INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

REPORT OF

EIGHTH MEETING OF THE COMMON AERONAUTICAL VIRTUAL PRIVATE NETWORK OPERATIONS GROUP (CRV OG/8)

Video Tele-Conference (VTC)
(17 to 19 May 2021)

The views expressed in this Report should be taken as those of the Meeting and not the Organization.

Approved by the Meeting
And published by the ICAO Asia and Pacific Office, Bangkok

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1. Introduction

1.1 The Eighth Meeting of the Common aeRonautical Virtual Private Network Operations Group of APANPIRG (CRV OG/8) was held via video tele-conference from *17 to 19 May 2021*.

2. Attendance

2.1 The meeting was attended by **97** participants from **22** States/Administration, **3** industries including Australia, Bhutan, Cambodia, China, Hong Kong China, Fiji Islands, France, India, Indonesia, Japan, Malaysia, Mongolia, Nepal, New Zealand, Pakistan, Philippines, Republic of Korea, Russian Federation, Singapore, Thailand, USA, Viet Nam, Aireon, a member of ICCAIA, Frequentis and PCCW Global via video conference. List of participants is at **Attachment 1**.

3. Opening of the Meeting

3.1 The meeting was opened by the Co-Chair of CRV OG, Mr. Kelepi Dainaki, Manager Air Navigation Engineering Services, Fiji Airport Limited. Mr. Kelepi Dainaki welcomed all participants, recalled the achievement made in CRV OG/7 and the main tasks that need to deal with by the CRV OG/8. He appreciated Mr. Terence Palmer, the former CRV OG Co-Chair (Asia) from Airservices, Australia and Mr. Li Peng, retired Regional Officer (CNS) of ICAO APAC Regional Office, for their contribution to the implementation and operation of CRV project. Furthermore, he extended warm welcome to all participants and expressed deep appreciation and gratitude to the efforts of all parties to make great achievements and expressed his thanks to the ICAO Secretariat for hard work.

3.2 Mr. Luo Yi, Regional Officer CNS highlighted the value of CRV implementation in the region and its role for SWIM Implementation. He extended warm welcome to all participants and expressed deep appreciation and gratitude to the efforts of co-chairs and all parties in supporting the setting up of this CRV OG/8 on-line meeting without compromising the values to the air navigation implementation in States.

4. Officers and Secretariat

4.1 Mr. Kelepi Dainaki, Manager Air Navigation Engineering Services, Fiji Airport Limited, and Mr. Vaughan Hickford, Team Leader Network Design, Airways New Zealand co-chaired the meeting. Mr. Luo Yi, Regional Officer CNS and Ms. Soniya Nibhani, Regional Officer ANS (CNS) Implementation, ICAO Asia and Pacific Regional Office, acted as secretary for the meeting with the support of Ms. Bhabhinan Sirapongkosit, the Programme Assistant of the same office.

5. Organization, Working Arrangements and Language

5.1 The CRV OG/8 met as a single body during the meeting. The working language for the meeting was English inclusive of all documentation and this Report. The meeting considered **Thirteen** (13) Working Papers, **Sixteen** (16) Information Papers, **Two** (2) Presentations including one for the CRV Service Report of PCCW Global (PCCWG) for 2020, and **One** (1) Flimsy under its twelve agenda items. A List of Working Papers and Information Papers is provided at **Attachment 2.**

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Agenda Item 1: Adoption of Agenda

Adoption of Agenda- Sec (WP/01)

1.1 The tentative agenda items presented in **WP/01** were adopted as agenda for the meeting.

Agenda Item 2: Election of Co-Chair (Asia)

2.1. Mr. Vaughan Hickford, Team Leader Network Design, Airways New Zealand was nominated by Fiji, seconded by Philippines and elected as the new Co-Chair (Asia) of the CRV OG.

2.2. Mr. Vaughan Hickford expressed his appreciation to the meeting for his nomination and selection as the Co-Chair (Asia) of CRV OG. He mentioned that he has been involved in CRV since 2014 and there are a lot of work to do towards successful CRV Implementation. He expressed that working together we can progress greatly and can achieve several milestones.

Agenda Item 3: Review outcomes of relevant meetings

Outcome of Relevant Meetings on Surveillance- Sec (WP/02)

3.1. The paper summarized relevant information and updates with the highlight on the reviewed outcomes of CRV OG/7, ACSICG/7, SWIM TF/4 and relevant discussions of other meetings of CNS SG/24 and APANPIRG/31.

3.2. The CNS SG/24 meeting adopted **eight** (8) Conclusions and **five** (5) Decisions. In addition, based on the outcome of discussions on various agenda items, the CNS SG/24 meeting developed four (4) Draft Conclusions for consideration by APANPIRG/31 Meeting, which was adopted by APANPIRG/31. The meeting noted Conclusion/Decision adopted by CNS SG/24 and also reviewed the different Conclusions and Decisions adopted by APANPIRG/31 in December 2020 of interest to the group and discussed the follow-up.

3.3. The Meeting was informed that with reference to the ***Decision CNS SG/24/16 (SURICG/5/1)*** - Establishment of Study Group under SURICG on Sharing of Surveillance Data in SWIM of APANPIRG/31. First meeting of surveillance data study group (SURSG/1) was held from *20– 22 April 2021*. Meeting was informed that SURSG/1 meeting report, working papers, information papers, and other resources can be accessed by following link: https://www.icao.int/APAC/Meetings/Pages/2021-SURSG-1.aspx.

Agenda Item 4: CRV OG Operations Manual

CRV OG Operational Manual- New Zealand (WP/03 and SP/02)

4.1. New Zealand presented an overview of the CRV Operations Manual covering the location, layout and content.

4.2. The CRV OG Operations Manual is an informal publication prepared by the CRV Task Force intended to provide an easy reference for interested parties, a consolidation of material particularly of a procedural nature, about the work of the CRV OG and its contributory bodies. It contains the Terms of Reference of the CRV OG established by APANPIRG Decision 27/34, the working arrangements, and internal instructions developed by the Group for the practical application of its Terms of Reference. Thus, the document describes: Terms of Reference; Composition; Position within ICAO; Working Arrangements; Rules of Procedure and Practices governing the Conduct of Business.

4.3. A presentation described about what is the Operations Manual, where it can be accessed by member states, and brief description of its content. The paper also described the layout of operational manual and how Changes to text will be identified. It was informed that The Operations Manual will be distributed to Members and Observers of APANPIRG, the ICAO Secretariat, to other States and international organizations participating in meetings, contributing and to, or having interest in the work of the CRV OG and/or its Contributory Bodies. .

4.4. The meeting reiterated that the CRV OG Operations Manual is of procedural nature which is owned and managed by CRV OG. The ICAO APAC Office provides secretariat support to CRV OG meetings and publish the Manual once it had been adopted by CNS SG on behalf of APANPIRG. The CRV OG Operations Manual (Edition 1.0) is provided in **Appendix A** to this Report and also accessible at: https://www.icao.int/APAC/Pages/eDocs.aspx under CNS section.

4.5. The CRV Operations Manual is also a living document, which needs to be continuously monitored and revised in an ongoing basis by the CRV OG with the implementation and operation of CRV. The up-to-date Operations Manual is located in the APAC CRV Portal hosted in the Airways New Zealand O365 environment located here: https://airwayscorporation.sharepoint.com/:w:/r/teams/APACCRV/Shared%20Documents/Operations%20Manual/Current%20Version/APAC%20CRV%20Operations%20Manual.docx?d=w3b36e5c790d44e0eb7b48941ee4f2386&csf=1&web=1&e=Pm3KVB

CRV Implementation Plan- IP Addressing Scheme for Third Party Service Provider- Singapore (WP/04)

4.6. Singapore presented the Internet Protocol (IP) addressing scheme for third party service providers, e.g. AIREON LLC providing Automatic Dependent Surveillance- Broadcast (ADS-B) data over the CRV and proposed the amendments to the CRV Implementation Plan.

4.7. The IPv4 addressing scheme in the CRV Implementation Plan was agreed to be used in the Asia Pacific region and was concluded through APANPIRG/21 Conclusion 21/22- Asia / Pacific ATN Interim Addressing Plan. It was informed that in the development of the IPv4 addressing scheme, a flexible margin had been designated so that it will allow future growth or change.

4.8. Through Decision CRV OG/6/2, the process for connecting third party service providers and service consumers to the CRV was adopted by the CRV OG/6 meeting. However, the IP addresses for third party service providers to deliver services over the CRV were not allocated.

4.9. In late 2020, the ad hoc CRV OG, including Fiji, New Zealand and Singapore, agreed to use 10.46.0.1 to 10.46.255.254 IP range, for the allocation of IP addresses to third party service providers. Each third party service provider can be assigned with 254, 510, 764 or 1022 usable network addresses but depending on third party service providers' technical specifications. Based on which third party service providers, namely AIREON LLC and PCCWG, were allocated with /24 IP address blocks. PCCWG and Aireon informed the meeting that the IP addresses provided to them are good enough.

4.10. With aforementioned, the meeting agreed to formulate the following Draft Conclusion for the consideration by the ACSICG/8 meeting.

<table>
<tr><td colspan="3">Draft Conclusion CRV/08/01 – CRV Implementation Plan amendment (Version 2.1, Attachment A)</td></tr>
<tr><td colspan="2">What: That, the CRV Implementation Plan be amended to include the following new text in paragraph 2.4.2 – IP Addressing

iii. In the development of the IPv4 plan, a flexible margin has been designated to allow future growth or change. Through draft Conclusion CRV OG/8/01, using 10.46.0.1 to 10.46.255.254, each third party Service Provider (e.g. AIREON LLC providing Automatic Dependent Surveillance - Broadcast data over CRV) is assigned 254, 510, 764 or 1022 usable Network addresses (depending on Service Providers' technical requirements); and</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To allocate IP addresses to third party service providers for the delivery of services over CRV</td><td colspan="2">Follow-up: ☒Required from States</td></tr>
<tr><td>When: 21-Jun-21</td><td colspan="2">Status: Draft to be adopted by Subgroup</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☐APAC States ☐ICAO APAC RO ☐ICAO HQ ☒Other: ACSICG</td></tr>
</table>

4.11. The proposed *CRV Implementation Plan amendment (Version 2.1*) is provided in **Appendix B** to this Report.

CRV Landing page- New Zealand (WP/05)

4.12. New Zealand presented implementation of a CRV landing page on the APAC ICAO website to provide information about CRV and how to join CRV. The meeting was informed that it was an action in response to **Decision CNS SG/24/5**. The location and content of the landing page was proposed and agreed by the meeting, which is provided in **Appendix C** to this Report, and is to be implemented by the ICAO APAC Regional Office IT Team at: https://www.icao.int/APAC/Pages/default.aspx.

Creation of expert groups within CRV OG along the lines of Strategy, Design, Transition and Operations- New Zealand (WP/12)

4.13. New Zealand presented a proposal to implement expert groups within the CRV OG for the purposes of increasing member participation outside the OG meetings and to provide the ability to turn around decisions and changes quicker than waiting for the OG meeting. It was emphasized that the CRV OG is a self-administering body provided by all APAC Member States/Administration and currently the CRV OG meets twice per year and Ad Hoc groups/meetings are being held as required.

4.14. As APAC region is in the early stage of implementing CRV, there is more work required in the establishment of both the network and the Polices, Process and Procedures required to administer the network. Other networks similar to APAC CRV, such as New PENS and REDDIG II, run separate governing bodies or administrators.

4.15. The APAC solution is to create Sub-Groups within the OG along the lines of Strategy, Design, Transition, and Operations. Continuous Service Improvement would continue as the wider group lead by the Co-Chairs. The groups make up and responsibilities will be recorded in the Operations Manual. It was further suggested that each group would be made up of a small number, possibly 3 or 4 of members of the Operations Group, and be responsible for the advancement, documentation and reporting to the Operations Group on that section. Volunteers would be called for each group at each Operations Group meeting. The member States/Administration volunteered for four expert group are as follows:

SN	Expert Group Name	Volunteered Member	Group leader
1	Service Strategy	Singapore, USA, India	New Zealand/Fiji
2	Service Design	Singapore, USA, Hong Kong China	New Zealand/Fiji
3	Service Transition	China, Singapore	New Zealand/Fiji
4	Service Operations	Australia, China, Singapore, India	New Zealand/Fiji

4.16. The meeting was informed that the four expert groups defined above were considered as *an Action Item* in the CRV Operational Manual adopted by CNS SG, which can be understood as *completed Action Item* after formation of four expert groups. PCCWG committed to provide necessary support to expert group upon request by CRV OG member. The list of experts for these groups is provided in **Appendix D** to this Report.

Agenda Item 5: CRV operational performance report

Latest CRV operational performance report- PCCWG (SP/01)

5.1. PCCWG shared Latest CRV Updates and CRV Network Yearly Service Review. PCCWG informed that there are *38 circuits* in *26 cities* with different CRV packages, A, B+, C+, C and D. There are 2 service providers in the CRV network and 3 sites (B+, C) are under implementation. It was further informed that 8 cities are planning to join CRV in 2021 which are *Mumbai (India), Jakarta (Indonesia), Makassar (Indonesia), Bangkok (Thailand), Moscow (Russia), Khabarovsk (Russia), New Caledonia, and French Polynesia.*

5.2. The meeting was informed that Standard CRV contractual period is 5 years and all authorities should join CRV network before 31 December 2022. *Additional charges* may apply to new users with billing start date later than 31 December 2022. The meeting requested the ICAO Secretariat to issue a State Letter to APAC member States to remind about the CRV joining deadline by States by the end of 2021 and to inform about potential additional charges.

5.3. Additionally, PCCWG shared 2020 Site Availability, 2020 Ticket Type Distribution, 2020 Number of Ticket Reported by States, 2020 Ticket Overview and incidents.

5.4. China asked about the status of Mongolia for CRV Implementation. PCCWG informed that Mongolia was in contact for initial years on the topic while they have not discussed about CRV Implementation in last few years.

5.5. PCCWG informed the meeting that within 5 years programme of CRV, member states may upgrade the package selected but cannot downgrade.

5.6. Bhutan shared the challenging situation since its CRV implementation as per the commitment to ICAO APAC common regional target while the peer States with Bhutan are in process to join CRV. Therefore, Bhutan is not able to utilize the CRV while they have to pay recurring charges every month to PCCWG. Bhutan requested the ICAO APAC Regional Office and CRV OG to help in negotiating with PCCWG to waive or reduce recurring charge till the peer States (India and Thailand) are ready. Bhutan also requested the ICAO APAC Regional Office to discuss for alternate solutions such as connection through Hong Kong, China or any other States hosting BBIS, which have joined CRV, in order to utilize CRV for AMHS traffic by Bhutan for the intended purpose. The meeting agreed to establish an ad hoc group to explore Bhutan's issue. The ICAO Secretariat will coordinate with Bhutan, Hong Kong China, Singapore, co-chairs of CRV OG, ACSICG chair and other concerned parties to set up on line discussion for addressing the issue before ACSICG/8 meeting.

In Case Of CRV Core Network Failure- Japan (IP/05)

5.7. Japan shared an experience of CRV Core network failure and proposed its measures. On 8th March 2021, Japan experienced an incident where the line did not switch automatically when a CRV network failure occurred. There are three PoP sites in Japan and JCAB contracts four package A on three sites. At the time of incident, the core router installation work was being conducted at Osaka PoP site and LAN cables were accidentally disconnected from core router. By this accident, three main lines over package A had been downed and the line did not change to sub-lines automatically. Accordingly, JCAB ATSEP staff manually changed from the main route to the sub route by disconnecting the cable from main CE router.

5.8. Japan informed that as per PCCWG, in case of CE-router and PE-router alive, the connection does not switch automatically, and this is the design policy for CRV network. This means that if core network downed of some PoP site, CRV traffic will not be automatically diverted even if we contract Package A and the traffic should be diverted to another PoP site appropriately.

5.9. PCCWG clarified that it is not Package A policy to not switch over in this situation. It is because of the static route configuration at the customer LAN. However, Customer might consider dynamic routing between PCCWG NID and their LAN gateway to fully automate fail over to cover this kind of rare situation.

5.10. Fiji informed that they have also faced the similar issues in the past and they resolved it by manual connection to the alternate route. It is the reason Fiji is upgrading the current Package C to Package B+. In case of package C, there is only one PoP in Sydney for CRV network for Fiji.

Agenda Item 6: Review and update the AMHS/ATN Implementation Status table and the APAC CRV Implementation Table

Update the AMHS/ATN Implementation Status Table and the APAC CRV Implementation Table- Sec (WP/06)

6.1. The meeting was informed about the State Letter Ref.: T 8/2.10 - AP041/20 (CNS) dated 2 March 2020, that extended the Reminder for implementation of Common aeRonautical VPN (CRV) in APAC Region by 2020. It was further informed that CRV OG might recommend to establish an Air Navigation Deficiency Report beginning 2021 for those States/Administrations that have not implemented CRV.

6.2. Considering the challenges and difficulties faced by States/Administrations under current pandemic situation, the APANPIRG/31 meeting adopted the Conclusion C31/12 - *Target Year of CRV Implementation in APAC Region* recommended by CNS SG/24, to postpone the target year of regional implementation of CRY *from 2020 to the end of 2021*. A State Letter Ref.: T 8/2.10-AP002/21(CNS), dated on 6 January 2021 was sent for this matter.

6.3. The latest updates submitted by the service provider on planning and implementation status of CRV was presented. As per the report, states having CRV Under Operation are *Australia, Bhutan, China, Fiji, Hong Kong China, Japan, New Zealand, Philippines, PNG, Republic of Korea, Singapore and USA*, states having CRV Under Provisioning are *Malaysia and Nepal* and states having Hot Prospects in 2021 are *India, Indonesia, New Caledonia, French Polynesia, Russia, Thailand.*

6.4. The meeting reviewed and updated the AMHS/ATN and APAC CRV Implementation Tables based on the updates since CNS SG/24 meeting in November 2020. These tables had been maintained by the contributory bodies of the CNS SG including CRV OG. The updated AMHS/ATN table is provided in **Appendix E** and the updated APAC CRV Implementation Table is provided in **Appendix F** to this Report.

6.5. France informed that they had commitment to implement CRV before end of 2021 but COVID-19 Pandemic has changed the scenario and France will *not be able to join CRV before 2023*. France asked the implication of non-joining of CRV before the end of 2021 as defined by APANPIRG Conclusion C 31/12. It was informed by PCCWG that it will potentially increase the cost implication to join CRV as explained in SP/01 by PCCWG and as per ICAO APAC State Letter Ref.: T 8/2.10 - AP041/20 (CNS) dated 2 March 2020, APANPIRG may consider it as an *Air Navigation Deficiency* for the State.

Connecting Russian Communication Centers to CRV- Russian Federation (WP/10)

6.6. As per Com Coordination Meeting between Japan, China, Mongolia, and Russia in Bangkok in May 2019 on the transition of information exchange using AMHS procedures, the Russian Federation agreed to consider the possibility of connecting to the CRV at three locations, namely Moscow, Khabarovsk and Irkutsk. The ICAO Regional Office facilitated the organization of negotiations between PCCWG and the Russian Federation on joining the CRV.

