



# ICAO

International Civil Aviation Organization  
North American, Central American and Caribbean Office

## On-line Workshop for the NAM/CAR/SAM Regions on Aviation Risk Mitigation Measures due to the Implementation of 5G Frequencies (5G/Frequencies/Workshop)

Online, 28 February 2023

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### Summary of Discussions

<b>Date</b>	28 February 2023
<b>Location</b>	On-line
<b>Participants</b>	The Workshop was attended by 143 delegates from 23 States/Territories and 5 International Organizations from the NAM/CAR/SAM Regions. The list of participants is shown in the <b>Attachment</b> .

#### 1. References

1.1 State Letter Ref.: *E.OSG-NACC95940 - LT12/3-SA044* dated 24 January 2023.

#### 2. Objectives

2.1 Present and share the lessons learned on the mitigating measures implemented by the NAM/CAR/SAM Regions due to the use of 5G technology by telecommunications companies. This information will help States to benefit from lessons learned and implement mitigating measures in their airports.

2.2 The information of this workshop can be found in the following link:  
<https://www.icao.int/NACC/Pages/meetings-2023-5grisk.aspx>

#### 3. Event Opening

3.1 ICAO, through Mr. Julio César Siu, Acting Regional Director of the North American, Central American and Caribbean Regional Office, welcomed all the participants to the workshop.

3.2 It was indicated that radio altimeters have a very critical function related to safety in all operational aircraft and serve many of the assistance functions, for which their proper functioning and operation is a safety issue and therefore adequate mitigation measures must be taken to prevent the deployment of 5G technology from interfering with the operation of radio altimeters.

3.3 The decision made by the Regional Aviation Safety Group–Pan America (RASG-PA) and the CAR/SAM Planning and Implementation Regional Group (GREPECAS) meetings on this issue was highlighted and ICAO thanked the States, International Organizations and the industry for their participation, especially Boeing for its support by graciously providing the interpretation, this event in which important information and lessons learned were discussed that will support the States in establishing and monitoring the mitigation measures implemented.

3.4 The States, International Organizations and members of the industry participating as speakers in the event were:

1. Boeing
2. The International Air Transport Association (IATA)
3. Brazil, through the Airspace Control Department
4. United States, through the Federal Aviation Administration (FAA)
5. The Central American Corporation for Air Navigation Services (COCESNA)



#### 4. Industry Participation

4.1 Boeing explained the problems in the operation of the radio altimeters since the information collected by these feeds and directly affects a large number of other security systems in the aircraft, that is, it is not an isolated system, for which the necessary measures to avoid such interference must be taken. It indicated that 5G technology will be of enormous benefit, and Boeing even confirmed that it promotes many of its services because of it, but that the safety issue in radio altimeters still needs to be effectively addressed.

4.2 In addition, Boeing emphasized the importance of creating a work synergy with the authorities that regulate the use of the radio spectrum in the States, since these are the ones that define the regulatory framework for the use of frequencies, grant the licenses and the operating conditions of the same, hence the importance of civil aviation authorities working closely with their national spectrum regulatory agencies.

4.3 Interference to radio altimeters caused by the deployment of 5G technology is a global problem and:

1. it is a public safety issue;
2. it can cause numerous safety hazards on aircraft;
3. restrictions on the deployment of 5G technology and mitigation measures at airports can help significantly;
4. there is a need for national aviation to work hand in hand with the national spectrum regulatory entity; and
5. everyone's support is essential to safeguard public safety.

4.4 During IATA's intervention, it indicated that aviation will also benefit from the implementation of 5G technology and that it must be taken into account that the development and implementation of this technology will require a greater radio spectrum and that interference in avionics of aircraft will not necessarily be a constraint for spectrum regulators. It is therefore important to focus on the positive part of this implementation.

4.5 Only in the American continent, updating software and hardware in radio altimeters will have an impact of around 637 to 1,000 million United States dollars. This update will allow aircraft to fly without the interference of emissions due to 5G technology impacting their operations.

4.6 In this sense, IATA indicated the importance of going alongside with telecommunications companies and not behind them. Aviation can benefit as an item from all the investments that telecommunications companies have made and will continue to make.

4.7 IATA recommended that we analyse how we can coexist with the telecommunications companies since many aviation services will be supported by communications. Communications, Navigation and Surveillance (CNS) functions will also be more secure and efficient due to 5G technology, including the incorporation of new aviation services that provided through said technology, for example, the incorporation of communications with Unmanned Aircraft Systems (UAS).

**Telecommunications industry - 5G solutions to aviation challenges**

Reliable Command and control (C2) communications. A key challenge for UAS is the need to improve the connectivity and reliability of the C2 channel. The use of 5G capabilities for the C2 channel is expected to improve connectivity compared to existing ones.

**Collision Avoidance: A key challenge is the need for a Detect and Avoid (DAA) system**

The use of 5G increases the reliability of the DAA and enables new methods for drone position transmission, drone-to-drone communications, and potentially using the 5G cellular network as a Ground Based Surveillance System (GBSS).



4.8 It is important that, in order to ensure a continuous growth, aviation transcend into the future through a pragmatic evolution of ground CNS services, in combination with the business models of air navigation service providers.

4.9 Aviation must coexist with the evolution of technology as per the following items:

1. Continued and increasing Radio Frequency Interference (RFI) with existing avionics technology. 6G technology is on the horizon: possible impact on aircraft weather radar.
2. Technological innovation advances at a faster rate than what the civil aviation sector has traditionally been able to absorb.
3. Steep learning curve for the aviation and telecommunications sectors.
4. If aviation lags behind the telecommunications industry in political and technological commitment, support in seeking new spectrum access may not be found.

## 5. Participation of States and International Organizations

5.1 Brazil shared the lessons learned through the mitigating measures implemented in its State to avoid interference from the implementation of 5G technology in radio altimeters.

5.2 Brazil mentioned that, through the National Telecommunications Agency (ANATEL), it submitted a proposal of operational requirements for comments and suggestions from the general public, for 5G stations operating in the 3.5 GHz band for radio protection altimeters that operate in the 4.2 - 4.4 GHz band. In this sense, ANATEL received comments from: EMBRAER, the Brazilian National Civil Aviation Agency (ANAC), DECEA, IATA/Boeing, ABEAR, RIOgaleão, ABINEE, CLARO, TIM, TELEFONICA, QUALCOMM, GSMA and 5G Americas.

