connected ANSP
- Bandwidth:
  - Argentina: estimated traffic for all FIRs 170,000 flight hours/year -> 170MB/year
  - Bolivia: estimated traffic 79,530 flight hours/year -> 80MB/year
  - Brazil: estimated traffic for all FIRs 1,600,000 flight hours/year -> 1600MB/year
  - Chile: estimated traffic for all FIRs 100,000 flight hours/year -> 100MB/year
  - Colombia: estimated traffic for all FIRs 374,000 flight hours/year -> 374MB/year
  - Ecuador: estimated traffic for all FIRs 78,000 flight hours/year -> 78MB/year
  - Guyana: estimated traffic 10,000 flight hours/year -> 10MB/year
  - Paraguay: estimated traffic 14,000 flight hours/year -> 14MB/year
  - Peru: estimated traffic for all FIRs 248,000 flight hours/year -> 248MB/year
  - Suriname: estimated traffic 7,000 flight hours/year -> 7MB/year
  - Uruguay: estimated traffic for all FIRs 36,000 flight hours/year -> 36MB/year
  - Venezuela: estimated traffic for all FIRs 160,000 flight hours/year -> 160MB/year

## 3. Suggested action

### 3.1 The Meeting is invited to:

- a) Take note of the information presented herein;
- b) Analyse the possibility of Space-based ADS-B surveillance data distribution through REDDIG, by implementing a Service Delivery Point (SDP) in one or two nodes in the SAM region, connect them to Aireon's Processing and Distribution Center and perform an evaluation of ADS-B surveillance data distribution through the network.

- END -