6.7. The participants of the CRV OG/7 meeting, held in Bangkok in January 2020, unanimously approved the connection of Russian Com Centres to the CRV. To clarify the technical details of the organization a survey in each Com Centre was carried out by the partners of PCCWG in Russia. Unfortunately, the survey took a long time due to the difficulties associated with the COVID-19. Therefore, the Russian side decided to limit itself at the initial stage to connecting only Com Centres in Moscow and Khabarovsk.

6.8. The draft technical and commercial proposals by PCCWG were formed and sent in February 2021. In March-April of this year, Russia discussed with the Japanese side (JCAB) the possibility of switching to interaction under the AMHS procedures. Russia informed that the situation with the transition to AMHS between the Com Centres of Beijing and Khabarovsk is slightly better. The satellite communication circuit has been replaced with a terrestrial one. The first interoperability tests were conducted between the Com Centres.

6.9. It was further informed that since November 2020, meteorological information in the IWXXM format is being transmitted between ROC and IROC using AMHS procedures. Russia proposed that as the APAC Centres are connected to the CRV, in order to solve the problems associated with the transition to interaction under the AMHS procedures between the Com Centres of Moscow and Fukuoka, Khabarovsk and Beijing, it is necessary to speed up the submission of official commercial and technical proposals for connecting Russian Com Centres to the CRV.

6.10. In reply to the question asked in section 2.4 for *a letter from ICAO APAC Office stating that PCCW Global is the official provider of the regional CRV based on the IP protocol for the APAC region*, the ICAO Secretariat informed that the letter has sent to Russia by **Ref:** T 8/2.10- AP-CNS0020/20 dated 20 February 2020 subject *Follow-up an Action Item of CRV OG/7 Meeting* on this request. It was further informed that by ICAO State Letter **Ref:** T 8/2.10:AP-CNS0111/16 dated 07 December 2016, subject *CRV Procurement Award and Finalization of Common Provisions*, ICAO has informed to Member States about PCCWG as Finalized Supplier for CRV.

6.11. In reply to another question asked in section 2.4 for *official letter to the CEO of State ATM Corporation from PCCWG*, PCCWG informed that the letter will be send to Russia at the end of May, 2021.

Korea new AMHS System Upgrade and CRV Implementation Plan- ROK (IP/06)

6.12. ICAO Asia/Pacific Regional Office encouraged all states/ Administrations to implement CRV through PCCWG. In CNS SG/24 the target date of CRV implementation has been postponed to 2021 due to Covid-19 Pandemic.

6.13. ROK tried to implement CRV under the COVID-19 pandemic, but the test with China and Japan was delayed, and this year (2021), the IOT using Basic AMHS-CRV conducted between

Korea and Japan has failed. As per the manufacturer, the failure was occurred by the Basic AMHS which was outdated. In order to minimize the delay the exchange of IWXXM and the implementation plan, Korea Airports Corporation (KAC) has started a project to upgrade Basic AMHS to Extended version.

6.14. KAC has signed a contract with Frequentis (April-2021, Germany) to complete the installation of HW and SW by the third quarter of 2021. Republic of Korea shared the plan for POT with China and Japan.

6.15. Meeting was informed that after successful POT in 4Q of 2022, Korea aims to switch from AMHS (Basic)/ATN to AMHS (Extended)/CRV between Korea-China. ROK shared test and cutover schedule between Korea, China, and Japan and requested active cooperation to China and Japan. After securing the stability of AMHS-CRV, Korea expect that the old aeronautical networks, AFTN and ATN will be gradually removed. In addition, ROK has a plan to convert the satellite communication network between Korea and China to landline in parallel with CRV transition, and aims to switch to the landline by the second half of 2021.

6.16. Japan shared it appreciation to ROK for the work and informed that Japan will be happy to do necessary adjustments needed in its current infrastructure for CRV connection with ROK.

Current Status and Convert Plan to CRV between KOR and JPN- ROK (IP/08)

6.17. ROK presented the current implementation status and plans to convert to VOIP lines over CRV between Republic of Korea and Japan. In 2020, Direct Circuits for voice were 5 lines between Korea (Daegu and Incheon) and Japan. Since a new ACC in KOBE, Japan was constructed, two CRV VoIP connections are implemented between Korea (Daegu & Incheon) and Japan (KOBE). In 2022, Korea and Japan are going to convert the existing networks to CRV. In 2023, there is a plan to make VOIP lines and to terminate current line between two ACCs in ROK and Tokyo ACC in Japan.

Update of China CRV implementation and operation- China (IP/09)

6.18. China shared CRV Implementation status between China and other States that have joined the CRV. It was informed that China has been contracted with PCCW Global Ltd. on August 2020 and China had already completed the CRV connection implementation on 26 October 2020.

6.19. Currently, China has single connection about CRV network for data. China has completed the transition and creation of AMHS and ATFM connection with States/Administrations that have joined CRV namely Japan and Hong Kong, China and AMHS data that support IWXXM format is being tested by CRV with other States/Administrations. The setting up of ATFM traffic over CRV is based on the planning requirement from operational departments responsible for traffic flow management.

Fiji's Experience in Providing Voice and AMHS Services over The CRV using SLA Package D- Fiji (IP/11)

6.20. Fiji shared their experience and the performance analysis in providing voice and AMHS services over the CRV network using SLA Package D with Australia, New Zealand & USA. Fiji has signed and implemented CRV Package C+ with PCCWG in 2019 operating voice and AMHS services with Australia, New Zealand & USA. The impact of COVID-19 had reduced the flight movement in Nadi FIR by 80% and affects our revenue directly. To control operational cost, Fiji had consulted with PCCWG to downgrade the CRV SLA from Package C+ to Package D. This was implemented in August, 2020. To date Fiji is still operating on SLA Package D using the internet connection and they plan to upgrade to Package B+ in June, 2021 as flight movement is now gradually increasing.

6.21. The PCCWG SLA Package D High Level diagram was shared with the specified service performance level. Fiji also shared a performance analysis of the CRV Package D from August 2020 to February, 2021 to compare with the performance of CRV Package C+ based on the data provided by PCCWG NOC. Based on the experience Fiji has with CRV Package D and the result of the performance analysis, Fiji recommended SLA Package D as the CRV solution for small ANSP like Pacific Island States and other small ANSP in the region to operate voice & AMHS services.

6.22. France inquired about the data about quality of voice communication in addition to other data measured for Package-D in the paper. Fiji informed that Fiji has not received any complaint about the voice quality from ATC or any other means. However, this parameter is not measured in current analysis.

Backup B2B Internet Service between FAA and Air services- FAA (IP/14)

6.23. FAA presented newly implemented B2B internet service between FAA and Air Services Australia as a backup to CRV. This B2B internet backup is designed to support AMHS. Since joining the CRV beginning in 2018, FAA telecommunication services to the Asia/Pacific region now rely solely on the CRV. CRV OG/6 meeting concluded that CRV only has one instance of its MPLS core access in the Pacific region. Air Services has coordinated with FAA to establish a B2B VPN over the internet as a backup in case of catastrophic failure that may cause disruption to ANSPs in the Pacific region.

6.24. In May 2021, FAA and Airservices Australia have successfully completed the testing of B2B connections at AMHS MTAs located at Salt Lake City and Brisbane. The B2B connection at these two AMHS MTAs will be permanently available. This connection will be tested monthly following the AIRAC cycle. This B2B connection is solely used to back up the CRV connection between the Salt Lake City AMHS and Brisbane AMHS when the CRV MPLS core or its Provider Edge (PE) routers are completely inoperable and AMHS alternative routing cannot be performed.

6.25. India appreciated the efforts being done by USA for implementing back up of CRV connection between the Salt Lake City AMHS and Brisbane AMHS. The meeting was informed that USA is using *a dedicated independent internet connection for B2B Internet Service* between USA and Australia, not the Package D provided by PCCWG.

FAA CRV Service- FAA (IP/15)

6.26. FAA has been a user of the CRV since January 2018 with initial services to Australia, Fiji and New Zealand. As CRV services' performance has met FAA telecommunication requirements, the FAA has expanded its service to more ANSPs. FAA's Oakland Center is configured with Package A and 2MB bandwidth. Salt Lake City and Atlanta (AMHS Comm centers) both have individual Package C with 2MB bandwidth. FAA presented current status of FAA CRV service.

6.27. Meeting was informed that The FAA is coordinating to have a direct voice and AMHS services with Papua New Guinea. When Indonesia joins the CRV, FAA is expected to begin its coordination with Indonesia to establish direct AMHS and voice services.

6.28. Indonesia informed about the latest status of CRV Implementation to USA by updating the **Appendix E** and **Appendix F** to the Report.

Update of CRV service of the Philippines- Philippines (IP/16)

6.29. Philippines provided an update of AMHS, VOICE and AIDC implementation of the Philippines over CRV service. The Philippines have been in CRV operations since March 18, 2018 with package-A subscription from PCCW Service Provider. With CRV implementation, the Philippines has been able integrate a voice and data connections with the following adjacent FIR's; Hong Kong, Taipei,

Singapore and Oakland. Philippines shared the progress of AMHS, AIDC and VOICE circuits over CRV network after a series of Interoperability and Pre Operational Tests.

6.30. Philippines informed that through Backbone Boundary Intermediate Systems (BBIS), the AIDC implementation with Ujung Pandang Indonesia has been successful. There were ongoing email coordination with Japan to connect a voice circuits thru CRV network and a suggestion to implement AIDC thru Backbone Boundary Intermediate Systems channel. The plan date for AIDC tests with Ho Chi Minh is to be determined through email discussion and will use the existing legacy AFTN connection, while an email was sent to Kota Kinabalu Malaysia to discuss the date for another round of AIDC tests.

Agenda Item 7: Revisit the CRV solution for small Pacific Islands and small ANSPs in APAC

Revisit the CRV solution for small Pacific Islands and small ANSPs in APAC- Fiji (WP/13)

7.1. Fiji presented the CRV solution for small Pacific Islands and small ANSPs in APAC region to implement CRV for voice & AMHS services. Meeting was informed that 2022 is now the target date agreed in the Beijing Declaration to implement CRV. It was further informed that the CRV Workshop for Pacific Island States during the CRV OG/4 meeting in April, 2018 recommended possible CRV solutions for the Pacific Island States to implement. The CRV solutions for the Pacific Island was further discussed at the CRV Workshop during the CRV OG/4 meeting Nadi, Fiji in April, 2018. Private VSAT and VPN over internet were considered as the proposed CRV solutions for the Pacific Islands.

7.2. From the recent regional CRV implementation update submitted by PCCWG, it is *noted that there has been slow implementation progress with the Pacific Island States and small ANSP in the region to date.* With the target date for the implementation of CRV by 2022, the CRV OG must find ways to assist these member States to implement CRV and ensures that *No Country is Left Behind*.

7.3. The The CRV SLA packages provided by PCCWG are designed based on the network performance level to meet the customer services requirement that is provided over MPLS, VSAT or VPN over internet connectivity. SLA package are charged differently based on the service performance level. A core component of the cost is noted on *the connectivity charges between the PCCWG MPLS POP and the ANSP NID which is normally refers to as the last mile connectivity. If the ANSP is not located in the same geographical area where PCCWG MPLS PoP resides it will pays more for the service cost due to international connection rate charge as compared to ANSP that resides in the same area with the PoP that is charged at a local rate* . For example, the nearest PCCWG MPLS POP for the Pacific Islands is located in Sydney, Australia and the cost of last mile connection to these Pacific Islands is *quite significant*.

7.4. The paper proposed CRV Solution for Vanuatu, Kiribati & Tuvalu in joining CRV. The three Pacific Island and New Caledonia comes under the Nadi FIR that is operated by Fiji for the provision of ATM services. The voice & AMHS/AFTN services are exchange between these Pacific Island ATC Tower/Center and Nadi Air Traffic Management Centre. Additionally, International communication link is provided to these Pacific Islands through satellite and submarine optical fiber cable for Vanuatu only. PASNET is a private communication link that is provided through VSAT and supplied by Airways NZ is another communication network that is available to these Pacific Islands to implement CRV.

7.5. These Pacific Island have small ANSP and PASNET will provide for secure and reliable connection that can support CRV SLA Package A, B+, B, C+ & C The alternative solution will using VPN over internet using SLA Package D over 1.0M internet connection at a much lower cost.
Fiji presented the service performance of SLA Package D in Information Paper (IP11). The performance analysis has confirmed that the service is reliable and is recommended for small Pacific Island and small ANSP in the region. Based on this service performance results, Fiji is working with PCCWG on a Technical proposal using Package D for Vanuatu, Kiribati & Tuvalu to implement CRV for voice & AMHS service. The paper presented High Level diagram of this propose CRV connectivity using SLA Package D. The proposed service to operate on the CRV with the required bandwidth was provided in

the table. It was informed that the voice circuit is between each ANSP ATC Tower/center with Nadi Air Traffic Management center (ATMC). For AMHS, Vanuatu is currently connected to Brisbane AMHS as an AMHS UA connection and Kiribati & Tuvalu will be connected to the Nadi AMHS as an AMHS UA connection. The proposed CRV solution total MRC will include the local internet charge and PCCWG CRV SLA Package D cost. PCCWG is charging the same MRC rate for 64kbps – 2.0Mbps bandwidth for the CRV SLA Package D.

7.6. It was recommended that the CRV OG should work closely with the small Pacific Islands, small ANSP in the region and PCCWG on a cost effective CRV solution to implement CRV. The meeting formulated the following draft conclusion for consideration by the ACSICG/8 meeting.

<table>
<tr><td colspan="3">Draft Conclusion CRV/08/02 - Implementation of CRV for small Pacific Island and small ANSP in the region using CRV Solution, PCCWG SLA Package D.</td></tr>
<tr><td colspan="2">What: That, the CRV OG should consider the following to assist small Pacific Islands & small ANSP in APAC in the implementation of CRV:
a) Small Pacific Island and small ANSP in the region to consider using CRV SLA package D as the CRV solutions to implement CRV for the exchange of voice & AMHS services
b) With target date to implement CRV by the end of 2021 by APANPIRG Conclusion C 31/12, it is recommended that the CRV OG to work closely with the small Pacific Islands, small ANSP in the region and PCCWG on a cost effective CRV solution to implement CRV.</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☒ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: To facilitate the implementation of CRV for the small Pacific Island & small ANSP in the region</td><td colspan="2">Follow-up: ☒Required from States</td></tr>
<tr><td>When: 17-May-21</td><td colspan="2">Status: Draft to be adopted by PIRG</td></tr>
<tr><td colspan="3">Who: ☒Sub groups ☒APAC States ☐ICAO APAC RO ☐ICAO HQ ☐Other: XXXX</td></tr>
</table>

Distribution of Surveillance Data to PNG via CRV- Aireon LLC (a member of ICCAIA) and NuiSky Pacific (PNG) (IP/07)

7.7. NiuSky Pacific Limited has designed and is in the final stages of implementing a country-wide CNS/ATM modernisation program. The previous operational surveillance was one radar, one ADS-B ground station as well as Aireon Space based ADS-B data. Space based ADS-B service was provided to NiuSky Pacific Ltd. via dual MPLS links.

7.8. In 2020, the CRV Operations Group authorised Aireon to connect and contract with the CRV provider. The contract has been signed by Aireon and NiuSky Pacific Limited. Aireon has established the first of two connections to CRV while NuiSky Pacific Limited implemented and tested the initial CRV connections. Space based ADS-B data can now be delivered to other Aireon customers in Asia Pacific via CRV, potentially without need for any additional communication link or telecommunications costs. An additional benefit flows to NiuSky Pacific because the same CRV physical connection could be used to exchange ADS-B ground station data with both Australia and Indonesia. This is likely to remove the need for the existing point to point circuit between Australia & PNG.

7.9. PNG discussed about the implementation of Space-Based ADS-B system in PNG and in particular that Space based ADS-B is now operational and one path is already using CRV for operational surveillance data. Space based ADS-B is now available on the CRV and can be supplied to other ANSPs without the additional cost of dedicated point to point circuits. When developing a CRV solution for small Pacific Islands and small ANSPs in APAC, members may wish to take note of this capability and take note the PNG plan to use CRV to allow data sharing between FIRs.

7.10. Meeting concluded that the Space Based ADS-B data on CRV is an extremely important steps for future usage of CRV for the purposes other than initially planned.

Presentation of PCCW Network Based IWXXM Translation and Exchange Services- Fiji and PCCWG (IP/12)

7.11. Fiji and PCCWG presented PCCW IWXXM Translation and Exchange Services, which can serve as an alternative solution for member States to fulfil the exchange of IWXXM messages as promulgated in Amendment 78 to ICAO Annex 3. It was informed that ICAO APAC CRV has been built leveraging PCCWG's high-speed international IP network, with mission-critical connections running across a diversified infrastructure supporting multiple aviation-specific applications. PCCWG, the CRV provider, is keen to develop value-added service on CRV to demonstrate their commitment to the Aviation industry.

7.12. It was informed that PCCWG has been developing the SWIM service on a private and scalable platform in partnering with one of leading aviation vendors - Frequentis. Additionally, PCCW Network Based IWXXM Translation and Exchange Services is one of the modules on PCCW SWIM (IWXXM, FIXM and AIXM) which is hosted in the high availability private platform and fully controlled environment which connects to CRV network infrastructure. PCCW said that the services complied with ICAO and WMO standards and are designed to support the acquisition, management, processing and dissemination of meteorological data related to aviation.

7.13. PCCWG presented features supported by PCCW SWIM Platform and service components. It also described four function namely Function 1 - *Translation and aggregation service*, Function 2 - *IWXXM Exchange Service,* Function 3 - *IWXXM Services for ANSPs without AMHS*, and Function 4 - *ANSPs without AMHS input TAC on message terminal*. PCCWG summarised that PCCW IWXXM Translation and Exchange services provide the flexibility and reliability to collect most of the current MET data from multiple designated sources and the processing functionality to validate, store and redistribute the data, along with the ability to display it on XML Browser via CRV private connection.

7.14. Nepal requested explanation of table presented in section 2.2 and asked to provide quantitative data for more understanding of proposal. The table was further explained by PCCWG and it was informed that at this stage providing quantitative data may be difficult as it varies based on sites requirements and available infrastructure.

Agenda Item 8: Review the progress on the next step for using the rest of CRV Pioneer State Contribution to the ICAO Managed Service Agreement (MSA)

Updates on CRV Pioneer State Contribution to the ICAO Managed Service Agreement (MSA) - Sec (WP/07)

8.1. The ICAO Secretariat informed meeting in CRV OG/2 about the fund balance as on 31 March 2017 of *USD 104,596* and proposed a draft of revision of Annex 1b to the MSA. In CNS SG/21 meeting a WP/17 proposed the recommendation to the meeting for APANPIRG decision to manage the remaining funds and the meeting endorsed Draft Conclusion CNS SG/21-DC6. The APANPIRG/28 adopted the Conclusion **APANPIRG/28/19**: *Amendment of the Management Service Agreement for CRV project (RAS14801).* CRV OG and concerned States/Administrations have taken various follow-up actions for Conclusion **APANPIRG/28/19**. However, the Conclusion itself remains as one of outstanding Conclusions/Decisions up to APANPIRG/31 held in December 2020.