5.3 In accordance with the data provided, ANATEL established, provisionally and as a precaution, that the beams of the antennas used in base, nodal or repeater stations that operate in the 3,300 MHz to 3,700 MHz sub-band, installed in areas close to the aerodromes specified Annex 14, have their pointing limited between the horizon line and below (downtilt). The area covered by the caput is limited by the rectangle included by the following distances:

1. 2,100 meters from the edges of the landing and take-off runway; and
2. 910 meters on each side of the central axis of the runway.

5.4 The intended pointing limit applies to both Advanced Antenna Systems (AASs) and non-AAS antennas. Moreover, for the base, nodal or repeater station installed in the areas defined in the aerodrome, the maximum Equivalent isotropic radiated power (EIRP), by polarization, must be limited to:

1. 67 dBm/100 MHz, when operating in the 3,300 MHz to 3,600 MHz sub-band; either
2. 65 dBm/100 MHz, when operating in the sub-band above 3,600 MHz.

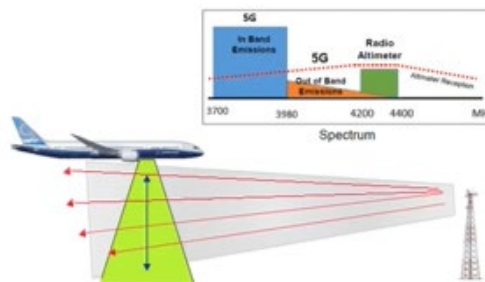
5.5 The mitigation measures implemented are in constant evaluation and improvement in Brazil.

5.6 United States shared the actions carried out in that State to avoid interference in radio altimeters due to the implementation of 5G, focusing on the coexistence of 5G technology with the operation of radio altimeters, taking into account the economic benefits that the implementation of this technology entails for the States.

5.7 What makes the radio altimeter susceptible to interference?

Radio altimeters (RA) are designed to "listen" for quiet signals that bounce in or near the RA band.

5G signals are broadcast near the RA band and may cross into the RA band, causing interference.



5.8 Some of the actions carried out by United States were some instructions to the aircraft in the airworthiness segment and safety alerts to the operators:

1. Airworthiness Directives (AD): 2021-23-12 and 2021-23-13 (December 2021)
2. AIR-21-18R1, which provides recommendations for radio altimeter manufacturers, aircraft manufacturers, operators and pilots.
3. Safety Alert for Operators (SAFO): Provides information and guidance for operators on the potential adverse risk to radio altimeters due to the deployment of 5G technology.

5.9 Mitigation measures implemented since January 2022:

1. Extensive technical, political and operational coordination with telecommunications companies.
2. Monthly evaluation in the location of new antennas (5 thousand to 8 thousand per month)
3. Monthly broadcasts of notices distributed by means of telecommunication (NOTAMS) with information on alternative methods.
4. Monthly meetings with the different stakeholders to ensure awareness and transparency.
5. Continuous redefinition of airspace protection models.
6. Direct agreements with the manufacturers of radio altimeters for the expedited approval of filters for them.
7. Facilitate meetings and discussions between aviation and telecommunications companies to develop and implement an adaptation plan.
8. Initial contacts with the licensees of phase 2 of band C (3.8-3.98 GHz).
9. FAA notice of proposed airworthiness directive to ensure continued safety in phase 2.
10. Preparation of a proposal for long-term palliative measures in the Air Navigation Services (ANS).

5.10 United States has redefined buffer zones around major airports:



The signal-in-space approach defines a maximum level of C-band emissions of 5G that can be experienced within the volume of airspace in which aircraft are expected to operate. **C-band transmitters can be installed anywhere as long as they do not generate emissions within the protected airspace that exceed these maximum levels.**

Defining the airspace around the runways in United States where it is required to ensure that there will be no 5G band signals that may affect the radio altimeters, so the airspace model is three-dimensional, a model that is understood to indicate an aircraft may be operating and therefore this protecting airspace activities.

5.11 United States has worked on a plan to retrofit RAs, retrofitting with a new RA that coexists in the new 5G environment, or an RA integrating filters to avoid 5G interference. In this sense, it has been agreed with the telecommunications companies to maintain the mitigating measures implemented until the retrofitting of the RAs in the defined groups of aircraft is completed:

Group	Expected completion date	Modernization goal
Group 1 E145/E170/E190 Regional fleet modernization	2 November 2022	75%
Group 2 Fleet A320 A330/a340 (international)	1 December 2022 Start-up with airports not served by Group 2 aircraft 1 January 2023 All airports	Estimated 75% of the domestic fleet 40% of the international fleet
Group 3A A380/B777 fleet modernization	1 March 2023	Estimated 40% of the 3A group international fleet
Group 4 Modernized aircraft are accepted in a full 62dBm environment.	1 July 2023	75% of the total domestic/international fleet without updating will be subject to AD restrictions.

5.12 Finally, it was noted that potential issues with the implementation of 5G technology are being handled through a process managed by the FAA from United States, as follows:

1. Notification of technology deployment through an established process.
2. Assessment of potential hazards through a pre-deployment analysis.
3. Only deployment limitations based on physical obstruction criteria.
4. Establishment of airworthiness requirements.
5. There are no limitations regarding aeronautical operations due to the deployment of 5G technology.
6. Lessons learned will be taken advantage of for future implementation plans such as 6G technology and others.

5.13 The Central American Corporation for Air Navigation Services (COCESNA) shared the process that the Central American States have followed for the implementation of mitigating measures to avoid problems with radio altimeter operations.

5.14 COCESNA, through its Executive Directorate and the Technical Committee, addressed an official letter to the Directors of Aeronautics and Civil Aviation of Central America, recommending the following actions:

1. Carry out an analysis that includes the national aircraft fleet, telecommunications companies and entities in charge of spectrum management to assess the impact of this technology on aviation operations.
2. Based on the results of said impact analysis, develop and implement the necessary mitigation mechanisms to avoid interference in the operations of the radio altimeters.