8.2. The CRV OG Co-Chair (Asia) presented a WP/08 to CRV OG/6 in May 2019 to summarize the efforts and outcomes after CRV OG/5. A questionnaire on use of the rest of MSA fund was developed and distributed to all Pioneer States/Administrations. Based on the response, the CRV OG co-chair (Asia) presented the working paper to propose forward for the balance of the funds under ICAO Managed Service Agreement (MSA). The CRV OG/6 meeting adopted the recommendation of

the WP/08 through the **Decision CRV OG/6/3-** *Using the Rest of CRV Pioneer State Contribution to the ICAO Managed Service Agreement (MSA).*

8.3. The CRV OG/7 was informed that the development of a scope of work had not progressed at the time. The meeting was also informed about 2020 APAC Aeronautical Fixed Service Safety and Protection Planning Working Group Meeting (AFSSP WG 2020) to be held in 21 - 23 April 2020. The agenda set for AFSSP WG 2020 was closely aligned with the agreed use of the balance of the MSA funds. Due to the outbreak of COVID-19 pandemic, the *AFSSP WG 2020 was postponed* and with the resignation of the CRV OG co-chair (Asia) for Air services Australia, there has been no further significant progress on this MSA issue.

8.4. On 15 April 2021, the ICAO Secretariat held an online discussion among TCB, ICAO APAC and ICAO SAM on how to address the unspent funds from the completed CRV project (RAS14801) and the possibility for APAC to make reference to the REDDIG II in SAM region. Administratively this could be done through either an extension/revision of RAS14801 to add new scope or through a new project (then funds from RAS14801 can be transferred to the new project). In either case it will need some formal acceptance from the contributing States.

8.5. The meeting agreed that it is important to first prepare the safety and security assessment requirement to define scope of the work based on available fund and priorities of work to be done. Fiji recalled that in previous CRV OG meeting, Fiji expressed its concern on PCCWG network failure and its impact on critical operations and reiterate the importance of Safety review or Implementation Review of CRV.

8.6. Australia inquired that Safety Assessment or Security assessment, as decided by CRV OG, will be one time event or recurring event. The meeting was informed that it should be one time event as the recurring event needs more funds and CRV OG needed to discuss about the funding model, if required.

8.7. The ICAO Secretariat reminded that the Conclusion APANPIRG/28/19- *Amendment of the Management Service Agreement for CRV project (RAS14801)* had advised the necessity for APAC Pioneer States to countersign the amended Pro Document *as per the format provided in Appendix D to the APANPIRG/28 report on Agenda Item 3.4*, this applied to new proposal as well, because the previous contract RAS14801 is considered as completed for ICAO TCB and new proposal will be considered as a new contract.

8.8. Indonesia queried about the usage of ISO 27001 standards for addressing Cyber Security issues in CRV. Additionally, Indonesia supported to security assessment including some test such as Penetration test for assurance of cyber security resilience of CRV network. Co-Chair informed that such issues has been discussed in previous meetings too. There is the need for concrete proposal for future usage of unspent fund. It was proposed that ICAO Secretariat will coordinate with key members to do offline discussion on finalization of the proposal to use unspent fund. The ICAO Secretariat informed the meeting that relevant cyber security requirements for CRV was included in ToR of CRV project and reiterated in IP/05 of CNS SG/23.

Agenda Item 9: MPLS/IP based inter-regional connection

MPLS/IP Based Inter-Regional Connection- Sec (WP/09)

9.1. The CRV was developed to improve regional connectivity and to reduce the cost on telecommunications. States that connect to the CRV should also connect to other regional networks such as REDDIG and New PENS to improve efficiency in the connection services such as SWIM and to reduce costs for states that connect to other regional networks.

9.2. There are communications requirements between APAC ANSPs and SAM ANSPs, CRV and REDDIG II, in order to set up the AMHS P1 connection between AMHS COM Centers of Christchurch (New Zealand) and Santiago (Chile). It is technically possible for two nodes of different networks (with different providers) to set up an IP connection. In this case, the concept of MPLS Network to Network Interface (NNI) is applied and the CSPs involved with different customers establish agreements. This concept can be applied by the CSPs of CRV and REDDIG II, in order to connect nodes of the two networks.

9.3. Further discussion on the administrative and technical aspects to establish the required aeronautical communications between APAC and SAM ANSPs through MPLS NNI are in progress. Besides this, discussions are also being done for various other feasible options for CRV and REDDIG II interconnection. Meeting was invited to provide need/willingness/interest to join other regional networks.

9.4. Singapore, New Zealand, and India shared their interest for the proposal for interconnection of CRV and REDDIG II. However, it was reiterated that commercial requirement and cost burden for states for interregional connection will be main factors for states' willingness to join the proposal. Co-Chair informed to meeting that the proposal is under initial discussion and further discussion on business model and commercial aspects will be done at later stage.

High Level Network Options to REDDIG- PCCWG (WP/11)

9.5. PCCWG described the options and considerations for connecting REDDIG users in South America. The CRV initial coverage included Asia Pacific and Middle East Regions. Up to till, CRV has been deployed to 26 cities with over 38 circuits. Further three cities are in progress and five cities are in negotiation. There is a need from CRV user, New Zealand to connect the ANSP in Santiago, Chile for AMHS traffic communication. This paper investigated the options for the connection to users in South America.

9.6. PCCWG presented two options for this interconnection purpose. Option 1 was CRV connection to South America (SA) ANSP and Option 2 was Network to Network Connection. Description of each option along with their potential advantages were discussed.

9.7. Co-Chair informed that Service Level Agreement (SLA), IP requirements, and costs are three main factors, which required attention and discussion among member states for this proposal and asked with PCCWG about the possibility of recurring cost in this proposal. PCCWG informed that based on the nodes connected by the states, recurring cost should be there. However, as there are many possibilities for interconnection among different states of different regions by re-routing, the cost sharing for a connection by re-routing via different nodes of states in different regions need to be discussed in Business Case. Furthermore, NNI fixed installation cost distribution among various stakeholders required commitments from states before Kick-off of the project, which should also be discussed and recorded in the Business Case.

CRV Connection to Santiago Chile- New Zealand (IP/10)

9.8. New Zealand presented information on the costs of an extra CRV circuit for Airways New Zealand. Airways New Zealand has a requirement to exchange AIDC data with Santiago Chile. Airways New Zealand is on CRV and Santiago Chile is in REDDIG II. At present the only options for Airways New Zealand is to have a CRV connection installed in Santiago Chile or a REDDIG connection installed in New Zealand. New Zealand shared cost of installing a single Package C, CRV connection. It was informed that the additional circuit severely affects the Cost Benefit of using CRV, other options such as NNI will need to be explored.

9.9. India shared its concerns on the high cost defined in the proposal discussed in the paper and mentioned that any commitment or willingness to join interregional connection from States need clear cost implication for the states.

Agenda Item 10: Share best practices on cybersecurity and develop agenda items for joint session of ACSICG/CRV/SWIMTF on cyber safety/security and resilience

Update on APAC Aeronautical Fixed Service Safety and Protection Planning- Sec (IP/03)

10.1. The paper presented the update of the planned cybersecurity and cyber safety/resilience related activities in ICAO Asia/Pacific Region.

10.2. In CNS SG/23 under Agenda Item 10- *Cybersecurity of CNS/ATM systems*, the meeting addressed the planned cybersecurity and cyber safety/resilience related activities which included a workshop on cyber safety and resilience and cyber tabletop exercise scheduled for *19 to 21 November 2019* at the ICAO APAC Office in Bangkok, a 5-day cyber-security and cyber safety training course jointly organized by ICAO (GAT) and Embry-Riddle Aeronautical University (ERAU) planned for *March 2020* at ICAO APAC Regional Office, and a joint ad hoc working group among CRV OG, ACSICG and SWIMTF focusing cybersecurity, cyber safety and resilience planned for *21 -23 April 2020* in USA.

10.3. The 5-day cyber-security and cyber safety training course was *finally suspended* until further notice. During CRV OG/7, FAA presented WP/06 to inform the meeting about its CRV and AFS Safety and Protection planning and offered to host AFS Safety and Protection joint working group meeting scheduled for 21 to 23 April 2020 in Nevada, USA. Due to the outbreak of COVID-19 pandemic, on 27 February 2020, ICAO APAC Regional Office issued State Letter with **Ref.:** T 8/2.10: AP042/20 (CNS) to inform concerned parties about the *Postponement* of APAC Aeronautical Fixed Service Safety and Protection Planning Working Group Meeting (AFSSP WG 2020) until further notice.

10.4. The ICAO Secretariat informed that the Cybersecurity webinar planned by ICAO APAC RO mentioned in IP/04 is a step for replacement of Postponement of APAC Aeronautical Fixed Service Safety and Protection Planning Working Group Meeting (AFSSP WG 2020).

Update on ICAO APAC Regional Cybersecurity Webinar- Sec (IP/04)

10.5. This paper presented information about the planning of ICAO APAC Regional Cybersecurity webinar on *14 June 2021*. In response to the Action Item No. 24-9 of CNS SG/24 meeting, ICAO APAC Regional Office planned a webinar on cybersecurity for the Region on 14 June 2021 and a State Letter has been issued on 16 March 2021, with Ref.: T 8/10.28 - AP046/21 (CNS).

10.6. The objectives of the webinar along with a tentative programme, as of 7 May 2021, was shared with the meeting. Meeting was informed that due to the restrictions of available resources and online mode, the webinar has been considered as a light version of this kind and is deemed to collect feedback for preparation of a face-to-face heavy version in 3 days for 2022.

10.7. Indonesia shared its concerns for increasing Cyber Security incidents and requested ICAO to invite industries and ISO to share their experience in Cyber Security webinar. The meeting was informed that the expert group formed under Service Design may work on Cyber Security issues for CRV.

Agenda Item 11: Review TOR and update Subject/Task list of CRV OG

Review ToR and subject tasks of CRV Operational Group- Sec (WP/08)

11.1. The meeting reviewed the ToR of CRV OG and reviewed and further updated the Subject Task list for CRV OG. The Meeting identified that there is no need for revision of ToR of CRV OG while the meeting identified some new Items for the work programme of CRV OG. The revised updated Subject Task list for CRV OG are provided in **Appendix G** to this Report.

Agenda Item 12: Next meetings and any other Business

Update on ICAO APAC Regional Webinars-Sec (IP/02)

12.1. The meeting was informed about the *18 webinars* to be hosted by ICAO APAC office in the year 2021 as **ICAO APAC series of webinars** along with the objectives of webinars related to CNS i.e. ICAO APAC Cybersecurity Webinar, Webinar on Implementation of CRV in APAC region, SWIM workshop, and Webinar on Implementation of ADS-B. The meeting was invited to contribute individual practice and experience to the webinar of interest as a speaker and to take maximum advantages of the webinars by registering more participants from states.

Presentation of PCCW Global's Surveillance Data Sharing Platform- PCCWG (IP/13)

12.2. PCCWG described the system architecture of PCCW SWIM service and its progresses to build its Surveillance data-sharing platform with EMS and Service Registry.

12.3. It was informed that PCCWG aimed at expanding the network by offering value-added services on top of the advanced aeronautical network. These services cover the provision of critical information through the globally interoperable System Wide Information Management (SWIM) infrastructure, interfaces and exchange models. By combining PCCWG network infrastructure and hosting facilities with Frequentis, State ANSPs will be able to benefit from SWIM initiatives without the high investment costs and development expenses of traditional systems.

12.4. The meeting was informed that PCCWG is working with Frequentis Comsoft to host their SDDS-NG (Surveillance Data Distribution System – Next Generation) in PCCW SWIM for qualified States/Administrations/Stakeholders to publish or subscribe surveillance data by following the guidelines of the CRV OG & SWIM TF.

12.5. PCCW informed about different function of SDSP surveillance data processing including data validation, filtering, modifications, format conversion, data distribution and forwarding. Each function was described in detailed.

Cohabitation between VSAT And 5G Cellular Network- France (Flimsy-1)

12.6. France shared DSNA background and experience regarding the potential influences of the 5G cellular network deployment on operational VSAT terminal stations. It was informed that DSNA had presented in the CRV OG/6 meeting *08-10 May 2019* in Bangkok the WP/06 to justify the need for a VSAT (Very Small Aperture Technology) link for international ATC exchanges link to avoid the SPOF (Single Point Of Failure) created by a unique terrestrial telecommunication access in isolated territories (small pacific Island). The objective of a VSAT was to set up another independent telecommunication access point to increase the availability and, thus the safety of the global architecture.

12.7. The telecommunication operators have been awarded the frequencies to test and begin the 5G cellular network deployment. In Europe, the new 5G cellular network operates in the 3.4 GHz to 3.8 GHz range corresponding to the beginning of the C-band which is also used by the VSAT telecommunication terminals for receiving space-to-earth signal in the 3.4 GHz to 4.2 GHz band.

12.8. DSNA operates three VSAT terminal stations in the C-band spectrum which are part of the VSAT network operated by the Air Navigation Service Provider ASECNA in the ICAO AFI Region. By DSNA, in close relationship with the Frequency Regulatory Authority, the VSAT reception frequencies for all the stations have been shifted outside the 5G spectrum. However, perturbations and interferences have been detected on one of the VSAT operational station due to the 5G deployment commencing. The survey made by the Frequency Regulatory Authority demonstrated that a 5G station located at around 100 m was at the origin of the issue. Thus, perturbations and interferences could append even if the frequency of the VSAT reception signal is outside the authorized 5G spectrum.

12.9. As a mitigation, a waveguide filter specifically designed to reject the 5G disturbances is foreseen to be installed in the reception branch.

12.10. The ICAO Secretariat informed that this kind of topic is under the purview of SRWG in this region. However, VSAT is considered as one of the possible CRV connection for States for last mile MPLS PoP. Therefore, the meeting agreed to pay attention on this information and the concerned parties including PCCWG should follow up as an issue in using VSAT.

Date and Venue for the Next Meeting

12.11. The meeting identified the need to organize face to face meeting, if possible, to further progress tasks listed in the Terms of Reference, with a tentative date in **January 2022**. The Secretariat will coordinate for hosting the next meeting in members States of the group or will organise it in ICAO APAC Office Bangkok, and inform participants in due course for the exact dates and venue.

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CRV OG/8

Appendix A to the Report

Common Regional Virtual Private Network (CRV) Operations Group (OG) of Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) (APANPIRG CRV OG)

OPERATIONS MANUAL

Edition v1.0 - December 2020

Record of Amendment

A/L No	Date	Entered By	A/L No	Date	Entered By
1.0	1/12/2020	Vaughan Hickford			

Contents

1 PART I: FOREWORD

1.1 Introduction

a. The Common Regional Virtual Private Network Operations Group (CRV OG) Operations Manual is an informal publication prepared by the CRV Task Force, intended to provide, for easy reference of interested parties, a consolidation of material, particularly of a procedural nature, about the work of the CRV OG and its contributory bodies. It contains the Terms of Reference of the CRV OG established by the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) (Decision 27/34). It also contains the working arrangements and internal instructions developed by the Group for the practical application of its Terms of Reference.

b. The document describes; Terms of Reference; Composition; Position within ICAO; Working Arrangements; Rules of Procedure and Practices governing the Conduct of Business.

c. The framework of Part and Sections headings in addition to the page numbering has been devised to provide flexibility and the facilitation of the revision of additional or new material. Each Part includes an Introduction giving its purpose and status. A Table of Contents is also provided which serves also as a subject index and as a check list for the current pages.

d. All pages bear the date of issuance. Replacement pages will be issued as necessary and any portion of a page that has been revised will be identified by a vertical line in the margin. Additional arterial will be incorporated in the existing Sections or will be the subject of new Sections, as required.

e. Changes to text will be identified by a vertical line in the margin in the following manner;

   i. N for new or revised text;
   ii. E for editorial modification that do not alter the substance or meaning of the text;
   iii. D for deleted text

   iv. For practical reasons, this shall not be applied to title pages or to the routine insertion and deletion of Conclusions and Decisions. The absence of change bars, when data or page numbers have changed, will signify reissue of the section concerned or rearrangement of text (e.g., following an insertion or deletion with no other changes).

f. The Operations Manual will be distributed to Members and Observers of APANPIRG, the ICAO Secretariat, to other States and international organizations participating in meetings, contributing and to, or having interest in the work of the CRV OG and/or its Contributory Bodies.

2 PART II: TERMS OF REFERENCE, COMPOSITION AND POSITION IN ICAO OF THE CRV OG

2.1 Background

The establishment of APANPIRG CRV OG was proposed during the deliberations of the CRV Task Force (TF) as a dedicated group to provide oversight of the CRV operations and the performance of the CRV Service Provider. The APANPIRG CRV OG is formally established by APANPIRG Decision 27/34.

2.2 Terms of Reference

The Common Regional Virtual Private Network (VPN) Operations Group (OG) will provide oversight of the function and performance of the CRV and the performance of the Service Provider. The following are the activities to be performed:

a. Oversee the implementation of the CRV post Contract Award;
b. Manage issues arising from the transition with CRV TF, if any;
c. Co-ordinate and standardize the establishment or upgrade of CRV services as required;
d. Co-ordinate activities with other ICAO CRV OGs, if any, to make sure that decision making and communication with CRV Service Provider is consistent and timely;
e. Oversee the performance of the CRV Service Provider, including customer service;
f. Oversee the performance of the CRV network;
g. Oversee the escalation and solving by the CRV Service Provider of issues associated with the provision of the CRV, including safety and security related issues;
h. Assist with the resolution of issues associated with the provision of the CRV among the CRV Users as required, including safety and security related issues;
i. Assist with the migration of Aeronautical Fixed Services (AFS) onto the CRV, in line with the GANP and seamless ATM plan;
j. Maintain CRV OG documentation associated with the function, performance and management of the CRV, including the CRV OG Operations Manual, a list of CRV users and a record of variations to the common tender package;
k. Accept deliverables from the CRV Service Provider on behalf of the CRV Users as required;
l. Promote the use of CRV; and
m. Perform any other activity as required by CRV operations.

2.3 Reporting

The CRV OG will report to Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG) through ACSICG and CNS SG.

2.4 Participation

The CRV OG will include all APAC Member States/Administrations, and any other organization as needed.

2.5 Conduct of the work

It is anticipated that the CRV OG will conduct its work primarily by Web Conferences, teleconferences and other electronic means of communications. Face to Face meetings of CRV OG may be required on an annual basis. The ICAO APAC Regional Office will provide secretariat support for the CRV OG.

2.6 Rapporteur

There will be two Co-Chairpersons of the CRV OG, one primarily responsible for Asia coordination and the other for Pacific coordination.