3. Follow up and evaluate the mitigation measures implemented.
4. Report the results to the ICAO NACC and SAM Regional Offices at the Twentieth Meeting of GREPECAS (GREPECAS/20).

5.15 Some activities planned during the meeting of the Working Group of Specialists for Control and Monitoring of the Radioelectric Spectrum at the subregional level to coordinate are:

1. Make contact with the spectrum regulatory entities in each country to find out what is stipulated regarding the use or implementation of 5G technology, expectations of the term for implementation.
2. Approach with the telephone companies in each of the countries to learn about implementation plans and elements to consider, taking into account the risk that interference to radio altimeters may cause.
3. Contact with the personnel of the Civil Aviation Authorities of the region to find out if there are regulations in place or in progress, that regulates the implementation of 5G in the vicinity of the airports.

5.16 The actions carried out by the Central American States and COCESNA have allowed them to have a greater coordination with and between spectrum regulation entities and telecommunications companies in the different States, allowing them to develop processes to ensure that radio altimeters do not suffer interference.

5.17 ICAO stressed the importance of radio altimeter functions and of this element for actions related to alarms and safety.

5.18 It emphasized the need for the States to work more proactively in the management of aeronautical frequencies, the need to work with the regulatory entities of the radioelectric spectrum, and the importance of analyzing in a very detailed manner the information on the meeting agenda proposals of the World Radiocommunication Conference (WRC), so that, in the future, the actions that affect safety and aeronautical activity be addressed in advance and not reactively.

5.19 ICAO appreciated the participation of the States, International Organizations and the industry that supported this event, the information they shared, the lessons learned and, above all, the information shared on actions that States have carried out during the last year, which is a reflection of the result of all the regional activities that have been developed.

## **6. Results/Recommendations**

That the States,

Recommendation 1 designate personnel within the aeronautical environment to work continuously on the management of aeronautical frequencies, dedicated to the management of aeronautical frequencies and of services that operate through these frequencies.

Recommendation 2 continue with the interference mitigation activities at international airports, follow up on the results of these measures and carry on with continuous monitoring and improvement according to the analyses carried out.

Recommendation 3 share the lessons learned with other States and learn for future actions, since the evolution of technology and the implementation of services moves at a faster pace than the implementation of aeronautical services, therefore, the lessons learned will serve to work on future technology implementations.

Recommendation 4 benefit from technological developments, implementation and investment that the telecommunications companies are making, since this technological development will also lead to promote and implement other services in the aeronautical environment.

Recommendation 5 consider the importance of coexisting with other companies that provide other services through frequencies and that it is necessary to find a balance of operation and work, for which the involvement of aviation in the management of the services provided through the radio spectrum is essential to find this balance of coexistence.

## **7. Achievements**

7.1 The information delivered during the event provided important knowledge regarding the lessons learned on mitigation measures implemented and the development of activities by some States and the Industry, in addition to taking advantage of this knowledge so that the aeronautical sector is prepared for future challenges.

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North American, Central American and Caribbean Office (NACC)  
Oficina para Norteamérica, Centroamérica y Caribe (NACC)

**Online Workshop for the NAM/CAR/SAM Regions on Aviation Risk Mitigation Measures due to the  
Implementation of 5G Frequencies**  
**Taller en línea para las Regiones NAM/CAR/SAM sobre la mitigación de riesgos en la aviación debido al uso de  
frecuencias 5G**  
**(5G/Frequencies/Workshop)**

On-line, 28 February 2023 / En línea, 28 de febrero de 2023

**LIST OF PARTICIPANTS / LISTA DE PARTICIPANTES**

**ARGENTINA**

1. Moira Callegare

**BAHAMAS**

2. Earl Rahming
3. Elton Joseph
4. Grafton Rolle
5. Sheano Dorsett
6. Sterling Gibson

**BOLIVIA (PLURINATIONAL STATE OF) / BOLIVIA (ESTADO  
PLURINACIONAL DE)**

7. Arturo Lopez
8. Jaime Yuri Alvarez M.
9. Jhonny Mamani Bautista
10. José Alberto Riveros Salazar
11. Luis Garcia Garcia
12. Mauricio Yamil Tejerina Buitrago
13. Mijael Vargas
14. Omar Leon Choque Rios
15. Pablo Zarate
16. Rodrigo Tejerina Rosas
17. Serafin Rocha Gonzales
18. Stalin Dennis Ramos

**BRAZIL / BRASIL**

19. Rodrigo Vieira Machado de Moraes
20. Sergio Roberto Ferreira Machado
21. Vahe Antoine Yaghdjian
22. Wallace Gutemberg

**CANADA / CANADÁ**

23. Michel Drolet
24. Ricardo Hisano

**CAYMAN ISLANDS / ISLAS CAIMANES**

25. Cleavy Scott
26. Sean Bridle
27. Wendell Prout

**CHILE**

28. Francisco Gálvez
29. Ricardo Velasquez Aravena
30. Alfonso E. De La Vega
31. Andrés Colmenares
32. Carlos Fabián Garay
33. Carlos Javier Garcia Cano
34. Diana Marcela Arias Rojas
35. Diana Paola Morales Mora
36. Diego Andres Guarin Villabon
37. Javier Leonardo Hernández Linares
38. Jhon Herrera
39. Jhon Jaiver Sabogal Corredor
40. Jose Francisco Lozano Gacha
41. Laura Fernanda Ramirez Sanchez
42. Oscar Serrato Gomez
43. Oscar Daniel Mosquera Valderrama
44. Paola Thiriat
45. Gloria Patricia Perdomo
46. Robinson Quintero Ladino
47. William Fernando Paez Acevedo
48. Luis Felipe Uribe Echeverri

**COSTA RICA**

- 49. Luis Gonzalez
- 50. Stephen Hunt
- 51. Warren Quiros

**CUBA**

- 52. Lizet Toirac
- 53. Wendy Watson

**CURAÇAO / CURAZAO**

- 54. Glennert Riedel
- 55. Martin Beringer

**DOMINICAN REPUBLIC / REPÚBLICA DOMINICANA**

- 56. Elvis Antonio Collado Alcantara
- 57. Felix Jose Peralta Diaz
- 58. Heilyn Cruz Saldivar
- 59. Joel Alexander Soto Vasquez
- 60. Junnior Pérez Gómez