2.7 Position within ICAO

a) CRV OG shall be the guiding and co-ordinating organ for all activities conducted within ICAO concerning the Common Regional VPN for the Asia and Pacific Regions. However, it shall not assume authority vested in other ICAO bodies, except where such bodies have specifically delegated their authority to the Group. The activities of the Group shall be subject to review by the APANPIRG.

b) The work of groups established and meetings held within the framework of ICAO, concerned with the Asia and Pacific CRV shall be coordinated with the CRV OG to ensure full harmonization with all regional activities regarding the development and operation of the Asia/Pacific system.

3 PART II: WORKING ARRANGEMENTS

3.1 APANPIRG Procedural Handbook

The CRV shall be guided by the APANPIRG Procedural Handbook to ensure that work arrangements are consistent with its parent body

3.2 Administration of the CRV OG

c) The CRV shall be administered as follows:

   i. by two (2) Chairpersons, one elected from the Representatives designated by member States of the Group from ASIA Region and one from the PACIFIC region; and

   ii. by ICAO Regional Director, Asia and Pacific Office designated as Secretary CRV OG by the Secretary General of ICAO. In the execution of duties the Secretary will be supported by the Asia and Pacific Regional Office.

d) The Chairpersons, in close co-ordination with the Secretary, shall arrange for the most efficient working of the Group. The Group shall always work with a minimum of formality and paperwork.

e) Between meetings of the CRV OG, some subjects may be dealt with by correspondence among appointed Representatives of Member States through the Secretary of the CRV OG. However, if States are to be consulted this should be done through the ICAO Regional Director, Asia and Pacific Office.

Service Strategy

- Strategy Management
- Service Portfolio Management
- Financial Management
- Business Relationship Management
- Demand Management

Service Design

- Service Catalogue Management
- Availability Management
- Capacity Management
- IT Service Continuity Management
- Service level Management
- Design Co-ordination
- Information Security Management
- Supplier Management

Service Transition

- Transition Planning and Support
- Change Management
- Service Asset & Configuration Management
- Release and Deployment Management
- Service Validation and Testing Management
- Change Evaluation
- Knowledge Management

Service Operation

- Event Management
- Incident Management
- Request Fulfilment
- Problem Management
- Access Management

Continual Service Improvement

- Service Review
- Process Evaluation
- Definition of CSI Initiatives
- Monitoring CSI Initiatives

4 PART III: SERVICE STRATEGY

4.1 Strategy Management

Process Objective: To assess the service provider's offerings, capabilities, competitors as well as current and potential market spaces in order to develop a strategy to serve customers. Once the strategy has been defined, Strategy Management for IT Services is also responsible for ensuring the implementation of the strategy.

a) Reduce telecommunication costs in most cases (to be confirmed by local CBA)
b) Enable integration in the aeronautical infrastructure and enhanced services (GANP, regional objectives)
c) Enhance information security
d) Provide a standardized interface for AFS (instead of multiple protocols, some of which are obsolescent)
e) Rationalize coordination for network management and enhancement
f) Respond to Air Traffic requirements in a timely and standardized manner
g) Coordination with Other Regional Private Networks
h) Promote the use of CRV

4.2 Service Portfolio Management

Process Objective: To manage the service portfolio. Service Portfolio Management ensures that the service provider has the right mix of services to meet required business outcomes at an appropriate level of investment.

- Criteria for services to be added to CRV.
- POC of new services.

4.3 Financial Management

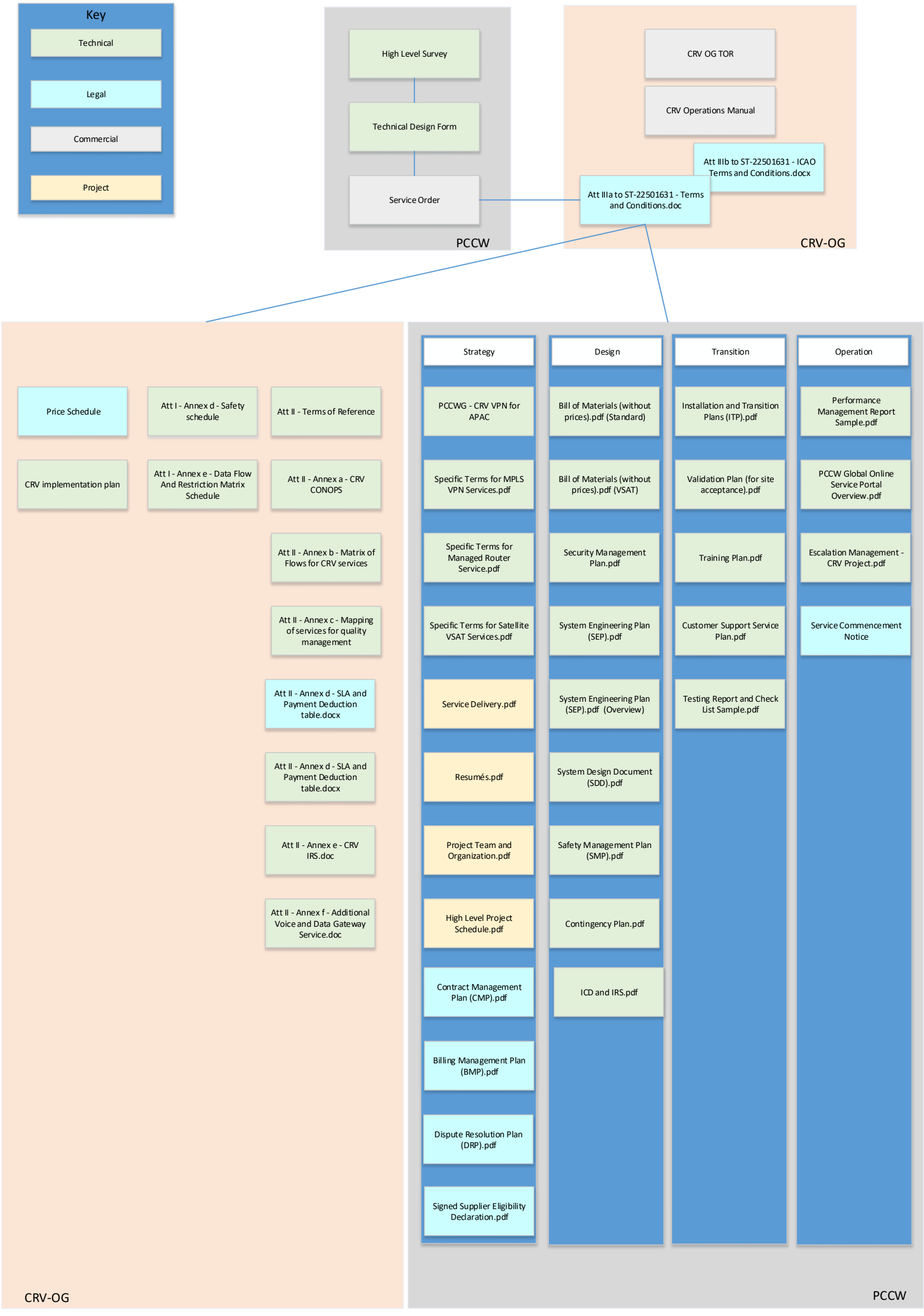
Process Objective: To manage the service provider's budgeting, accounting and charging requirements.

4.4 Business Relationship Management

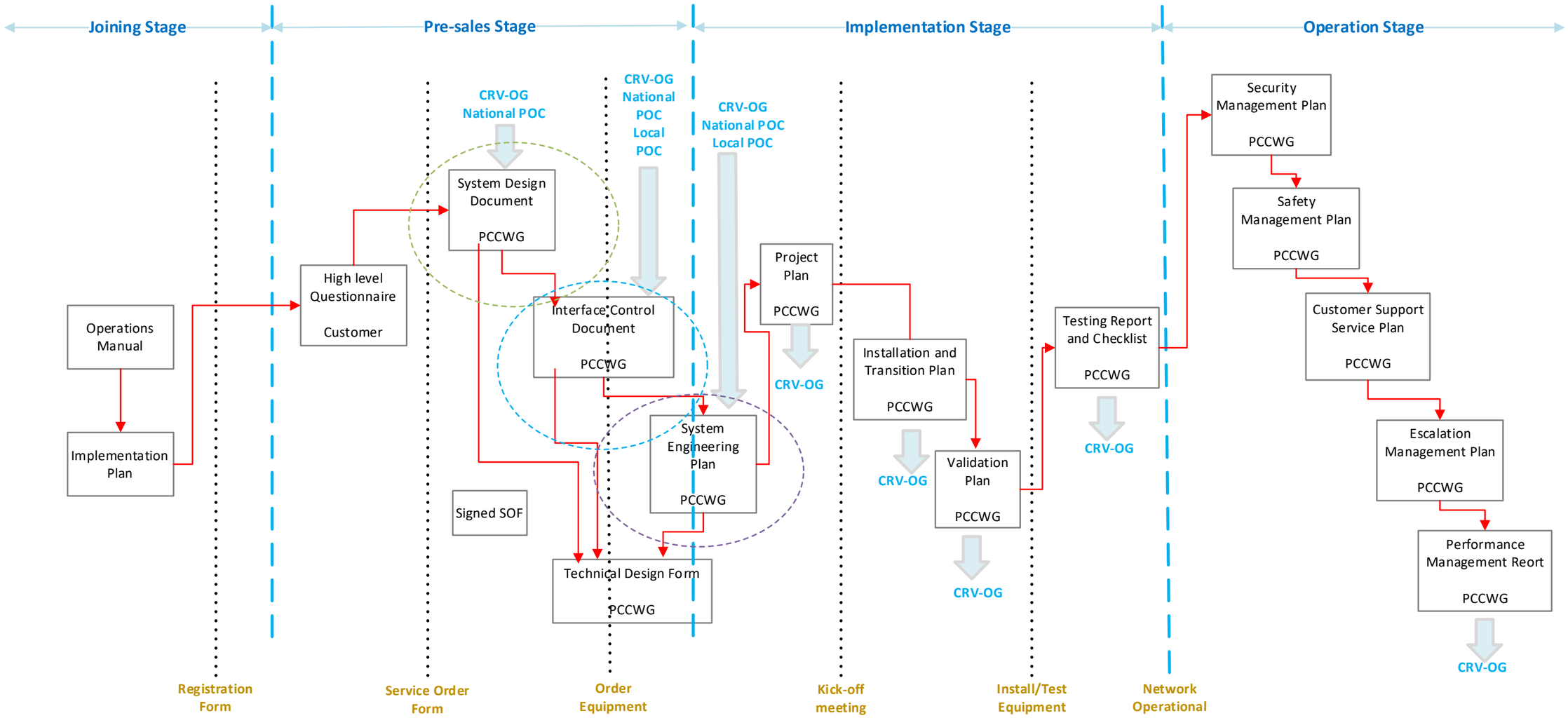
Process Objective: To maintain a positive relationship with customers. Business Relationship Management identifies the needs of existing and potential customers and ensures that appropriate services are developed to meet those needs.

4.4.1 Legal Documentation

The list below shows the precedence of the legal documents that pertains to CRV.



4.4.2 Design and Implementation document flow



4.4.3 Common Package

The Common Package is the common set of documents required to be used to join and operate the CRV Network.

The documents and how they relate to the stages in the Design and Implementation document flow is detailed below.

This is located on the CRV Users Portal here: Common Package.

4.4.4 Joining Stage

a. Operations Manual

This provides the Policies, Processes and Procedures for the Strategy, Design, Transition and Operation of the CRV network.

b. Implementation Plan

The purpose of this Implementation Plan is to provide guidance for all States/ Administrations on the operation requirements for implementing the Common aeRonautical Virtual Private Network (CRV) used in Asia/ Pacific (APAC) Region and the roadmap for implementation.

It contains information on Points of Contacts for each State, Allocated IP addressing for States and Service Providers, proposed implementation dates and suggested tests.

IP Addressing is also listed on the APAC CRV Portal.

c. Registration Form

Provides the information required to connect to CRV as an ANSP.

Example of the Registration Form

4.4.5 Pre-Sales Stage

a. High Level Questionnaire

This provides the high level information to PCCW to be able to provide the Service Order Form (SOF) for signing.

Example of the High Level Questionnaire

b. Service Order Form

Provides the information to PCCW to provide the connection and initiate billing.

Example of the Service Order Form.

c. System Design Document

This is the over-arching Design Document for the CRV Network.

Example of System Design Document

d. Interface Control Document

Example of Interface Control Document

e. Technical Design Form

Example Technical Design Form

f. System Engineering Plan

This is a living document covering the technical aspects of the CRV implementation. Any changes can be updated by the User or PCCW.

Example of a System Engineering Plan

4.4.6 Implementation Stage

a. System Engineering Plan

This is a living document covering the technical aspects of the CRV implementation. Any changes can be updated by the User or PCCW.

Example of a System Engineering Plan

b. Project Plan

Provided to each state post signing of the Contract and is only relevant to that state. It is updated regularly by the PCCW Project manager

Example of a Project Plan

c. Installation and Transition Plan

Example of an Installation and Transition Plan

d. Validation Plan

This is PCCW's testing plan post implementation of the Managed Service

Example of a Validation Plan

e. Testing and Report Checklist

This is the result of PCCW's Testing plan post implementation of the Managed Service and is accompanied by the Service Commencement Notice (SCN)

Testing and Report Checklist

4.4.7 Operation Stage

a. Security Management Plan

Example of the Security Management Plan

b. Safety Management Plan

Example of a Safety Management Plan

c. Customer Support Service Plan

This details the contact details for any Problems or Incidents that the State may encounter.

Example of a Customer Support Service Plan

d. Escalation Management Plan

This details the contact details if the need arises to escalate any Tickets. It also details the escalation criteria

Example of an Escalation Management Plan

e. Performance Management Report

Example of a Performance Management Report

4.5 Demand Management

Process Objective: To understand, anticipate and influence customer demand for services. Demand Management works with Capacity Management to ensure that the service provider has sufficient capacity to meet the required demand.

5 PART IV: SERVICE DESIGN

Service Design

- Service Catalogue Management
- Availability Management
- Capacity Management
- IT Service Continuity Management
- Service level Management
- Design Co-ordination
- Information Security Management
- Supplier Management

5.1 Service Catalog Management

Process Objective: To ensure that a Service Catalogue is produced and maintained, containing accurate information on all operational services and those being prepared to be run operationally. Service Catalogue Management provides vital information for all other Service Management processes: Service details, current status and the services' interdependencies.

5.1.1 Requirements

a. Latency (from the ADDENDUM TO THE SPECIFIC TERMS)

Locations	Average Round Trip Delay
Within the cities specified in Asia (On-net/Off-net)	200ms
Within the cities specified in Oceania (On-net/Off-net)	200ms
Between the cities specified in Middle East and Europe (On-net/Off-net)	200ms
Within the cities specified in Europe (On-net/Off-net)	200ms
Other cities combination not specified above	600ms

b. Availability (from the ADDENDUM TO THE SPECIFIC TERMS)

Service Package	Service Availability
Package A	99.97%
Package B	99.5%
Package B+	99.95%
Package C	99.5%
Package C+	99.7%
Package D	99.5%

c. Jitter (from the ADDENDUM TO THE SPECIFIC TERMS)

The Target Average Jitter Level for voice application and data application is 15ms and 250ms respectively

d. QoS/DSCP markings

Service class name	DSCP Name
Border Gateway Protocol (BGP)	CS6
Voice	EF
Voice Signaling	CS5 (preferred) EF (if CS5 is not possible)
ADS-B	CS4
AFTN, ATN.	AF21
All traffic not otherwise defined.	DF (CS0)

e. Security

Security is the responsibility of each of the ANSPs. Basic security is provided by PCCW utilising Route Filtering and GRE tunnels between ANSP sites.

5.1.2 Criteria to add a new service

a. Considerations

i. Connecting a Service Provider / Service Consumer (SPSC) to the CRV can be initiated by any party that identifies a need for an SPSC to connect to it. The following should be consider by the SPSC and the CRV-Member state.

ii. Service Provider (SP) is defined as a company that provides aeronautical service using the CRV as the means of communication.

iii. Service Consumer (SC) is defined as a company or organisation that consumes aeronautical information using the CRV as the means of communication.

iv. The SPSC should be referred to PCCW to enable an initial discussion with them to assess the feasibility of connecting to the CRV. During this discussion the SPSC should clarify:

v. Interfaces

vi. Data transfer rates

vii. DSCP marking etc.

viii. It is recommended that Service Providers use public ip addressing for the delivery their services.

ix. It is recommended that Service Consumers are provided with a 10.x.x.x ip addressing from the CRV Member State where the PCCW NID is installed.

x. SPSCs will NOT be a member of the CRV Operations Group (OG). The OG may establish a CRV user group that could facilitate discussion on the use of the CRV by SPSCs.

xi. SPSCs will need to adhere to the Common Regional VPN (CRV): System Design Document (SDD). Substantive changes to the SDD MUST be endorsed by the CRV OG.

xii. CRV member states should consider ICAO Doc 9855 AN/459 Guidelines on the Use of the Public Internet for Aeronautical Applications as guidance when they are the Primary sponsor.

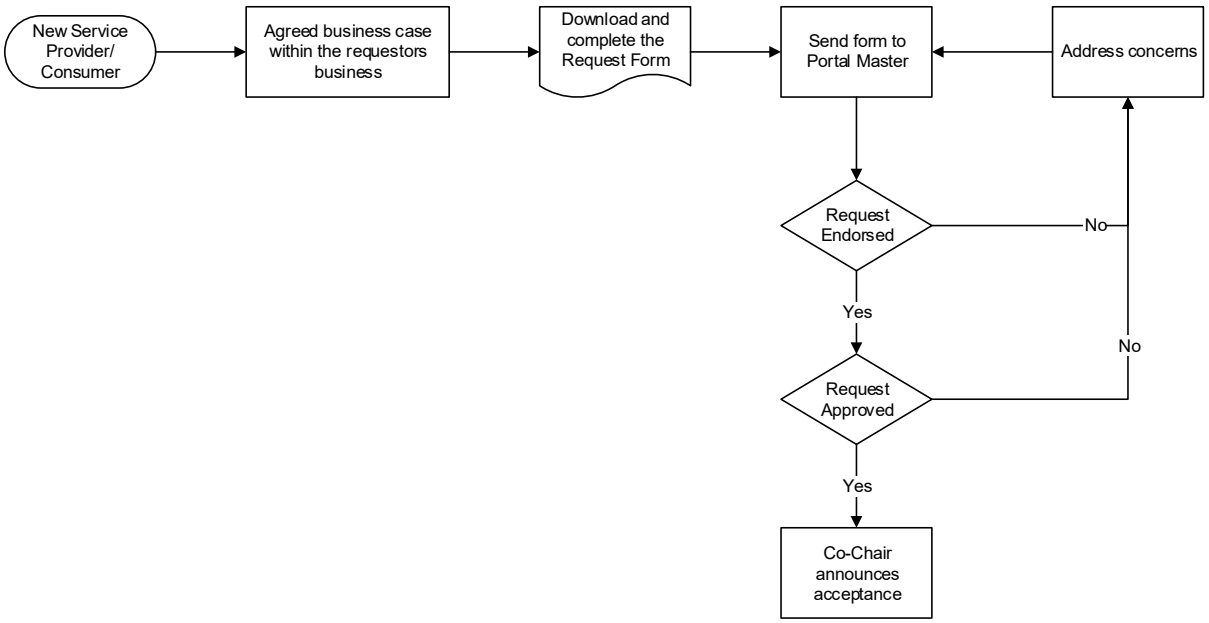
xiii.

xiv. The CRV OG IS NOT responsible for the accreditation/certification/validation of a Service Provider, but must ensure that the all reasonable steps have been taken to ensure that the Service Provider has sufficient systems and process in place to provide their service over the CRV.

xv.

xvi. Service Consumers and CRV members SHOULD ensure that when obtaining a Service from a Service Provider that the service meets their operational service requirements.

b. Process



1. Procedure.

i. The information required in the connection request, should be presented in English and in a clear and logical format. The following process will be used for an SPSC to obtain approval connect to the CRV:

ii. Provide a business justification including Benefits Realization for joining the CRV

iii. For a Service Provider:

a. provide a documentation using Section 2.3 ACCREDITATION OF AN IASP in ICAO Doc 9855 AN/459 as a guide including a cyber-security plan.

iv. For a Service Consumer; at a minimum, provide a CRV connection plan and cyber-security plan on how they will shield the CRV from their organisation.

v. Obtain a Primary CRV member state to sponsor their connection to the CRV.

vi. Obtain business justification from Primary Sponsor to support their request.

vii. Obtain a Secondary CRV member state to sponsor their connection to the CRV based on the information above.

viii. The information provided above, will be provided to the CRV OG via the APAC CRV portal.

ix. CRV OG members will be notified and have 25 business days to review and address any concerns that they may have with the request.

x. After the 25 days, if the majority of reviews by CRV OG members are endorsed, the CRV OG chairs will review the request.

xi. For the request to be approved, both CRV OG C-Chairs need to approve the request.

xii. A Document/Certificate will be provided to the primary sponsor that can used to verify that the SPSC is approved to connect the CRV.

xiii. The on boarding of Service Provider / Service Consumer will be supported by the Airways New Zealand provided APAC CRV SharePoint portal. There will be word forms to facilitate the information and these forms will be migrated to an automated SharePoint Workflow as soon as practical.

Service Provider / Service Consumer will be required to undertake the following:

Provide a business justification including Benefits Realisation for joining the CRV

Provide a High Level System Design oh how their Service could potentially connect to the CRV.

Service Providers to use Public IP Addressing

Service Consumers to use the ICAO allocated IP addresses

Interfaces

Data transfer rates

DSCP marking

5.2 Availability Management

Process Objective: To define, analyse, plan, measure and improve all aspects of the availability of IT services. Availability Management is responsible for ensuring that all IT infrastructure, processes, tools, roles etc. are appropriate for the agreed availability targets.

5.2.1 Monthly Performance Management Reports

Provided by PCCW to each State that has joined CRV covering:

- Router report
- Interface report
- QoS report
- Traffic report

(More SLA data is available from the PCCW Portal)

5.2.2 Monthly Operations Reports

Provided by PCCW to each State that has joined CRV covering:

- Active Service Inventory
- Site Availability (More SLA data is available from the PCCW Portal)
- Ticket Statistic
  - Problem Statistic
  - Incident Statistic
  - Requests
  - Maintenance
- Ticket Details
- AOB

5.2.3 Monthly meetings with PCCW

Conducted via Telephone conference that is hosted by PCCW, with each State that has joined CRV to discuss:

- States Performance Management Report (information from the Portal)
- States Operations Report (Service Report)

5.2.4 Quarterly Operations Reports

Provided by PCCW to the OG covering:

- Implementation progress
- Site Availability (More SLA data is available from the PCCW Portal)
- Ticket Statistic
  - Problem Statistic
  - Incident Statistic
  - Requests
  - Maintenance
- Ticket Details
- AOB

5.2.5 Annual OG meetings

- Implementation progress
- Site Availability (More SLA data is available from the PCCW Portal)
- Ticket Statistic
  - Problem Statistic
  - Incident Statistic
  - Requests
  - Maintenance
- Ticket Details
- Network Utilisation
- AOB

5.2.6 Root cause analysis reports

Provide detail post every Incident to the affected State and the APAC CRV OG. Include these in each of the Monthly, Quarterly and Annual Report.

5.2.7 Notifications of Maintenance

Ensuring that all affected parties of maintenance releases are updated as appropriate.

5.2.8 Diversity Audits

A rolling audit of States/Sites physical and logical connectivity based on the information provided in the Service Commencement Notice.

5.2.9 Testing failover

State LOA/MOU/Technical Letter for carrying out failover testing to ensure service continuity.

5.3 Capacity Management

Process Objective: To ensure that the capacity of IT services and the IT infrastructure is able to deliver the agreed service level targets in a cost effective and timely manner. Capacity Management considers all resources required to deliver the IT service, and plans for short, medium and long term business requirements.

Co-ordinate and standardize the establishment or upgrade of CRV services as required

Oversee the performance of the CRV network;

5.4 IT Service Continuity Management

Process Objective: To manage risks that could seriously impact IT services. ITSCM ensures that the IT service provider can always provide minimum agreed Service Levels, by reducing the risk from disaster events to an acceptable level and planning for the recovery of IT services. ITSCM should be designed to support Business Continuity Management.

a) CRV Contingency Operations

from CRV TF/6 report there is this report:

The meeting discussed again the contingency plan in relation to the safety case. To mitigate the risk of a total or major failure (such as IT disaster that would affect the whole CRV), two layers of process would have to be articulated:

- *the procedures and measures planned and implemented by PCCW; and*
- *consistently, the procedures and measures planned and implemented by the CRV Users, as part of their contingency plan required by ICAO SARPS.*

Furthermore, the meeting agreed that procedures to mitigate the total failure of CRV should be discussed by CRV OG as part of the contingency planning.

5.5 Service Level Management

Process Objective: To negotiate Service Level Agreements with the customers and to design services in accordance with the agreed service level targets. Service Level Management is also responsible for ensuring that all Operational Level Agreements and Underpinning Contracts are appropriate, and to monitor and report on service levels.

5.6 Design Co-ordination

Process Objective: To coordinate all service design activities, processes and resources. Design coordination ensures the consistent and effective design of new or changed IT services, service management information systems, architectures, technology, processes, information and metrics.

Change Requests

Engineering Package

Legal Documents

Dial Plan

5.7 Information Security Management

Process Objective: To ensure the confidentiality, integrity and availability of an organization's information, data and IT services. Information Security Management usually forms part of an organizational approach to security management which has a wider scope than the IT Service Provider.

Security is the responsibility for the implementation of security controls to ensure the integrity of services.

As a minimum the connectivity states is via GE Tunnels.

Other methods of ensuring the security of the connectivity are:

a. Utilising as small an IP Address range as possible.
b. Only advertising relevant IP addresses.
c. Only accepting verified IP Routes when required.
d. Utilising firewalls.
e. Utilising NAT.
f. Utilising Intrusion Protection Software (IPS)

It is recommended that external security advice is sought.

5.8 Supplier Management

Process Objective: To ensure that all contracts with suppliers support the needs of the business, and that all suppliers meet their contractual commitments.

a) Oversee the performance of the CRV Service Provider, including customer service;

b) Oversee the escalation and solving by the CRV Service Provider of issues associated with the provision of the CRV, including safety and security related issues

6 PART V: SERVICE TRANSITION

Service Transition

- Transition Planning and Support
- Change Management
- Service Asset & Configuration Management
- Release and Deployment Management
- Service Validation and Testing Management
- Change Evaluation
- Knowledge Management

6.1 Transition Planning and Support

Process Objective: To plan and coordinate the resources to deploy a major Release within the predicted cost, time and quality estimates.

a) Covered by the Implementation Plan

6.2 Change Management

Process Objective: To control the lifecycle of all Changes. The primary objective of Change Management is to enable beneficial Changes to be made, with minimum disruption to IT services.

All changes are to be conveyed to PCCW via their Change Request Form. And covered by the Change Management Process as found in the Common Package.

6.3 Service Asset and Configuration Management

Process Objective: To maintain information about Configuration Items required to deliver an IT service, including their relationships.

a) Maintain CRV OG documentation associated with the function, performance and management of the CRV, including the CRV OG Operations Manual, a list of CRV users and a record of variations to the common tender package;

   This information is collated in the following ways:

   CRV Operations Manual – APAC Portal
   A list of CRV users – Registrations page on the APAC portal
   Record of Variations is found in the APAC CRV Portal in the Common Package Folder

6.4 Release and Deployment Management

Process Objective: To plan, schedule and control the movement of releases to test and live environments. The primary goal of Release Management is to ensure that the integrity of the live environment is protected and that the correct components are released.

a) Oversee the implementation of the CRV post Contract Award;

b) Manage issues arising from the transition with CRV TF, if any

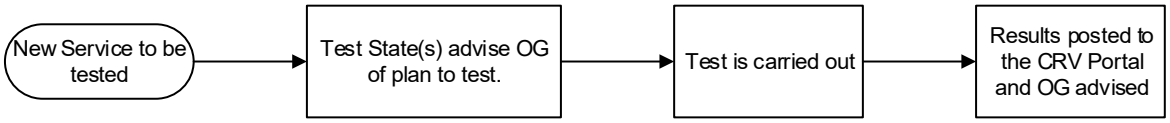
6.5 Service Validation and Testing Management

Process Objective: To ensure that deployed Releases and the resulting services meet customer expectations, and to verify that IT operations is able to support the new service.

a) Accept deliverables from the CRV Service Provider on behalf of the CRV Users as required;

b) Refer to the CRV Implementation Plan

c) New Services



New services being tested by any state,
Notifies OG intention to test as soon as practical.
Advises CRV OG and PCCW 48hrs prior to testing

Testing is to be carried out with a DSCP marking of DF so as to avoid impacting other services.

The results of the tests are to be posted on the CRV portal and the OG advised of the posting.

6.6 Change Evaluation

Process Objective: To assess major Changes, like the introduction of a new service or a substantial change to an existing service, before those Changes are allowed to proceed to the next phase in their lifecycle.

6.7 Knowledge Management

Process Objective: To gather, analyse, store and share knowledge and information within an organization. The primary purpose of Knowledge Management is to improve efficiency by reducing the need to rediscover knowledge.

a) All information relating to the ongoing operation of the network shall be retained in the APAC CRV Portal

There will be a link to the portal from the ICAO APAC page.

b) To add items to the portal.

c) To Workflow a document.

7 PART VI: SERVICE OPERATION

7.1 Event Management

Process Objective: To make sure CIs and services are constantly monitored, and to filter and categorize Events in order to decide on appropriate actions.

a) Managed by PCCW

7.2 Incident Management

Process Objective: To manage the lifecycle of all Incidents. The primary objective of Incident Management is to return the IT service to users as quickly as possible.

a) Managed by PCCW

After an incident, an incident report (IR) can be provided upon request.

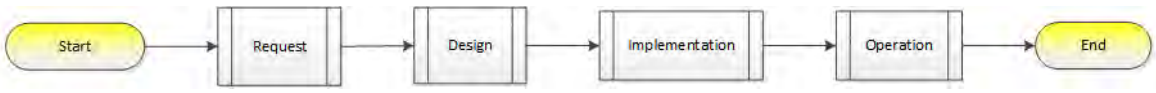
Under normal circumstances, an IR would be ready in 3 working days.

An IR Form template is provided in the Common Package as an example.

7.3 Request Fulfilment

Process Objective: To fulfil Service Requests, which in most cases are minor (standard) Changes (e.g. requests to change a password) or requests for information.

- Process

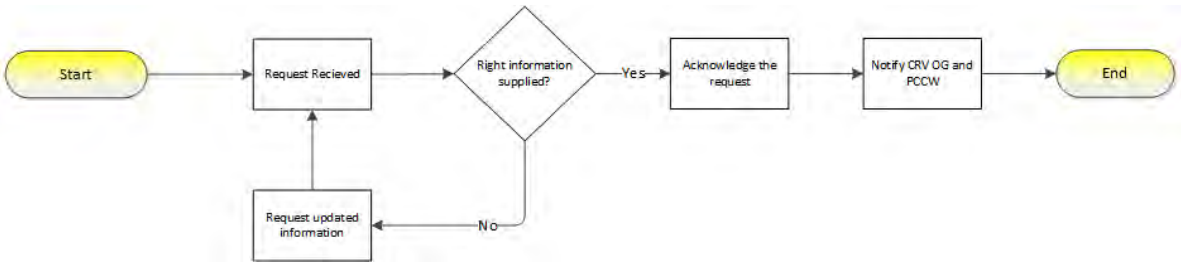


- Procedure
  - Request

    There are four types of requests:

    1. Request to join CRV as a user.
    2. Request to change
    3. Request to add a new service
    4. Request to terminate the CRV connection

    - Process



- Procedure

1. Details on how to join CRV are posted on the ICAO APAC and ICAO MID pages.
2. An initial request is sent to the APAC CRV Portal Administrator requesting to join, leave or add a new connection to CRV.
3. Upon receipt of the request to join, leave or add new connection to CRV, a registration form is provided.
4. Upon receipt of the registration form to join or leave, check the content is complete:
    a. ANSP Making the Request
    b. Technical Point of Contact
    c. State(s) connecting to.
    d. Proposed services between ANSPs
    e. Proposed go live/removal date
5. If complete, acknowledge the request with a link to the Common Package, the Operations Group Manual and the Implementation Plan and the CRV Portal.
6. If not complete, request updated information.
7. Notify the CRV OG and PCCW.
8. Update the Registrations List.

- Design
    - Go to Design Co-ordination
- Implementation
    - Go to Change Management
- Operation
    - Go to Service Operation

7.4 Problem Management

Process Objective: To manage the lifecycle of all Problems. The primary objectives of Problem Management are to prevent Incidents from happening, and to minimize the impact of incidents that cannot be prevented. Proactive Problem Management analyses Incident Records, and uses data collected by other IT Service Management processes to identify trends or significant Problems.

a) PCCW Initiated – Follow the Customer Support Service Plan

b) Authority Initiated

a. Troubleshoot local connectivity

b. Polling the NID. On the ANSP NID provided by PCCW, a loop back IP will be configured using a specified IP address from the allocated range of IP addressing. This will be called the troubleshooting IP address.

c. Troubleshoot with peers

d. Fault with PCCW following the Customer Support Service Plan

7.5 Access Management

Process Objective: To grant authorized users the right to use a service, while preventing access to non-authorized users. The Access Management processes essentially execute policies defined in Information Security Management. Access Management is sometimes also referred to as Rights Management or Identity Management.

a) Physical Access Control

   i. The Cabinet for Core Routers are locked

   ii. The network main PoP sites are under 7x24 CCTV monitoring and recording

b) Remote Network Access Control

   i. The remote access of Cores and CE routers are controlled by access-list ACL that is only allow authorized terminal of management systems.

   ii. The TACACS is deployed to allow the authorized persons of PCCWG to access Core Routers or CE routers as AAA clients.

c) Portal Access

   Review member's access annually.

PART VII: CONTINUAL SERVICE IMPROVEMENT

Continual Service Improvement

- Service Review
- Process Evaluation
- Definition of CSI Initiatives
- Monitoring CSI Initiatives

7.6 Service Review

Process Objective: To review business services and infrastructure services on a regular basis. The aim of this process is to improve service quality where necessary, and to identify more economical ways of providing a service where possible.

Volunteers for each section

Small groups around these sections.

Report back up to the master document owner

Approval by Chairs

Approval by APANPIRG

Master owner of the document updates and publishes every two months?

Quarterly conference call to start with to update the document.

7.7 Process Evaluation

Process Objective: To evaluate processes on a regular basis. This includes identifying areas where the targeted process metrics are not reached, and holding regular bench markings, audits, maturity assessments and reviews.

7.8 Definition of CSI Initiatives

Process Objective: To define specific initiatives aimed at improving services and processes, based on the results of service reviews and process evaluations. The resulting initiatives are either internal initiatives pursued by the service provider on his own behalf, or initiatives which require the customer's cooperation.

7.9 Monitoring CSI Initiatives

Process Objective: To verify if improvement initiatives are proceeding according to plan, and to introduce corrective measures where necessary.

8 PART VIII
DEFINITIONS

8.1 Definitions

A Service is defined as any service provided over the CRV supporting Meteorological Service for International Air Navigation or Air Traffic Control Services.

Service Provider / Service Consumer (SPSC)

Incident - An Incident is defined as an unplanned interruption or reduction in quality of an IT service (a Service Interruption).

Eg. A link has been flapping in the network causing reroutes.

Problem - A cause of one or more Incidents. The cause is not usually known at the time a Problem Record is created.

Eg. Link flaps have been caused by unplanned work by a third party.

INTERNATIONAL CIVIL AVIATION ORGANIZATION

COMMON AERONAUTICAL VPN (CRV) IMPLEMENTATION PLAN

Version 2.10

17 May 2021

Table of Contents

ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AFTN	Aeronautical Fixed Telecommunication Network
AIDC	ATS Inter-facility Data Exchange
AMHS	Air Traffic Service Message Handling System
ANSP	Air Navigation Service Provider
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
APAC	Asia/Pacific
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
BBIS	Backbone Boundary Intermediate System
BIS	Boundary Intermediate System
CAA	Civil Aviation Authority
CAR	Caribbean Region
CBA	Cost Benefit Analysis
CNS	Communications, Navigation and Surveillance
ConOps	Concept of Operations
CRV	Common aeRonautical Virtual Private Network
DSCP	Differentiated Services Code Point
EUR	European Region
FIXM	Flight Information Exchange Model
FPL	Flight Plan
ICAO	International Civil Aviation Organization
IP	Internet Protocol
IPS	Internet Protocol Suite
IWXXM	ICAO Weather Information Exchange Model
MET	Meteorological
MPLS	Multi-Protocol Label Switching
NAT	Network Address Translation
NID	Network Interface Device
OH	Operational Hazard
OG	Operation Group
OSI	Open Systems Interconnections
PoC	Point of Contact
QoS	Quality of Service
RFI	Request for Information
RFP	Request for Proposal
SARP	Standards and Recommended Practices
SAT	Site Acceptance Test
SIP	Session Initiation Protocol
SME	Subject Matter Expert
SOP	Standard Operating Procedures
ST	Sealed Tender
SWIM	System-Wide Information Management

ABBREVIATION	DESCRIPTION
TF	Task Force
WXXM	Weather Information Exchange Model (based on XML)
UC	Use Case
VoIP	Voice Over Internet Protocol
VPN	Virtual Private Network
XML	Extensible Markup Language

1.0 INTRODUCTION

1.1 Purpose

The purpose of this Implementation Plan is to provide guidance for all States/ Administrations on the operation requirements for the upcoming Common aeRonautical Virtual Private Network (CRV) used in Asia/ Pacific (APAC) Region and the roadmap for implementation.