**ECUADOR**

- 61. David Minango
- 62. Jorge Zuñiga
- 63. Juan Francisco Soto
- 64. Lizeth Aldas
- 65. Mauricio Imbaquingo
- 66. Richard Jaramillo Ojeda

**EL SALVADOR**

- 67. Fredy Penado
- 68. Miguel Angel Ramos Suria
- 69. Renato Neira

**GUYANA**

- 70. Ronald Mohanram

**HAITI / HAITÍ**

- 71. Louis Fanel Telcy
- 72. Maxo Demersier
- 73. Nadia Leopold
- 74. Philippe Riche
- 75. Reginald Bien-Aime
- 76. Schiller Domond

**MEXICO / MÉXICO**

- 77. Andrés Bravo Herrera
- 78. Christian Ramírez
- 79. Daniel Brian Carrión Patrón
- 80. Daniel Conrado Castañeda Cruz
- 81. Diego Rivera
- 82. Edgar Gerardo Vázquez
- 83. Guillermo Arturo Pintor Sill
- 84. Jose Rodriguez
- 85. Julio Cesar Sosa Galindo
- 86. Miguel Angel Valles Galvan
- 87. Ricardo Orozco

**NICARAGUA**

- 88. Blanca Jarquin
- 89. Juan Carlos Morales
- 90. Luis Aleman
- 91. Silvio García

**PARAGUAY**

- 92. Carlos Castro Jara
- 93. Federico Gonzalez Bello
- 94. Hugo Andres Villalba Acosta
- 95. Jorge Ortiz
- 96. Marcos Adrian Ramirez Arce
- 97. Vicente Ramon Martínez Carreras

**SAINT VINCENT AND THE GRENADINES / SAN VICENTE Y LAS GRANADINAS**

- 98. James Ollivierre
- 99. Kazx Hackshaw

**TRINIDAD AND TOBAGO / TRINIDAD Y TABAGO**

- 100. Aaron Simon
- 101. Conrad Toby
- 102. Shiraz Gopaul

**UNITED STATES / ESTADOS UNIDOS**

- 103. Candace Keefe
- 104. Chris Hope
- 105. Jennifer Arquilla
- 106. Jessa Gottlich
- 107. Michael Linegang
- 108. Roderick DeGrate
- 109. Sergio Molas

**URUGUAY**

- 110. Horacio Berretta Kramer
- 111. Marcos Vignolo
- 112. TRIANA CARREIRA

**VENEZUELA (BOLIVARIAN REPUBLIC OF) / VENEZUELA (REPÚBLICA BOLIVARIANA DE)**

- 113. Jarumy Roserlyn Castillo Jiménez
- 114. JEAN CARLOS LOZANO GARCIA
- 115. Luis Escobar
- 116. MARIBEL MAYORA
- 117. Orlando Sanchez
- 118. Thania Marlene Goyo de Posadas

**BOEING**

- 119. Alvimar Lucena
- 120. Fabio Catani
- 121. Marcella Ost
- 122. Mike Snover

**COCESNA**

- 123. Alejandro Romero
- 124. Daniel Fernández
- 125. Gabriel Mauricio Quirós Pereira
- 126. Guillermo Cruz
- 127. Marvin Darinell Gómez Gutiérrez
- 128. MIGUEL Raxtun
- 129. Oscar Pagoada
- 130. Pablo Luna
- 131. Rodolfo Rosales
- 132. Roger Perez
- 133. Rony Montenegro

**IATA**

- 134. Jose Ruiz Llorente
- 135. Alejandro Cruz
- 136. Ana Milena Herrera Cabrera
- 137. Laura Maria Rojas Barrientos
- 138. Orlando Espinosa
- 139. Jorge Alejandro Suarez Avellaneda
- 140. Diego Sebastián Quiroga
- 141. Jaime Escobar

**PMC GLOBAL AVIATION**

- 142. Cliff Belfor

**Tigo**

- 143. Danys Rivera

**ICAO / OACI**

- 144. Julio César Siu
- 145. Mayda Ávila

## LIST OF PARTICIPANTS / LISTA DE PARTICIPANTES

Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e
<b>Argentina</b>		
<b>Moira Callegare</b> Directora de Proyectos de Navegación Aérea	ANAC Argentina	Tel. '+54 9 11 31384581 E-mail mcallegare@anac.gob.ar
<b>Bahamas</b>		
<b>Earl Rahming</b> CNS Deputy Director	Bahamas Air Navigation Services Authority (BANSAS)	Tel. (242) 377 - 2007 / (242) 376 - 0972 E-mail earl.rahming@bansdbahamas.com
<b>Eltone Joseph</b> Electronic Technician	Bahamas Air Navigation Services Authority (BANSAS)	Tel. 12424673365 E-mail eltonevey@gmail.com
<b>Grafton Rolle</b> Airworthiness Inspector	Civil Aviation Authority Bahamas	Tel. 2423974700 E-mail grafton.rolle@caabahamas.com
<b>Sheano Dorsett</b> Chief CNS Officer	Bahamas Air Navigation Services Authority (BANSAS)	Tel. 12423760861 E-mail sheano.dorsette@bansdbahamas.com
<b>Sterling Gibson</b> Inspector	Civil Aviation Authority Bahamas	Tel. E-mail sterling.gibson@caabahamas.com
<b>Bolivia (Plurinational State of) / Bolivia (Estado Plurinacional de)</b>		
<b>Arturo Lopez</b> Analista de Otorgamientos	ATT	Tel. '+591 72539796 E-mail arlopez.casas@gmail.com
<b>Jaime Yuri Alvarez M.</b> Jefe de la Unidad CNS	Dirección General de Aeronáutica Civil	Tel. '+591 72043698 E-mail jalvarez@dgac.gob.bo
<b>Jhonny Mamani Bautista</b> Supervisor Electronico	NAABOL	Tel. 59177714651 E-mail jmmb9871@gmail.com
<b>José Alberto Riveros Salazar</b> Resp. Nal. Telecomunicaciones y Telemática	NAABOL	Tel. 74039452 E-mail joseriveross@gmail.com
<b>Luis Garcia Garcia</b> Responsable Nacional De Navegacion Y Vigilancia	NAABOL	Tel. '+59170671797 E-mail lugarbol1@gmail.com
<b>Mauricio Yamil Tejerina Buitrago</b> Responsable Nacional Ayudas Visuales - Naabol	NAABOL	Tel. '+591 77124356 E-mail yamilteje@hotmail.com
<b>Mijael Vargas</b> Inspector CNS	DGAC	Tel. 72033620 E-mail ivargas@dgac.gob.bo
<b>Omar Leon Choque Rios</b> Jefe TIC	ATT	Tel. '+591-69949000 E-mail ochoque@att.gob.bo
<b>Pablo Zarate</b> Inspector II CNS	DGAC	Tel. 75386665 E-mail pzarate@dgac.gob.bo
<b>Rodrigo Tejerina Rosas</b> Encargado de Navegacion y Vigilancia	NAVEGACION AEREA Y AEROPUERTOS BOLIVIANOS	Tel. 59176033444 E-mail tejerinaroddy@gmail.com

Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e
<b>Bolivia (Plurinational State of) / Bolivia (Estado Plurinacional de)</b>		
<b>Serafin Rocha Gonzales</b> Aeropuerto Viru Viru	NAABOL	Tel. 59172149299 E-mail seramar27@gmail.com
<b>Stalin Dennis Ramos</b> Responsable C.N.S.	NAABOL	Tel. 67196867 E-mail stalin_dlr@hotmail.com
<b>Brazil / Brasil</b>		
<b>Rodrigo Vieira Machado de Moraes</b> Civil Aviation Regulation Specialist	ANAC (Brazil)	Tel. '+55 12 32036629 E-mail rodrigo.machado@anac.gov.br
<b>Sergio Roberto Ferreira Machado</b> Civil Aviation Regulation Specialist	ANAC - Civil Aviation Agency of Brazil	Tel. '+551232036704 E-mail sergio.roberto@anac.gov.br
<b>Vahe Antoine Yaghdjian</b> CNS Advisor	DECEA - Department of Airspace Controle	Tel. E-mail vahe.antoine@gmail.com
<b>Wallace Gutemberg</b> CNS Advisor	DECEA	Tel. E-mail gutembergwgml@gmail.com
<b>Canada / Canadá</b>		
<b>Michel Drolet</b> Air Navigation Standards and Aviation Spectrum Advisor	Transport Canada	Tel. E-mail michel.drolet@tc.gc.ca
<b>Ricardo Hisano</b> Engineer	Transport Canada	Tel. 438-465-9481 E-mail ricardo.hisano@tc.gc.ca
<b>Cayman Islands / Islas Caimanes</b>		
<b>Cleavy Scott</b> Maintenance Program Coordinator	Cayman Islands Airports Authority	Tel. E-mail cleavy.scott@caymanairports.com
<b>Sean Bridle</b> CNS Manager	Cayman Islands Airports Authority	Tel. E-mail sean.bridle@caymanairports.com
<b>Wendell Prout</b> Electronic Engineering Officer	Cayman Islands Airports Authority	Tel. E-mail wendell.prout@caymanairports.com
<b>Chile</b>		
<b>Francisco Gálvez</b> Ingeniero de Mantenimiento	DGAC CHILE	Tel. E-mail francisco.galvez@dgac.gob.cl
<b>Ricardo Velasquez Aravena</b> Jefe Servicios de Vuelo - Administración Frecuencias Aeronáuticas	DGAC - Chile	Tel. '+56 9 773400 48 E-mail rvelasquez@dgac.gob.cl
<b>Alfonso E. de la Vega</b> Asesor de Navegación Aérea	DGAC	Tel. '+569 89230386 E-mail adelavega@dgac.gob.cl

Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e
<b>Colombia</b>		
<b>Andrés Colmenares</b> Coordinador Grupo Comunicaciones y Redes Aeronáuticas	Aeronáutica Civil de Colombia	Tel. 5.7317860629e+11 E-mail andres.colmenares@aerocivil.gov.co
<b>Carlos Fabián Garay</b> Coordinador de Monitoreo de Televisión Radiodifundida	Agencia Nacional del Espectro	Tel. 3166699709 E-mail carlos.garay@ane.gov.co
<b>Carlos Javier García Cano</b> Coordinador Grupo Servicios de Tránsito Aéreo Regional Occidente	Aeronáutica Civil	Tel. E-mail carlos.garciac@aerocivil.gov.co
<b>Diana Marcela Arias Rojas</b> Asesora Despacho Ministra	3153051880	Tel. 3153051880 E-mail dmarias@mintic.gov.co
<b>Diana Paola Morales Mora</b> Subdirector de Gestión y Planeación Técnica del Espectro	Agencia Nacional del Espectro	Tel. 3043272666 E-mail dianapa.morales@gmail.com
<b>Diego Andres Guarín Villabon</b> Subdirección de Vigilancia y Control	Agencia Nacional del Espectro	Tel. 3016581980 E-mail diegoguarin@gmail.com
<b>Javier Leonardo Hernández Linares</b> Profesional Especializado	MinTIC	Tel. 3015505326 E-mail jhernandezl@mintic.gov.co
<b>Jhon Herrera</b> Controlador Aéreo	Aeronautica Civil de Colombia	Tel. 3106297776 E-mail jhon.herrera.r@gmail.com
<b>Jhon Jaiver Sabogal Corredor</b> Coordinador Grupo Gestión de Servicios de Tránsito Aéreo	Aeronáutica Civil de Colombia	Tel. E-mail jhon.sabogal@aerocivil.gov.co
<b>Jose Francisco Lozano Gacha</b> Profesional	Agencia Nacional del Espectro	Tel. 3013309051 E-mail josefrancolozanog@gmail.com
<b>Laura Fernanda Ramirez Sanchez</b> Técnico ATSEP	Aeronáutica civil de Colombia	Tel. 3204116468 E-mail laura.ramirez@aerocivil.gov.co
<b>Oscar Serrato Gomez</b> Controlador de Transito Aéreo	aerocivil	Tel. 3014184857 E-mail oscar.serrato@aerocivil.gov.co
<b>Oscar Daniel Mosquera Valderrama</b> Controlador Radar Cali	UAEAC	Tel. E-mail oscarmosquera2007@gmail.com
<b>Paola Thiriat</b> Coordinadora del GIT de Gestión de Espectro Radioeléctrico	MinTIC	Tel. 3105805014 E-mail pthiriat@mintic.gov.co
<b>Gloria Patricia Perdomo</b> Subdirectora para la Industria de Comunicaciones	Mintic	Tel. 3204500684 E-mail gperdomo@mintic.gov.co

Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e
<b>Colombia</b>		
<b>Robinson Quintero Ladino</b> Ingeniero de Comunicaciones	AEROCIVIL COLOMBIA	Tel. 3002188209 E-mail robinson.quintero@aerocivil.gov.co
<b>William Fernando Paez Acevedo</b> Aeronavegacion occidente	UAE Aerocivil	Tel. 3006850366 E-mail william.paez@aerocivil.gov.co
<b>Luis Felipe Uribe Echeverri</b> Especialista infraestructura aeroportuaria	Fuerza aérea colombiana	Tel. +3186094856 E-mail luis.uribe@fac.mil.co
<b>Costa Rica</b>		
<b>Luis Gonzalez</b> Inspector Aeronáutico	Dirección General de Aviación Civil	Tel. E-mail lgonzalez@dgac.go.cr
<b>Stephen Hunt</b> CNS Consultant	DC-ANSP	Tel. '+15065317448 E-mail huntsv@hotmail.com
<b>Warren Quiros</b> Inspector CNS	DGAC Costa Rica	Tel. E-mail wquiros@hotmail.com
<b>Cuba</b>		
<b>Lizet Toirac</b> Especialista CNS	Instituto de Aeronáutica Civil de Cuba	Tel. (53) 78381121 E-mail IACC_lizet_toirac@icao.int
<b>Wendy Watson</b> Especialista CNS	Instituto de Aeronáutica Civil de Cuba	Tel. (53) 78381121 E-mail IACC_lizet_toirac@icao.int
<b>Curaçao / Curazao</b>		
<b>Glennert Riedel</b> Technical Affairs Officer	Bureau Telecommunicatie en Post	Tel. E-mail g.riedel@burtel.cw
<b>Martin Beringer</b> CNS Consultant	DC-ANSP	Tel. (599-9) 8393-550 E-mail m.beringer@hotmail.nl
<b>Dominican Republic / República Dominicana</b>		
<b>Elvis Antonio Collado Alcantara</b> Encargado de Comunicaciones de Radio	IDAC	Tel. 809-315-6931 E-mail ecollado@idac.gov.do
<b>FELIX JOSE PERALTA DIAZ</b> ENCARGADO DE LA SECCION DE COMUNICACIONES DE RADIO ACC-AB	Instituto Dominicano de Aviacion Civil, (IDAC)	Tel. E-mail felix.peralta@idac.gov.do
<b>Heilyn Cruz Saldivar</b> Tecnico de Redes	Cuerpo especializado en Seguridad Aeroportuaria y de la Aviación Civil (CESAC)	Tel. E-mail heilyncruz@gmail.com
<b>Joel Alexander Soto Vasquez</b> Soporte Técnico de Informática	CESAC	Tel. E-mail joelalexandersotovasquez@gmail.com
<b>Junnior Pérez Gómez</b> Soporte técnico de informática	CESAC	Tel. E-mail juniorperez@hotmail.es

Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e
<b>Ecuador</b>		
<b>David Minango</b> Especialista CNS	Dirección General de Aviación Civil - Ecuador	Tel. 593-2947400 E-mail davidminango@aviacioncivil.gob.ec
<b>Jorge Zuñiga</b> Air Traffic Controller	DGAC	Tel. E-mail jorge.zuniga@aviacioncivil.gob.ec
<b>Juan Francisco Soto</b> SMS ATSP	DGAC	Tel. E-mail radaratcjs@gmail.com
<b>Lizeth Aldas</b> Especialista ATM	Dirección General de Aviación Civil - Ecuador	Tel. E-mail lizlimatc@gmail.com
<b>Mauricio Imbaquingo</b> Controlador Aproximación	Dirección General De Aviación Civil	Tel. E-mail mauricio.imbaquingo@aviacioncivil.gob.ec
<b>Richard Jaramillo Ojeda</b> Controlador Radar	Dirección General de Aviación Civil	Tel. E-mail rivanjao@gmail.com
<b>El Salvador</b>		
<b>Fredy Penado</b> Inspector de Operaciones e Ingeniería	Autoridad de Aviación Civil	Tel. E-mail fpenado@aac.gob.sv
<b>Miguel Angel Ramos Suria</b> Inspector CNS	Autoridad de Aviación Civil	Tel. E-mail miguel.suria.777@gmail.com
<b>Renato Neira</b> Encargado de Ingeniería Aeronáutica	Autoridad de Aviación Civil	Tel. E-mail renatoneiraleon@gmail.com
<b>Guyana</b>		
<b>Ronald Mohanram</b> CNS Technician 11	Guyana Civil Aviation Authority	Tel. E-mail ronal902002@yahoo.com
<b>Haiti / Haití</b>		
<b>Louis Fanel TELCY</b> Technician	OFNAC	Tel. 50936421781 E-mail telcyfa03@gmail.com
<b>Maxo Demersier</b> Electronician	Office National de l'Aviation Civile (OFNAC)	Tel. 49243155 E-mail dmax105@yahoo.com
<b>Nadia Leopold</b> Air-Ground Ground-Ground Communications Unit	OFNAC-Haiti	Tel. 50937711287 E-mail nleopold@hotmail.com
<b>Philippe Riche</b> Deputy Air Navigation	Office National de l'aviation civile (OFNAC)	Tel. '+5093121-0009 E-mail riche.philippe@ofnac.gouv.ht
<b>Reginald Bien-Aime</b> technicien	OFNAC	Tel. '+50937066210 E-mail bienaimereginald15@gmail.com
<b>Schiller DOMOND</b> Technicien CNS	OFNAC	Tel. 509 36533254 E-mail schillerdomond@yahoo.fr



Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e
<b>Mexico / México</b>		
<b>Andrés Bravo Herrera</b> Procedure design specialist	SENEAM	Tel. 5526782271 E-mail asbravo25@gmail.com
<b>CHRISTIAN RAMÍREZ</b> Jefe de División	AFAC	Tel. E-mail christian.ramirez@afac.gob.mx
<b>Daniel Brian Carrión Patrón</b> Tecnico Aeronautico Calificado	SENEAM	Tel. 5539921539 E-mail ingenierobrian9@gmail.com
<b>Daniel Conrado Castañeda Cruz</b> Inspector Verificador Aeronáutico	Agencia Federal de Aviación Civil	Tel. 5514867197 E-mail daniel.castaneda@afac.gob.mx
<b>Diego Rivera</b> Safety Manager	Agencia Federal de Aviación Civil	Tel. E-mail diego.rivera@afac.gob.mx
<b>Edgar Gerardo Vázquez</b> Especialista en diseño de procedimientos de vuelo	SENEAM	Tel. 5545282295 E-mail Gerardovazquez_hdez@outlook.com
<b>Guillermo Arturo Pintor Sill</b> Jefe de Sistemas de Vigilancia Aérea	SENEAM	Tel. 5532537708 E-mail arturopintorsill@hotmail.com
<b>Jose Rodriguez</b> Navigation Services Supervisor	SENEAM	Tel. 5584289240 E-mail cheporodm45@gmail.com
<b>Julio Cesar Sosa Galindo</b> Inspector SMS/SSP	Agencia Federal de Aviación Civil	Tel. E-mail julio.sosa@afac.gob.mx
<b>Miguel Angel Valles Galvan</b> Técnico en Comunicaciones	SENEAM	Tel. 5525631622 E-mail mavalles@gmail.com
<b>Ricardo Orozco</b> Especialista en Comunicaciones	SENEAM	Tel. 5561119838 E-mail ricardo.orozco.delg@hotmail.com
<b>Nicaragua</b>		
<b>Blanca Jarquin</b> Operadora de Radio y Telecomunicaciones	Empresa Administradora de Aeropuertos Internacionales EAAI	Tel. '+505 22768580 E-mail inacvirtual.alba@gmail.com
<b>Juan Carlos Morales</b> Asesor de la Dirección de Calidad y Monitoreo de Radioeléctrico	TELCOR	Tel. +505 22768580 E-mail inacvirtual.carlosulloa@gmail.com
<b>Luis Aleman</b> Inspector CNS	Instituto Nicaragüense de Aeronáutica Civil - INAC	Tel. '+505 84123560 E-mail inacvirtual@gmail.com
<b>Silvio García</b> Técnico en Telecomunicaciones.	Fuerza Aerea	Tel. '+505 22768580 E-mail inacvirtual.salalegal@gmail.com

Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e
<b>Paraguay</b>		
<b>Carlos Castro Jara</b> Jefe de seccion	Dinac	Tel. '+595981884404 E-mail carcastrojara@gmail.com
<b>Federico Gonzalez Bello</b> ATSEP	Dirección Nacional de Aeronáutica Civil	Tel. E-mail cfgonzalez@dinac.gov.py
<b>Hugo Andres Villalba Acosta</b> Inspector de Operaciones	Dirección Nacional de Aeronautica Civil	Tel. '+595 981923000 E-mail hvillalba@dinac.gov.py
<b>Jorge Ortiz</b> Encargado de la Gerencia de Operaciones	Dirección Nacional de Aeronáutica Civil	Tel. E-mail jortiz@dinac.gov.py
<b>Marcos Adrian Ramirez Arce</b> Dpto. CNS/GNNA	DINAC	Tel. '+59594881400 E-mail mramirez@dinac.gov.py
<b>Vicente Ramon Martínez Carreras</b> Sección NAV/CNS	DINAC	Tel. '+59591716177 E-mail vicentemartinezcarreras@gmail.com
<b>Saint Vincent and the Grenadines / San Vicente y las Granadinas</b>		
<b>James Ollivierre</b> Senior Air Traffic Controller	Civil Aviation Department	Tel. 17845324938 E-mail jaysyl2009@gmail.com
<b>Kazh Hackshaw</b> AIS Assistant	Civil Aviation	Tel. 1784-5322020 E-mail hackshaw_kaz@hotmail.com
<b>Trinidad and Tobago / Trinidad y Tabago</b>		
<b>Aaron Simon</b> Telecommunications Engineer	Telecommunications Authority of Trinidad and Tobago	Tel. +868 481-7930 E-mail Asimon@tatt.org.tt
<b>Conrad Toby</b> Manager Spectrum, Planning & Broadcasting	Telecommunications Authority of Trinidad and Tobago	Tel. 8687694395 E-mail CToby@tatt.org.tt
<b>Shiraz Gopaul</b> CASI - CNS	Trinidad and Tobago Civil Aviation Authority	Tel. E-mail sgopaul@caa.gov.tt
<b>United States / Estados Unidos</b>		
<b>Candace Keefe</b> Manager	FAA	Tel. 405.474.0019 E-mail
<b>Chris Hope</b> Division Manager	FAA	Tel. 1-202-263-9296 E-mail Chris.Hope@faa.gov
<b>Jennifer Arquilla</b> Director, Aviation Safety International	US Federal Aviation Administration	Tel. 202267862 E-mail
<b>Jessa Gottlich</b> Foreign Affairs Specialist	FAA	Tel. 202-267-6433 E-mail Jessa.S.Gottlich@faa.gov;
<b>Michael Linegang</b> Manager, Operational Safety	FAA	Tel. 202-527-2034 E-mail michael.linegang@faa.gov;
<b>Roderick DeGrate</b> Air Traffic Safety Inspector	US Federal Aviation Administration	Tel. 8172225358 E-mail
<b>Sergio Molas</b> Aviation safety inspector	AOV	Tel. 4123351318 E-mail

Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e
<b>Uruguay</b>		
<b>Horacio Berretta Kramer</b> Asesor Técnico	DINACIA	Tel. '+59899397173 E-mail horaciobk@gmail.com
<b>Marcos Vignolo</b> Asesor / Inspector ANS/CNS	DINACIA - URUGUAY	Tel. E-mail mvignolo@dinacia.gub.uy
<b>Triana Carreira</b> Directora de Seguridad de Vuelo	DINACIA	Tel. E-mail triana.carreira@dinacia.gub.uy
<b>Venezuela (Bolivarian Republic of) / Venezuela (República Bolivariana de)</b>		
<b>Jarumy Roserlyn Castillo Jiménez</b> Gerente de Mantenimiento SNA	Instituto Nacional de Aeronáutica Civil	Tel. '+58 424 3549924 E-mail jarumycastillo@gmail.com
<b>Jean Carlos Lozano Garcia</b> Jefe del ACC	INAC/SNA	Tel. '+58 4167226428 E-mail jclozgar94@gmail.com
<b>Luis Escobar</b> Coordinación Comunicación CNS	INAC-SNA	Tel. '+584142532204 E-mail escoguil5@gmail.com
<b>Maribel Mayora</b> Coordinadora ATS	INAC	Tel. E-mail maribelmayora@gmail.com
<b>Orlando Sanchez</b> MET	INAC	Tel. E-mail osanz1974@gmail.com
<b>Thania Marlene Goyo de Posadas</b> Jefe de Operaciones ACC Maiquetia	INAC	Tel. '+58 4243646326 E-mail thania.goyo@inac.gob.ve
<b>Boeing</b>		
<b>Alvimar Lucena</b> Regulatory Affairs Specialist	Boeing	Tel. '+5512996461023 E-mail alvimar.lucena@boeing.com
<b>Fabio Catani</b> Aviation Safety Manager - Latin America & Caribbean	Boeing	Tel. '+55 (12) 99618-4978 E-mail fabio.catani@boeing.com
<b>Marcella Ost</b> Director, Spectrum Policy & Regulatory Affairs	Boeing	Tel. E-mail marcella.s.ost@boeing.com
<b>Mike Snover</b> Director Latin America and Caribbean	Boeing	Tel. '+5512996487497 E-mail michael.r.snover@boeing.com
<b>COCESNA</b>		
<b>Alejandro Romero</b> Gestor técnico	COCESNA	Tel. '+50433828922 E-mail alejandro.romero@cocesna.org
<b>Daniel Fernández</b> Ingeniero en Mantenimiento	COCESNA	Tel. E-mail daniel.fernandez@cocesna.org
<b>Gabriel Mauricio Quirós Pereira</b> Gerente Técnico	COCESNA	Tel. '+50670195522 E-mail gabriel.quirós@cocesna.org

Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e
<b>COCESNA</b>		
<b>Guillermo Cruz</b> Gestor técnico	COCESNA	Tel. 502 55560366 E-mail gicm.1977@gmail.com
<b>Marvin Darinell Gómez Gutiérrez</b> Ingeniero Inspector en vuelo	COCESNA	Tel. 52019496 E-mail mdgomez07@gmail.com
<b>Miguel Raxtun</b> Tecnico Aeronautico	COCESNA	Tel. 22606362 E-mail miguel.raxtun@cocesna.org
<b>Oscar Pagoada</b> Ingeniero de Mantenimiento	COCESNA	Tel. +(504)98190713 E-mail oscar.pagoada@cocesna.org
<b>Pablo Luna</b> Coordinador SMS	COCESNA	Tel. 98763705 E-mail pablo.luna@cocesna.org
<b>Rodolfo Rosales</b> Coordinador Técnico	COCESNA	Tel. +50583799778 E-mail rodolfo.rosales@cocesna.org
<b>Roger Perez</b> Gerente Senior ACNA	COCESNA	Tel. +50422757090 E-mail roger.perez@cocesna.org
<b>Rony Montenegro</b> Gerente de Estación Guatemala	COCESNA	Tel. E-mail rony.montenegro@cocesna.org
<b>IATA</b>		
<b>Jose Ruiz Llorente</b> Regional Director, Operations, Safety and Security, The Americas	IATA	Tel. E-mail ruizjo@iata.org
<b>Alejandro Cruz</b> Operational Safety & Quality Assurance Manager	AeroRepública	Tel. 3506754706 E-mail alecruz@copair.com
<b>Ana Milena Herrera Cabrera</b> Directora de Seguridad Operacional	Aerosucre S.A	Tel. +57 3233264832 E-mail direccionesms@aerosucre.com.co
<b>Laura Maria Rojas Barrientos</b> Coordinadora de Seguridad Operacional	Aerosucre S.A	Tel. +57 3017601111 E-mail seguridadoperacional@aerosucre.com.co
<b>Orlando Espinosa</b> Gerente SMS	Aerosucre S.A	Tel. +57 3153628072 E-mail orlando1_co@yahoo.com
<b>Jorge Alejandro Suarez Avellaneda</b> SMS Manager	Avianca	Tel. E-mail jorge.suarezavellaneda@aviancaexpress.com
<b>Diego Sebastián Quiroga</b> NEP	Satena	Tel. E-mail ingaeronauticoquiroga@gmail.com
<b>Jaime Escobar</b> Pilot	Ultraair	Tel. 3144117241 E-mail jaimeoesobar@hotmail.com
<b>PMC Global Aviation</b>		
<b>Cliff Belfor</b> Consultant, Strategist & Aviation Specialist	PMC Global Aviation	Tel. +59995137387 E-mail cbelfor@pmcglobal.net

Name / Position Nombre / Puesto	Administration / Organization Administración / Organización	Telephone / E-mail Teléfono / Correo-e	
<b>Tigo</b>			
<b>Danys Rivera</b> Opetation Manager	TIGO	Tel.	99340002
		E-mail	danys.rivera@tigo.com.hn
<b>ICAO / OACI</b>			
<b>Julio César Siu</b> Acting Regional Director	ICAO / OACI	Tel.	+ 52 55 5250 3211
		E-mail	jsiu@icao.int
<b>Mayda Ávila</b> Regional Officer, Communications, Navigation and Surveillance / Especialista Regional en Comunicaciones, Navegación y Vigilancia	ICAO / OACI	Tel.	5574741159
		E-mail	mavila@icao.int