The details includes in Table 1, Table 2 and Appendix A, a list of all States/ Administrations concerned, and for each State/ Administration it includes the:

i. National Points of Contact and Local Points of Contact; and

ii. expected deployment date.

The information contained in this document was first adopted by the 1st Meeting of CRV Operations Group (CRV OG/1). It is intended that this Implementation Plan shall be used as the means to:

i. identify all actions required to implement CRV;

ii. ensure a harmonized approach for the APAC Region;

iii. monitor and report on progress; and

iv. identify any issues, risks or problems which may arise.

1.2 Overview of the CRV

Currently, aeronautical ground-ground communications in the ICAO Asia/Pacific Region, and in particular Aeronautical Fixed Telecommunication Network (AFTN) and AMHS services, operate over point-to-point international leased circuits. However, this network configuration exhibits a number of limitations such as the inability to switch to new protocols like Voice over IP (VoIP) or System Wide Information Management (SWIM) efficiently, high cost for every connection and limited flexibility for increase in bandwidth.

A CRV Task Force (TF) was formally established in accordance with APANPIRG Decision (24/32), (Bangkok, Thailand, 24-26 June 2013). The concept of CRV was taken from other common network that has already implemented in other regions such as Pan-European Network Services (PENS) and FAA Telecommunication Infrastructure (FTI).

The CRV is a dedicated multiprotocol label switching (MPLS) Internet Protocol (IP) based Virtual Private Network (VPN) communication network provided by a common network service provider and support all Aeronautical Fixed Service (AFS) in the APAC region. Telecommunication costs are reduced as States/ Administrations will only require minimal connections to a far reaching network instead of individual connections to each neighboring State/ Administration. The CRV service provider provides the service to allow CRV members to exchange voice and data information with each other.

Each CRV member should determine the amount of bandwidth require for each Quality of Service (QoS) sub queue. In addition, each CRV member should also determine the total access bandwidth that they need to subscribe.

2.0 IMPLEMENTATION OVERVIEW AND PROCESSES

2.1 General Description of Implementation

States/ Administrations should refer to the implementation roadmap (see Appendix A) to take note of the estimated CRV implementation date provided by other States/ Administrations that they wish to exchange data/ voice via the CRV.

The implementation date, type of data, voice, bandwidth and QoS between the two States/ Administrations shall be negotiated and agreed bilaterally and supported by the CRV service provider.

CRV service provider is to put up individual service contracts for the two connecting States/ Administrations.

The work processes and CRV implementation roadmap in 2.2 provides a breakdown of the estimated schedule and serve as a guide.

2.2 Implementation Schedule/ Roadmap

The planned project timeline for each States/ Administrations to implement CRV could be based on the estimated work processes schedule and roadmap for CRV.

2.2.1 Work Processes

The projected activities and schedule to implement the services includes the following:

S/No.	Subject	Projected Activities	Projected Schedule
1	Technical requirements and SOW	1. Respective ANSPs develop their associated requirements and Statement of Work (SOW) that specify performance, interface, conversion, operational procedure, acceptance test procedure 2. Present to Vendor for comment and response 3. To seek CRV-OG concurrence on deviation from CRV common package 4. Finalize requirements	6 to 9 months
2	Negotiation and agreement between two connecting States/ Administrations	1. To decide the type of data or voice to be exchanged via CRC, QoS for each type of applications and the required bandwidth 2. CRV Contractor to comment and response to the agreed requirements 3. Agree to implementation schedule	6 to 9 months
3	CRV Contractor proposes Contract to ANSP	4. Contractual and Legal review 5. Technical and operational review 6. Finalize contract 7. Establish contract and payment system	6 to 9 months
4	Site preparation	Site preparation and implementation of the service	1 to 3 months

S/No.	Subject	Projected Activities	Projected Schedule
5	Test and evaluation	1. Perform acceptance test with associated applications 2. Perform acceptance test with respective ANSPs	3 to 6 months
6	Service acceptance	Service acceptance	1 week

2.2.2 Roadmap for CRV

The roadmap for CRV implementation in the APAC Region is appended in Appendix A.

2.3 Application Transition Schemes

This paragraph provides States/ Administrations the recommended transition scheme for each application (e.g. AMHS, ATFM, ADS-B, Voice, etc.) targeted to be implemented or migrated from the existing communication link/ network.

2.3.1 AMHS

Being IP, it should be possible to reroute the existing connection at the IP layer either by an address translation or by pointing the LA at a new IP address in the AMHS system. However the recommended approach will be to setup a parallel connection using the CRV that can be thoroughly tested to the satisfaction of both ANPS's. Once the stability of the CRV has been verified, the cutover would be conducted by the respective com-centers at the AMHS system level. The actual approach taken will require a negotiation between each pair of ANSP's.

2.3.2 AFTN

Depending on the existing AFTN connection there are a number of migration strategies available.

Option 1. Migration to AMHS

Setting up a new AMHS link over the CRV as per ICAO grand master plan *xyz.123* would be the preferred option for migration of AFTN. It would allow the new connection to be setup and tested independently.

Option 2. Migrate from native X.25 to XoT

Where the existing connection is a native X.25 connection end to end, and migration to AMHS is not possible, then XoT is the next preferred option. It is recommended that a new LA be setup that uses the XoT over CRV path. Once the XoT connection has been verified and tested by each ANSP then actual migration of AFTN would be performed by the respective com centers similar to AMHS in 2.3.1 above. If PCCW are not able to provide serial interfaces on their CE routers then it would be incumbent on the ANSP to deliver the AFTN traffic as a XoT connection.

Option 3. Migrate from XoT to XoT

Where the AFTN connection between two ANSP's is already using XoT, and if the trust in the performance of the CRV is high, then the cutover from the legacy link to the CRV could be as simple as an X25 route change on each ANSP's respective XoT routers. Alternatively, a new LA could be setup and tested before being cutover at the system level by the respective ANSP's com-centers.

2.3.3 ADS-B

To deliver their stream to the PCCW gateway, likewise at the other end it would be up to the partner ANSP to ensure that that there is a multicast path available from the CRV egress to their flight data management system. Being multicast it is possible for the same information to traverse the same two endpoints via multiple network paths simultaneously, however some ANSPs may decide to setup new multicast groups via the CRV so that the performance of the CRV can be measured against the legacy link. Alternatively, ANSPs may decide to replace the multicast stream with unicast data flows that operate via an ADS-B filter.

PCCW could implement Generic Routing Encapsulation (GRE) tunnel solution (NID to NID) between States/ Administrations who are agreeable to have direct connection for routing control over the any to any MPLS layer 3 backbone.

2.3.4 Voice

The specific strategy used to migrate the voice services will vary depending on the existing setup, the proposed voice interface between the ANSP and PCCW (E&M / ISDN / VoIP), how the partner ANSP is setup and their intended connection to PCCW. Despite this there are two main options.

Option 1 – New buttons on the operator consoles - Preferred

This option involves setting up new buttons on the operator consoles at each end. The new buttons are configured from the outset to route via the CRV. This strategy allows the new service to be configured and tested with minimal disruption to operators and also allows for an almost seamless cutover (pressing a different button). Another great advantage of this strategy is to ability to do a practical test of the voice quality by allowing the same pair of controllers test both paths within a few seconds of each other.

Option 2 – Reconfigure existing connections to use the CRV

Where Option 1 is not possible, the only other alternative is to reconfigure the existing connection. This will involve increased coordination between the two ANSP's and PCCW as well as potentially multiple technical groups within an ANSP as it is likely that multiple systems will need to be reconfigured at the same time. E.g. Voice switches, networking devices etc. This option would also involve a lengthy outage and interruption to operational staff.

2.4 Technical Specifications of CRV (for applications reference)

CRV envisaged in the ICAO CNS/ ATM concept via through two backbones (one Multiprotocol Label Switching (MPLS), based on a terrestrial, satellite, or both networks, and one based on a secured Virtual Private Network over the public internet.

i. It will be a homogeneous and generalized application of the IP protocol in the transport network for voice and data aeronautical communications;

ii. It will established an appropriate Quality of Service (QoS) quality requirements;

iii. It will have a centralized and common network management;

iv. It will have a homogeneous and standardized interface, consisting Network Interface Device(s) (NID(s)) linked to the existing local switches, satellite and/or terrestrial links based on the Multiprotocol Label Switching (MPLS) technology, as well as ground services, based on a Virtual Private Network (VPN) over the public internet;

v. It will have voice and data gateway service by the Service Provider; and

vi. For IT security, individual ANSPs may implement an authentication service based on a cooperative public key infrastructure (PKI) including IPSec for IPv4 and IPv6 and digital certificates management for public IP links between ANSPs.

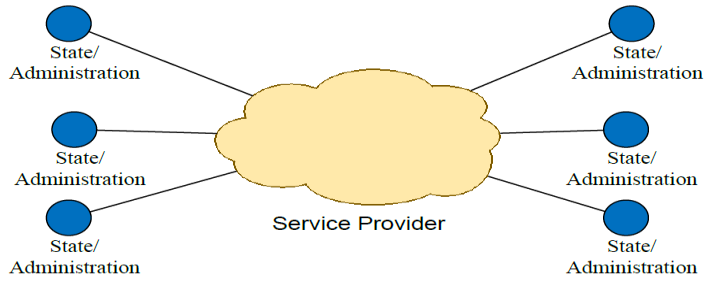


Figure 1: High level system overview of CRV

2.4.1 Service Level Agreement & Quality of Service

i. QoS are implemented using guidance from IETF RFC 4594 Configuration Guidelines for Different Service Classes. The routing protocol, voice, voice signaling, real-time interactive and standard data types shall all be given separate QoS bandwidth;

ii. Differentiated Services Code Point (DSCP) QoS markings to traffic will be used before it enters the network; and

iii. SLAs are based on States/ Administrations' requirements (i.e. Packages A, B, B+, C, C+ and D offered by CRV contractor).

2.4.2 IP Addressing

i. CRV supports IPv4 and IPv6 addressing. The overall IP addressing plan will be centrally managed by the CRV contractor and will be known as the CRV IP address plan;

ii. An IPv4 plan, appended as Appendix B, was agreed in the APAC region and was concluded through Conclusion 21/22 - Asia/Pacific ATN Interim Addressing Plan; ~~and~~

~~ii.~~iii. In the development of the IPv4 plan, a flexible margin has been designated to allow future growth or change. Through draft Conclusion CRV OG/8/XX, using one vacant /19 IP address block "10.46.0.1 to 10.46.255.254", each third party Service Provider (e.g. AIREON LLC providing Automatic Dependent Surveillance - Broadcast data over CRV) is assigned 254, ~~or~~ 510, ~~or~~ 764 or 1022 usable Network addresses (depending on Service Providers' technical requirements); and

~~iii.~~iv. The Middle East Regional (MID) region IPv4 plan is appended as Appendix C of this document.

2.4.3 Interface

i. The interface type provided by the NID to the CRV User is the Ethernet IEEE 802.3ab (1000 Base-T).

2.4.4 Routing Restrictions

i. Route advertisements will be restricted so that each CRV User which interacts with the CRV routing protocol can only advertise subnets which are allowed in the CRV IP Address Plan.

ii. When peering with the CRV Contractors network, it is permissible to use the CRV User's own Public IP addressing and ASN, and the CRV Contractor will use a Public AS.

2.4.5 Packet Loss Rate:

i. Packet loss rate of less than 0.1% for all the SLA-Voice; and

ii. Packet loss rate of less than 0.5% for all the SLA-Data.

2.4.6 For VoIP Transport (ED-137)

i. The VoIP Transport shall provide a maximum jitter of 40ms;

ii. The VoIP Transport shall provide a maximum packet loss of 0.1%;

iii. The VoIP Transport shall provide an availability greater than 99.9%; and

iv. The CRV shall use the high priority tags in the VPN packet headers to ensure that VoIP traffic is given high priority and minimal delay. An appropriate level of priority will be given to ED-137 SIP signaling.

2.4.7 Standards used

i. SNMP and MIB-II management protocols, implemented in accordance with RFC 1157 and RFC 1213;

ii. Implementation of the RTP/RTCP and RTP "header compression" protocols, in accordance with RFC 2508;

iii. The multiservice IP network permit the creation of VPNs using MPLS, in accordance with RFC 2547 and RFC 3031, and QoS configuration over MPLS/VPN, in accordance with RFC 3270 and RFC 2983;

iv. QoS is implemented using guidance from IETF RFC 4594. (Covered under QoS); and

v. The CRV provide transport for the ED-137 VoIP.

*Note: If at the time of the publication of this document the specific rules and standards mentioned in any of the other Sections have been revoked, superseded or updated, the new rules or standards shall be deemed as applicable.

2.5 Use Cases

Use Case 1 – ANSPs Interconnect AMHS

Summary of Situation
ANSP 'A' and ANSP 'B' wish to have a direct connection between their AMHS. Both ANSPs decide that the AMHS application shall be built upon the Aeronautical Telecommunication Network (ATN). The ATN will in turn use the CRV.

User Response
Each ANSP already has a connection to the CRV. Each ANSP:
1. Notifies the CRV-OG Coordinator of their intention to establish the new facility.
2. Determines if their existing access speed is sufficient. If it is not the ANSP will arrange with the CRV Service Provider to increase their bandwidth.
3. Negotiates bi-laterally with the other ANSP to determine what IT security arrangements are required. In this User Case they decide to implement an IPSec VPN.
4. Negotiates bi-laterally with the other ANSP to determine what testing, acceptance and commissioning procedures are required.
5. Notify CRV-OG on completion of the implementation to update records.
Operational Needs

UC1.1 The CRV link must meet the reliability and availability needs of AMHS.
UC1.2 The CRV link must provide IP version 4 transport for the ATN.
UC1.3 The CRV link must provide IP version 6 transport for the ATN.
UC1.4 The CRV link must allow the ANSPs to implement IPSec VPN tunnels.
UC1.5 The CRV link must allow for bandwidth changes.

Use Case 2 – ANSPs Implement ATC Voice over Internet Protocol Circuits

Summary of Situation
ANSPs 'A' and 'B' wish to build upon the success of their AMHS implementation and have identified four Voice over Internet Protocol (VoIP) voice circuits which should be moved to the CRV.

User Response
Each ANSP already has a connection to the CRV. Each ANSP:
1. Notifies the CRV-OG Coordinator of their intention to establish the new facility.
2. Determines if their existing access bandwidth is sufficient. If it is not, the ANSP will arrange with the Service Provider to increase their bandwidth.
3. Negotiates bi-laterally with the other ANSP to determine what IT security arrangements are required. In this Case they decide to implement an IPSec VPN to provide secure end-to-end transport between ANSPs.
4. Negotiates bi-laterally with the other ANSP to determine what testing, acceptance and commissioning procedures are required.
5. Tags the VPN traffic containing the Voice over Internet Protocol (VoIP) Real-time Transport Protocol (RTP) and Session Initiation Protocol (SIP) data with appropriate priority markings to allow the CRV Service Provider to identify the voice traffic.
Operational Needs

UC2.1 The CRV link must meet the reliability and availability needs of ATC voice.
UC2.2 The CRV link must provide an IP version 4 VPN tunnel to transport IP version 4 VoIP and SIP signaling.
UC2.3 The CRV link must provide an IP version 6 VPN tunnel to transport IP version 6 VoIP and SIP signaling.

UC2.4 The CRV link will use the high priority tags in the VPN packet headers to ensure that VoIP traffic is given high priority and minimal delay.

Use Case 3 – ANSPs Implement Automatic Ring-down Circuits

Summary of Situation
ANSPs 'A' and 'B' wish to build upon the success of their AMHS implementation and have identified an Automatic Ring-down (ARD) analog voice circuit which should be moved to the CRV.

User Response
Each ANSP already has a connection to the CRV. Each ANSP:
1. Notifies the CRV-OG Coordinator of their intention to establish the new facility.
2. Determines if their existing access bandwidth is sufficient. If it is not, the ANSP will arrange with the Service Provider to increase their bandwidth.
3. Negotiates bi-laterally with the other ANSP to determine what voice quality Mean Opinion Score (MOS) is required. Perceptual Evaluation of Speech Quality (PESQ) ITU-T Rec. P.862 may be used to measure the effects of distortions (e.g. errors, packet loss, delay, etc.) to provide the MOS score.
4. Negotiates bi-laterally with the other ANSP to determine what testing, acceptance and commissioning procedures are required.

UC3.1 The CRV link must meet the reliability and availability needs of ATC voice.
UC3.2 The CRV link must provide conversion from analog voice to VoIP.
UC3.3 The CRV link must provide appropriate SIP signaling to support the ARD functionality.
UC3.4 The CRV link must provide IP version 4 transport for the VoIP.
UC3.5 The CRV link must provide IP version 6 transport for the VoIP.
UC3.6 The CRV link will use the high priority tags in the packet headers to ensure that VoIP traffic is given high priority and minimal delay. The CRV must give an appropriate level of priority to SIP.
UC3.7 The CRV link must deliver voice so that it is clearly understood with minimal delay.

Use Case 4 – ANSPs Implement Analog Voice Circuits

Summary of Situation
ANSPs 'A' and 'B' wish to build upon the success of their AMHS implementation and have identified four analog voice circuits which should be moved to the CRV.

User Response
Each ANSP already has a connection to the CRV. Each ANSP:
1. Notifies the CRV-OG Coordinator of their intention to establish the new facility.
2. Determines if their existing access bandwidth is sufficient. If it is not, the ANSP will arrange with the Service Provider to increase their bandwidth.
3. Negotiates bi-laterally with the other ANSP to determine what voice quality Mean Opinion Score (MOS) is required. In this Case they decide a MOS of 4.0 is required so they select a CRV service level that provides the required voice quality.
4. Negotiates bi-laterally with the other ANSP to determine what testing, acceptance and commissioning procedures are required.
Operational Needs

UC4.1 The CRV link must meet the reliability and availability needs of ATC voice.
UC4.2 The CRV link must provide conversion from analog voice to VoIP.
UC4.3 The CRV link must detect analog signaling and provide appropriate SIP signaling and vice versa.
UC4.4 The CRV link must provide IP version 4 transport for the VoIP.
UC4.5 The CRV link must provide IP version 6 transport for the VoIP.
UC4.6 The CRV link will use the high priority tags in the packet headers to ensure that VoIP traffic is given high priority and minimal delay. The CRV must give an appropriate level of priority to SIP.
UC4.7 The CRV link must deliver voice so that it is clearly understood with minimal delay.

3.0 IMPLEMENTATION SUPPORT

3.1 Introduction

The aim of the transition is to be interruption less. But as the services must migrate from the current network infrastructure to the CRV, an interruption time due to disconnection and reconnection, is mandatory and the team involved (CRV-OG, CRV Members and Contractor) will be of utmost importance to the overall process.

This chapter comprises the basic teams involved in the implementation of the CRV infrastructure, the roles of each professional and the main coordination steps and stakeholders including the CRV-OG.

These responsibilities come in addition to those stated in the Terms and Conditions and Terms of Reference.

Figure 3 describes the relevant entities for the CRV implementation.

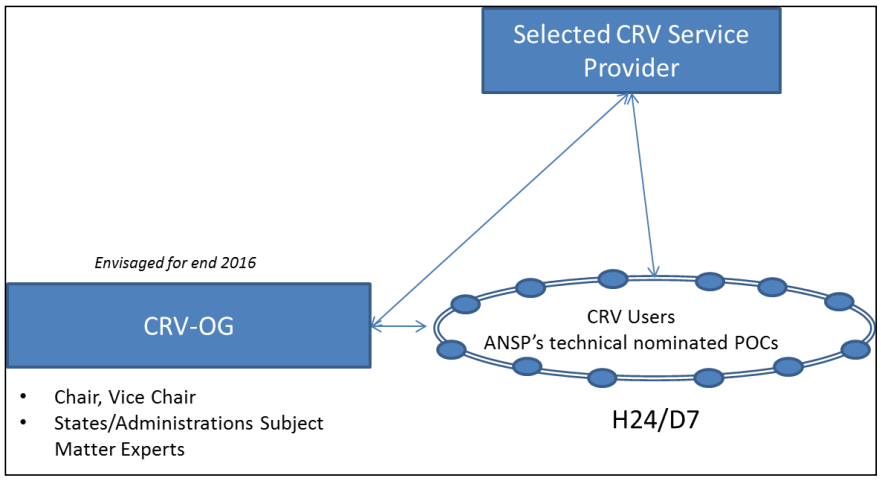


Figure 3: Relevant Entities to this Project.
(Source: CRV Tender doc - Att II - Terms of Reference_v3)

3.2 Implementation Team

The implementation team will be composed of the CRV-OG representatives, the National Points of Contact (NPOC), Local Points of Contact (LPOC) and the CRV Contractor Team, as described in the following sections.

3.2.1 CRV-OG

The CRV Operations Group (OG) will provide oversight of the function and performance of the network after the CRV is completely installed. Besides, it will be involved in the oversight of the implementation of the CRV post Contract Award.

The main activities and roles applied to the CRV-OG during the implementation of the CRV infrastructure are:

i. Develop close coordination with the National CRV POC and Contractor for the complete implementation of the CRV node;

ii. Provide the CRV IP Addressing Scheme (Plan) to the Contractor, in close coordination with the National CRV POC; and

iii. Provide the classification and marking scheme for the prioritization of traffic for the QoS to be used by the aeronautical applications in the CRV network.

Note: When applying QoS, the end-to-end configuration needs to be observed (LAN- layer 2 switches and WAN- Layer 3 routers devices). So, this activity will involve close coordination with the National CRV POC and Contractor, taking into consideration the tender document Att II - Annex b - Matrix of Flows for CRV services_v2), SLA, and the tender document Att II - Annex c - Mapping of services for quality management_v2.

3.2.2 National CRV Points of Contact

Table 1 contains the National CRV Points of Contact that will be in charge of the whole process in each CRV Member, independently if the State involved has more than one node.

The main activities and roles of the National CRV Points of Contact are:

i. Develop close coordination with the CRV-OG representatives, Contractor and Local CRV POC for the complete implementation of the CRV node;

ii. Receive the requests for site surveys from the Contractor, coordinating the actions with the Local CRV POC;

iii. Participate and/or Coordinate the participation of the Local CRV POC and Local Staff in the implementation meetings with the Contractor;

iv. Participate and/or Coordinate the participation of the Local CRV POC and Local Staff in the training package (on line, on site, initial and refresh) as defined in the Section 3.12 (Training) of the Terms of Reference (TOR) document;

v. Coordinate the actions and instruct the Local CRV Points of Contact regarding all activities

involved in the implementation phase;

vi. Review and approve the System Design Document (SDD), System Engineering plan (SEP) and other documents, part of the tender package, prepared by the Contractor upon the contract award and signature;

vii. Review and approve the Validation Plan, including the Site Acceptance Test (SAT), prepared by the Contractor;

viii. Oversee if the Contractor is following the national laws and procedures concerning the assignment of frequencies with the radio regulator authorities in each country (case of microwave and satellite equipment);

ix. Update the ICAO CNS Regional Officer (ICAO Asia and Pacific Regional Office) with regard to the timeframe, situation, difficulties and other topics deemed necessary for the implementation of the CRV node(s);

x. Provide the local CRV IP Addressing Scheme - Plan to the Contractor in close coordination with the CRV-OG representatives.

xi. Provide the current numbering plan for the ATS Switched Voice Circuits to the Contractor;

xii. Provide the current direct hotline Voice Circuits configuration to the Contractor;

xiii. Provide the classification and marking scheme for the prioritization of traffic for the QoS to be used by the aeronautical applications in the CRV network (See note in the paragraph 3.2.1.3);

xiv. Receive the requests for site surveys from the Contractor and coordinate the activities with the Local CRV POC; and

xv. Approve the implementation planning.

Table 1: National CRV Points of Contact

Asia Pacific Region:

State/ Administration	ANSP/ CAA	National CRV Point of Contact (POC)	Job Title	E-mail	Telephone/FAX	Address
The information is restricted and can be accessed by New Zealand hosted CRV portal at https://airwayscorporation.sharepoint.com/teams/APAC-CRV/SitePages/Home.aspx or ICAO APAC **CRV** Secure Portal. If you are an ANSP wishing to connect to another ANSP or consume a service, please email the APAC CRV Portal administrator at vaughan.hickford@airways.co.nz. to get access to New Zealand hosted CRV portal If you are proposing the provision of a service be added to the CRV, please liaise through your sponsoring ANSP. To get access to ICAO Secure portal, please use group Name: **CRV**						

MID Region (CRV) Focal Points (updated in December 2017 at CRV OG/3 meeting):

State	Name/Title	Contact Details (Tel./Fax/Mobile/Email)
The information is restricted and can be accessed by New Zealand hosted CRV portal at https://airwayscorporation.sharepoint.com/teams/APAC-CRV/SitePages/Home.aspx or ICAO APAC **CRV** Secure Portal. If you are an ANSP wishing to connect to another ANSP or consume a service, please email the APAC CRV Portal administrator at vaughan.hickford@airways.co.nz. to get access to New Zealand hosted CRV portal If you are proposing the provision of a service be added to the CRV, please liaise through your sponsoring ANSP. To get access to ICAO Secure portal, please use group Name: **CRV**		

3.2.3 Local CRV Points of Contact

Table 2 contains the Local Points of Contact. In fact, the professionals nominated and listed in the referred tables will really take part in the installation, on behalf of the States, and will be in charge of the oversight of the Contractor´s team in each site. They will report directly to the National Points of Contact of each CRV Member. The main activities and roles for the Local CRV Points of Contact are:

i. Instruct and coordinate the actions with all the local staff involved in the CRV implementation;

ii. Develop close coordination with the National CRV POC and the Contractor´s site staff for the complete implementation of the CRV node;

iii. Coordinate the actions for the site surveys with the National CRV POC;

iv. Participate in the implementation meetings with the Contractor (if decided by the National Point of Contact);

v. Participate to the elaboration of the implementation planning;

vi. Participate in the Training Package and nominate, to the National CRV POC, the Local staff there will participate in the referred events;

vii. Report, give feedback and update the National CRV POC regarding all aspects concerning the implementation of the CRV node;

viii. Assist the National POC in the revision and approval of the SDD, SEP and other implementation documents, prepared by the Contractor;

ix. Assist the National POC in the revision and approval of the Validation Plan including the SAT, prepared by the Contractor;

x. Oversee the installation in order to ensure that the Contractor team is keeping the working area clean and free from fire hazards and if after installation, all excess material is duly removed;

xi. Make sure that the local safety rules are observed by the Contractor in terms of intervention on operational systems;

xii. Oversee the installation in order to ensure that the Contractor is following what is described in the TOR, item 3.3.2.9, concerning the Electromagnetic compatibility/ grounding;

xiii. Oversee if the QoS configuration is duly performed by the Contractor, as defined by the CRV-OG representatives and the National CRV POC;

xiv. Oversee if the CRV IP Addressing Scheme (Plan) is duly performed by the Contractor, as defined by the CRV-OG representatives and the National CRV POC;

xv. Oversee if the configuration of current numbering plan for the ATS Switched Voice is duly performed by the Contractor, as defined by the CRV-OG representatives and the National CRV POC;

xvi. Oversee if the configuration of the current Direct Circuits (DIR) is duly performed by the Contractor, as defined by the CRV-OG representatives and the National CRV POC;

xvii. Coordinate the actions for the site surveys and assist the Contractor´s personnel during the visits; and

xviii. Hold meetings with the Contractor as deemed necessary and report to National POC.

Local CRV Points of Contact (installation and oversight of the Contractor´s team on each site)

State	State/ANSP	Site	Local CRV Points of Contact	Email	Telephone / Fax	Service installation
The information is restricted and can be accessed by New Zealand hosted CRV portal at https://airwayscorporation.sharepoint.com/teams/APAC-CRV/SitePages/Home.aspx or ICAO APAC **CRV** Secure Portal. If you are an ANSP wishing to connect to another ANSP or consume a service, please email the APAC CRV Portal administrator at vaughan.hickford@airways.co.nz. to get access to New Zealand hosted CRV portal If you are proposing the provision of a service be added to the CRV, please liaise through your sponsoring ANSP. To get access to ICAO Secure portal, please use group Name: **CRV**						

3.2.4 CRV Contractor

The Contractor shall nominate all the staff involved in the implementation of the CRV node, mainly the Program Manager for the CRV program. The Contractor will follow all the steps described in the tender documentation, specially the TOR and Instructions to Tenderers, for the implementation of the CRV node. The main activities to be carried out by the Contractor during the implementation are:

i. Submit the updated SDD and the SEP to the CRV-OG, to the CNS Officer for the Asia/Pacific Regional Office and to the National CRV POC;

ii. Submit the requests for site surveys to the National CRV POC following the procedures described in the paragraph 4.1.2.2;

iii. Update and submit the Installation Transition Plan to the CRV-OG, to the CNS Officer for the Asia/Pacific Regional Office and to the National CRV POC;

iv. Be responsible for the supply, transport, installation, start-up and operation of all CRV equipment especially designed for a given CRV node;

v. Be dealing with customs and transport company about shipping and introducing the equipment in the Country;

vi. The interconnection (to be provided by CRV users) of the Network Interface Device (NID) to the Local Area Network (LAN) switches and other local equipment, including Voice Communication System (VCS), will be confirmed during the site survey;

vii. Demonstrate before the final validation of the SDD and through a test bed that the main characteristics of the intended design of the network will meet the performance requirements, SLA, safety, security and contingency requirements;

viii. Implement the CRV IP Addressing Scheme (Plan), following the information provided by the CRV-OG and/or the National CRV POC;

ix. Implement the classification and marking scheme for the prioritization of the traffic and Quality of Services (QoS), as described in the document Att II - Annex c - Mapping of services for quality management_v2 and in coordination with the CRV-OG and the National and Local CRV POCs (See note in the paragraph 3.2.1.3);

x. The Contractor shall measure the established parameters during circuit implementation (in accordance with ITU-T), and shall also monitor them for 24 hours to show compliance with the established specifications;

xi. Implement the configuration of current numbering plan for the ATS Switched Voice, as defined by the CRV-OG representatives and the National CRV POC, and taking into account the tender document Att II - Annex b - Matrix of Flows for CRV services_v2;

xii. Implement the configuration of the current Direct Circuits (DIR), as defined by the CRV-OG representatives and the National CRV POC and taking into account the tender document Att II - Annex b - Matrix of Flows for CRV services_v2;

xiii. Submit, in details, the escalation process to be followed for the implementation in each CRV node;

xiv. Submit, to the CRV National POC, the documentation for the training of the CRV technicians;

xv. Contractor Representative shall record the minutes of the meeting and distribute the minutes within three (3) Business Days of the meeting date;

xvi. The Contractor shall propose a planning chart that includes all the actions, steps, milestones, meetings, after negotiations with CRV Local and National POC and respect it once approved by the CRV User Representative or amend it in coordination with CRV User representatives; and

xvii. The Contractor shall help the CRV User in the uptake of responsibility before commissioning the equipment by accompanying the CRV User technicians in charge of the equipment.

4.0 BASIC SITE IMPLEMENTATION REQUIREMENTS

Chapter 4 describes the site and facilities requirements envisaged in the implementation phased for the CRV infrastructure, divided into CRV User´s and Contractor´s responsibilities, and also the main hardware and software for the proof of concept and implementation of the WAN links, LAN protocols, applications and main equipment.

These responsibilities come in addition to those stated in the Terms and Conditions and Terms of Reference.

4.1 Site/ Facilities Requirements

4.1.1 CRV User Responsibility

i. The CRV User shall provide the physical space for the installation of cabinets and equipment;

ii. The CRV User shall deliver to the premises the electric power required to feed the equipment to be provided by the Contractor;

iii. The CRV User shall provide access to the equipment to be connected to the CRV NID and to analog/ digital voice gateway;

iv. The CRV User shall accompany and assist the Contractor during the whole operation;

v. The CRV User shall provide room for storing the equipment, received before its installation; and

vi. The CRV User shall inform the Contractor about the local safety rules and procedures and produce suited documents as deemed necessary.

4.1.2 Contractor Responsibility

i. The Project Manager, on behalf of the Contractor, shall nominate and introduce all the staff involved in the site surveys and in the implementation of a CRV node. The list with the staff nominated will be submitted to the National and Local CRV POCs with the formal requests for the site survey and beginning of the very implementation of the CRV equipment and following the

procedures described in the paragraph 4.1.2.4;

ii. The Contractor shall identify the exact locations of the equipment during the site survey;

iii. The Contractor will be responsible for providing the accessories, switches, cables, connections between the main distribution panel and the NID;

iv. The Contractor shall be responsible for the installation of the CRV network equipment, accessories and the provision of the tools, testing equipment and software for the Site Acceptance Tests (SAT);

v. The procedures to the Contractor for the site surveys aiming the installation of the equipment are as follows:

a) Send a formal request to the national CRV POC, with an anticipation of 20 days for the required coordination with the local CRV POC, sending the names of the staff to be involved with the visit;
b) If authorized, the Contractor shall proceed to the site survey in the date and time indicated by the national CRV POC;
c) If the Contractor fails to comply with the survey in the exact date, the national POC will cancel the visit and the Contractor will have to restart the whole site survey process; and
d) The Contractor will provide all of the instruments and tools deemed necessary for the site survey.

vi. The Contractor shall be held liable for any damage to existing property in each CRV User facilities caused to the facilities by its staff and/or its sub-contractors';

vii. The Contractor shall comply with the site safety rules especially during critical phases such as commissioning or interferences with operational systems by following CRV User staff indications in charge of technical safety and not take personal initiatives that could have an impact on operational systems;

viii. The Contractor shall be responsible for storing the equipment before its installation;

ix. The Contractor may be asked to sign additional documents in order to follow local safety rules;

x. The Contractor shall keep the working area clean and free from fire hazards. After installation, all excess material shall be removed;

xi. The Contractor shall identify the exact locations for the installation of cabinets and equipment during the site survey;

xii. The Contractor shall provide the CRV equipment grounding in each node;

xiii. If necessary, the Contractor shall install protection against atmospheric discharges for all the equipment to be implemented for the provision of the CRV infrastructure in each node;

Note: The Contractor will be responsible for reviewing the characteristics of any existing devices that might be available as long as it is allowed the usage by the CRV representative;

xiv. The Contractor shall be responsible for the connection to the power supply in the installation site, including electrical wiring between the power outlet and the equipment rack of the Contractor, including the respective circuit breakers and devices to protect against surges and atmospheric

discharges;

xv. The Contractor shall be running simulations over a period that has to be determined before commissioning the equipment. CRV User representatives shall be involved in the setting and execution of these simulations; and

xvi. The Contractor shall procure the results of the tests.

4.2 Hardware and Software Requirements

4.2.1 General Topics

i. For the installation of the equipment to be provided, the Contractor shall follow and consider all the tender documents, especially the TOR, the Att II - Annex e - CRV IRS_v2 and the Att II - Annex f - Additional Voice and Data Gateway Service_v3.

ii. Although the Contractor operates MPLS data transport solutions, it is fully committed to the perfect operations of the applications and shall follow the initial end-to-end applications trials.

4.2.2 Hardware Requirements

i. For the satellite equipment, the Contractor shall install the indoor and outdoor units.

ii. Where Applicable, the basic satellite equipment to be provided and checked is: Block Up Converters (BUC), Low Noise Block (LNB) down converters and Satellite Modems and VSAT Network management sub-system.

iii. Where Applicable, the basic ground/terrestrial equipment to be provided will comprise: routing system of the IP VPN Internet (with the needed interfaces), the basic ground voice and data gateway (with the needed interfaces), the NID (with the needed interfaces), switches (with the needed interfaces), A/B baseband switch (with the needed interfaces), Multiprotocol Label Switching (MPLS) for the Wide Area Network (WAN) (optical and/or microwave) links equipment.

iv. Before connecting the NID and the analog/digital, if needed, the contractor´s team shall install the new racks and prepare the transition cables, such as junction coaxial cables, junction sub-d cables or RJ based cables.

v. All the test and measurement tools shall be provided by the Contractor. No testing and measurement equipment will be provided by the CRV User representatives.

vi. All the needed equipment must be shipped and acknowledge by the CRV-User before the installation phase with sufficient delay. The Provider have to take the customs procedure delay into account.

vii. All the received items must be inventoried and tested before the beginning of installation in order to avoid dispute.

4.2.3 Software Requirements

Where applicable, the basic software to be provided and/or used in each site is: Network Management Systems (NMS) software, if the SDD indicates that one or more CRV nodes will be selected to manage the CRV network in parallel with the Contractor´s Network Operations Center (NOC), software for BUC, Satellite Modems, NID, Voice/Data Gateway and switches.

4.2.3.1 Documentation Requirements

The needed documentation for the uptake of the equipment shall be provided to CRV User on its demand as deemed necessary.

5.0 TESTING AND EVALUATION.

The tests for the acceptance of the implemented equipment in each CRV node will be performed using simulations of the applications and, eventually, the real application tests that will follow the operational requirements as described in the tender documents, mainly, but not restricted to:

i. Att II - Annex a - CRV CONOPS_v2;

ii. Att II - Annex b - Matrix of Flows for CRV services_v2;

iii. CRV Implementation plan (Chapter 5); and

iv. Validation Plan including the Site Acceptance Test (SAT) protocols (prepared by the Contractor).

The main testing and measurement equipment and tools that shall be used by the Contractor are:

i. Spectrum Analyzer;

ii. cable analyzer;

iii. audio analyzer/generator;

iv. Multi-meters;

v. LAN/Network protocol analyzer; and

vi. Telephones.

Note: This paragraph doesn´t exhaust all the testing and measurement equipment to be used during the implementation phase, and the Contractor shall describe all of them in the documentation to be provided after the contract signature.

The Contractor shall test its backbone (end-to-end) and the connection to its Network Operating Center (NOC). The links will be tested using computers for asynchronous and IP flows for example, and analogical phones.

An example of asynchronous test is opening a HyperTerminal session and send characters and a Bit Error Rate Test using a software such as WinSSD.

The requirements for the test procedures will be reflected in the Chapter 5 (Testing and Evaluation). Notwithstanding this fact, the tests procedures will need some software for the applications as reflected in the following paragraphs.
Note: The following paragraphs don´t exhaust all the software and the Contractor shall describe all of them in the documentation to be provided after the contract signature.

For AFTN simulation: The simulation will consist of connecting a PC to the AFTN port at the back of the rack (with the right rate described in the document Att II - Annex b - Matrix of Flows for CRV services_v2) and close the serial interface at the other end of the circuit (loop). With the PC launch the *winssd* program (or other similar) and start the Bit Error Rate (BER) test. Run the test for 5 minutes and check that there are only a few errors.

For AMHS simulation: AMHS service is over IP (see the document Att II - Annex b - Matrix of Flows for CRV services_v2. To simulate it:

i. ping any remote equipment in the network according to the following cross matrix; and

ii. Verify that the end user is exchanging information correctly.

IP based RADAR and Asterix: The simulation will consist in selecting two sites, configuring sufficient bandwidth and multicast an IP flow.

ATS/DS Circuits: All ATS/DS calls are auto-dialed. The communication is established after the user picks up the phone. The simulation will consist of connecting a telephone on the desired line at the back of the rack, pick-up the phone make the call to the other end of the circuit. For E1 based circuits, to be connected to a VCS, this cannot be simulated.

ATS Switched Circuits: ATS switched calls are dialed. The communication is established after the user picks up the phone and dials the remote dial number. The simulation will consist of connecting a telephone on the desired line at the back of the rack, pick-up the phone and dial a remote number in order to call the other end of the circuit. For E1 based circuits, connected to a VCS, this cannot simulated.

6.0 CONTINGENCY PLAN/ BACK-OFF PLAN

6.1 Purpose

States/ Administrations are to establish contingency plan, with the CRV contractor in case of the following scenario:

i. CRV total failure;

ii. CRV partial failure (e.g. voice channel failure);

iii. Provider Edge (PE) to Customer Edge (CE) link failure (e.g. ANSP1 lose connectivity to CRV); and

iv. PE to PE failure (e.g. ANSP1 and ANSP2 unable to exchange data/ or voice).

6.2 Harmonized Contingency Plan

States/ Administrations could also bilaterally/ multilaterally setup additional IPLC(s) as a contingency. This contingency plan could be harmonized in the APAC region to reduce costs.

7.0 MIXED OPERATING ENVIRONMENT

7.1 Routing of AFTN/ AMHS messages to non-CRV States/ Administrations

During the initial phase of the CRV implementation, States/ Administrations who have joined CRV are to ensure the routing of AFTN/ AMHS messages to States/ Administrations who have not joined CRV.

7.2 Inter-Region common network connectivity

It is envisaged for common networks (e.g. PEN, FTI and CRV) in different Regions to be inter-connected.

Appendix A – APAC IPv4 Address Plan

Appendix A

1 Introduction

1.1 Objective

This document is meant to describe the addressing plan for IPv4 addresses throughout the Asia/Pacific Region. This document defines the recommended address format for IPv4 addresses. The IPv4 network is to be used within region.

1.2 References

[1]	ICAO Doc 9705-AN/956	Manual of Technical Provisions for the ATN
[2]	ICAO Doc 9896	Manual for the ATN using IPS Standards and Protocols
[3]	ICAO Doc 7910	ICAO Location Indicators
[4]	RFC 1518	An Architecture for IP Address Allocation with CIDR
[5]	RFC 1918	Address Allocation for Private Internets
[6]	RFC 2050	BGP-4 Internet Registry IP Allocation Guidelines
[7]	RFC 3330	Special-Use IPv4 Addresses
[8]	RFC 4271	BGP-4 Specification

1.3 Terms Used

Administrative Domain	–	An administrative entity in the ATN/IPS. An Administrative Domain can be an individual State, a group of States, an Aeronautical Industry Organization (e.g., an Air-Ground Service Provider), or an Air Navigation Service Provider (ANSP) that manages ATN/IPS network resources and services. From a routing perspective, an Administrative Domain includes one or more Autonomous Systems.
Autonomous System	–	A connected group of one or more IP prefixes, run by one or more network operators, which has a single, clearly defined routing policy.

Intra-domain (interior gateway) routing protocol	–	Protocols for exchanging routing information between routers within an AS.
Inter-domain (exterior gateway) routing protocol	–	Protocols for exchanging routing information between Autonomous Systems. They may in some cases be used between routers within an AS, but they primarily deal with exchanging information between Autonomous Systems.
Local Internet Registry	–	A Local Internet Registry (LIR) is an IR that primarily assigns address space to users of the network services it provides. LIRs are generally ISPs, whose customers are primarily end users and possibly other ISPs. [LACNIC]

1.4 Acronyms

AMHS	–	ATN Message Handling System
ARP	–	Address Resolution Protocol
ATN	–	Aeronautical Telecommunications Network
BGP	–	Border Gateway Protocol
DNS	–	Domain Name Service
IANA	–	Internet Assigned Numbers Authority
ICS	–	ATN Internet Communication Service
IP	–	Internet Protocol
IPv4	–	Internet Protocol Version 4
IPv6	–	Internet Protocol Version 6
IPS	–	Internet Protocol suite
LACNIC	–	Latin American and Caribbean Internet Address Registry
LIR	–	Local Internet Registry
OSPF	–	Open Shortest Path First
RIR	–	Regional Internet Registry

1.5 Overview of Addressing Issues

The following subsections present issues that affect the completion of the addressing plan for operating the IPS-based AMHS network.

1.5.1 Public or Private Address

An important decision for the region is whether to use private or public addresses. Private addresses can be used if coordinated by all participating States and Organization; however, it is possible that existing networks already use addresses in the private block ranges. Public addresses must be obtained from a Regional Internet Registry (RIR). The Internet Assigned Numbers Authority (IANA) has delegated responsibility for administration of Internet numbering to the Latin American and Caribbean Internet Address Registry (LACNIC).

1.5.2 Address of Systems in External Regions

Systems in external regions could be assigned an address from the APAC address space rather than use an address in their regional address block. Note however that this must be coordinated with private addresses so as to avoid collisions.

2 IPv4 Addressing Overview and Fundamentals

In the Internet Protocol a distinction is made between names, addresses, and routes. A name indicates what we seek. An address indicates where it is. A route indicates how to get there. The Internet protocol deals primarily with addresses. Its main task is to forward data to a particular destination address. It is the task of higher-level protocols to make the mapping from names to addresses, for example using a domain name service (DNS). The Internet protocol forwards packet data units (PDU) to a destination address using routing tables maintained by a routing protocol. The routing tables contain the address of the next hop along the route to the destination. There are in general two classes of routing protocols: inter-domain or exterior routing protocols such as the Border Gateway Protocol (BGP) and intra-domain or interior routing protocols such as the Open Shortest Path First (OSPF) protocol. In order to forward PDUs to the next hop address, there must be a mapping from this address to the link level address, for example, an Ethernet address. This mapping is maintained by an address discovery protocol such as the Address Resolution Protocol (ARP).

An IPv4 address consists of four bytes (32 bits). These bytes are also known as octets. For readability purposes, humans typically work with IP addresses in a notation called dotted decimal. This notation places periods between each of the four numbers (octets) that comprise an IP address. For example, an IP address that a computer sees as

00001010 00000000 00000000 00000001

is written in dotted decimal as

10.0.0.1

Because each byte contains 8 bits, each octet in an IP address ranges in value from a minimum of 0 to a maximum of 255. Therefore, the full range of IP addresses is from 0.0.0.0 through 255.255.255.255. That represents a total of 4,294,967,296 possible IP addresses.

A network may be set up with IP addresses to form a private or public network. On a private network a single organization controls address assignment for all nodes. On a public network there must be some conventions to assure that organizations do not use overlapping addresses. In the Internet this function is performed by the Internet Assigned Numbers Authority (IANA), which delegates authority to Regional Internet Registries (RIR). For the CAR/SAM Region the RIR is the Latin American and Caribbean Internet Address Registry (LACNIC).

IPv4 Addresses are a fixed length of four octets (32 bits). An address begins with a Network ID, followed by a Host ID as depicted in Figure 2-1.

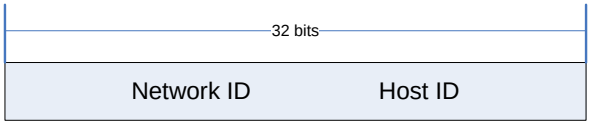


Figure 2-1. IPv4 Address Format

The original IP addressing scheme divided the Network ID from the Host ID is in a several octet boundaries. In this scheme the main classes of addresses were differentiated based on how many octets were used for the Network ID. This method is called classful addressing. Classful addressing was by convention further modified so that the Host ID could be split into subnet ID and sub host ID. This is typically accomplished using a subnet mask and is called classful addressing with subnetting. This eventually evolved into classless addressing where the division between the Network ID and Host ID can occur at an arbitrary point, not just on octet boundaries. With classless addressing the dividing point is indicated by a slash (/) followed the number of bits used for the Network ID. This value is called the prefix length of the address and the address value up to that point is called the network prefix.

Private Addressing is defined in RFC 1918. IANA has reserved the following three blocks of the IP address space for private Internets:

10.0.0.0 - 10.255.255.255 (10/8 prefix)
172.16.0.0 - 172.31.255.255 (172.16/12 prefix)
192.168.0.0 - 192.168.255.255 (192.168/16 prefix)

Because of the number of bits available to users, these blocks are referred to as a "24-bit block", a "20-bit block", and a "16-bit" block. An enterprise that decides to use IP addresses out of the private address space defined by RFC 1918, can do so without any

coordination with IANA or an Internet registry. Addresses within this private address space will only be unique within an enterprise or a group of enterprises (e.g., an ICAO region), which chose to cooperate over this space so they may communicate with each other in their own private Internet.

3 IPv4 Addressing

3.1 Overview CAR/SAM

3.1.1 During the fourth meeting of ATN/TF4 (Santo Domingo, Dominican Republic, 27 to 28 June 2008) the group analyzed different alternatives for the implementation of the TCP/IP in the CAR/SAM Regions identifying the available options that would facilitate this implementation in the AMHS Service and future applications. This was reviewed in accordance with Document 9880 Part IIB of the ICAO. In this respect the Meeting decided two viable options for the implantation the TCP/IP:

a) AMHS using the RFC1006 on Guiders TCP/IP (IPv4) to allow AMHS to directly interface with IPv4 Guiders for the intra-regional connections.

b) Configurating AMHS, as specified in a) with capacity for IPv4 conversion to IPv6 through the implementation of a function of IP router as gateway for the interregional connections.

3.1.2 The Sixth Meeting of Committee ATM/CNS (ATM/CNS/6) (Santo Domingo, Dominican Republic, 30 June to the 04 July 2008) analyzed this Plan of IP Addressing for CAR/SAM Regions and considered that such a plan would be sent to the ICAO for revision.

3.1.3 During the ACP/WG/I/8 (Montreal, Canada, 25 to 29 August 2008) it was concluded that it is possible to consider a regional scheme of IPv4 addressing. Taking into consideration that the private sector would be using the propose addressing scheme in other applications, the Meeting considered nonviable to apply the IP addressing scheme at a global level.

3.1.4 The Third Meeting of the Group of Regional Implementation SAM/IG/3 (Lima, Peru, 20 to 24 April 2009) considered that, taking into account specified in Table CNS 1Bb from the FASID, the AMHS system to be installed in the SAM Region will use IP protocol and will initially use the IPv4 version. The block of used IPv4 addresses will follow the format established during the ATM/CNS/SG/6 Meeting.

3.2 IP Addressing Plan

When we began to work on the plan of IP addressing, we once again reviewed the scheme that was originally proposed, analyzed the amount of States/Territories by

Region, the amount of addressing that each State/Territory could use and the amount of addressing reserved for the interconnection between States/Territories. The result of this study concluded that:

3.2.1 1 bit would be reduced to State/Territory level. This means the transfer of 256 States to 128 States by region. In the EUR/NAT Region, which is most numerous, has 53 States/Territories, means that there are many vacant numbers.

3.2.2 1 bit at Host's level would be added. This would allow the transfer from 4096 to 8190 hosts per State/Territory. This was considered due to the amount of future applications that would be implemented, mainly in the more developed States, and could cause the amount of directions not to be sufficient. The structure is shown below:

IPv4 Address						
10		Region / State / Territory		State / Territory / Host's		Host's
0 0 0 0 1 0 1 0	.	0 0 0 0 0 0 0 0	.	0 0 0 0 0 0 0 0	.	0 0 0 0 0 0 0 1
1st. Byte	.	2nd. Byte	.	3rd. Byte	.	4th. Byte

3.2.3 It should be noted the networks assigned to each State are private networks (RFC 1918). The first Bytes that integrate the assigned address will always maintain a decimal value of 10. Whereas the other three Bytes are used to distribute, in hierarchic form, the blocks of directions corresponding to each State.

3.2.4 The first four bits of the second Byte (4 bits) will be used to identify the regions in around which the States/Territories of the world are grouped:

- 0000 => SAM: South American Office.
- 0001 =>. NACC: North American, American Power station and Caribbean Office.
- **0010 => APAC: Asia and Pacific Office.**
- 0011 => MID: Middle East Office.
- 0100 => WACAF: Western and Central African Office.
- 0101 => ESAF: Eastern and Southern African Office.
- 0110 => EUR/NAT: European and North Atlantic Office.

3.2.5 On the other hand, the last four bits of the second Byte, and the first three bits of the third Byte (7 bits) will be used to identify the States/Territories of each region.

3.2.6 Whereas the last five bits of the third Byte and the eight bits that compose the fourth Byte (13 bits) will be used by each one of the States/Territories to assign addressing to their terminals/servers

3.2.7 The IPv4 address allocation scheme will be able to cover:

- 16 Regions.

- 128 States/Territories by each Region.
- 8190 Host' s for each State/Territory

3.2.8 The IPv4 addressing plan would allow each State/Territory to be able to make use of the block of directions assigned as needed.

a) Each State has been assigned 8190 usable Network addresses, which seem to be sufficient to cover existing needs.

b) In the development of the mentioned scheme, a flexible margin has been designated so that it will allow the future growth or change in the network in the future. For example, if a region were subdivided in two or more regions, or the emerging of a new State/Territory.

c) Argentina has already implemented its ATN network with a scheme of addresses different from the proposed one, prior to the publication of this document, has placed a border devise with the intention that this devise will make the address translation between the outer directions.

3.3.1 Network Assignment for ASIA/PACIFIC

Ref	State/Administration	Network	Direction used	Decimal notation	Binary Notation	Region	State/Territory	Host's
The information is restricted and can be accessed by New Zealand hosted CRV portal at https://airwayscorporation.sharepoint.com/teams/APAC-CRV/SitePages/Home.aspx or ICAO APAC **CRV** Secure Portal. If you are an ANSP wishing to connect to another ANSP or consume a service, please email the APAC CRV Portal administrator at vaughan.hickford@airways.co.nz. to get access to New Zealand hosted CRV portal If you are proposing the provision of a service be added to the CRV, please liaise through your sponsoring ANSP. To get access to ICAO Secure portal, please use group Name: **CRV**								

3.3.2 Network Assignment for USA

Ref	State/Administration	Network	Direction used	Decimal notation	Binary Notation	Region	State/Territory	Host's
The information is restricted and can be accessed by New Zealand hosted CRV portal at https://airwayscorporation.sharepoint.com/teams/APAC-CRV/SitePages/Home.aspx or ICAO APAC **CRV** Secure Portal. If you are an ANSP wishing to connect to another ANSP or consume a service, please email the APAC CRV Portal administrator at vaughan.hickford@airways.co.nz. to get access to New Zealand hosted CRV portal If you are proposing the provision of a service be added to the CRV, please liaise through your sponsoring ANSP. To get access to ICAO Secure portal, please use group Name: **CRV**								

3.4 Using IPv4-Compatible Address Formats

In many instances, you can represent a 32-bit IPv4 address as a 128-bit IPv6 address. The transition mechanism defines the following two formats.

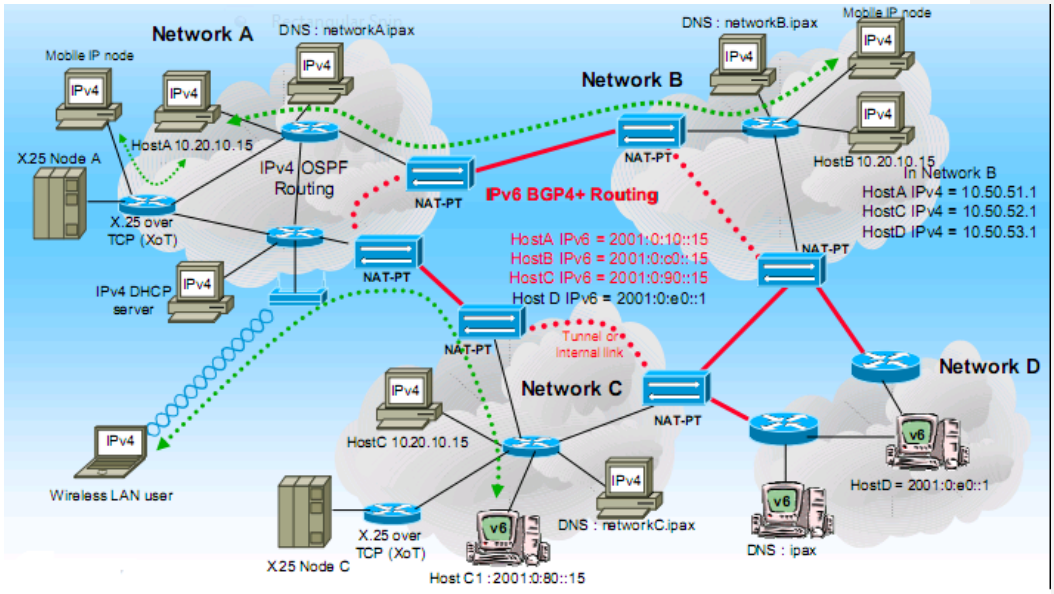
IPv4-compatible address

000 ... 000	IPv4 Address

IPv4-mapped address

000 ... 000	0xffff	IPv4 Address

The mapped address format is used to represent an IPv4 node. The only currently defined use of this address format is part of the socket API. An application can have a common address format for both IPv6 addresses and IPv4 addresses. The common address format can represent an IPv4 address as a 128-bit mapped address. However, IPv4-to-IPv6 protocol translators also allow these addresses to be used.

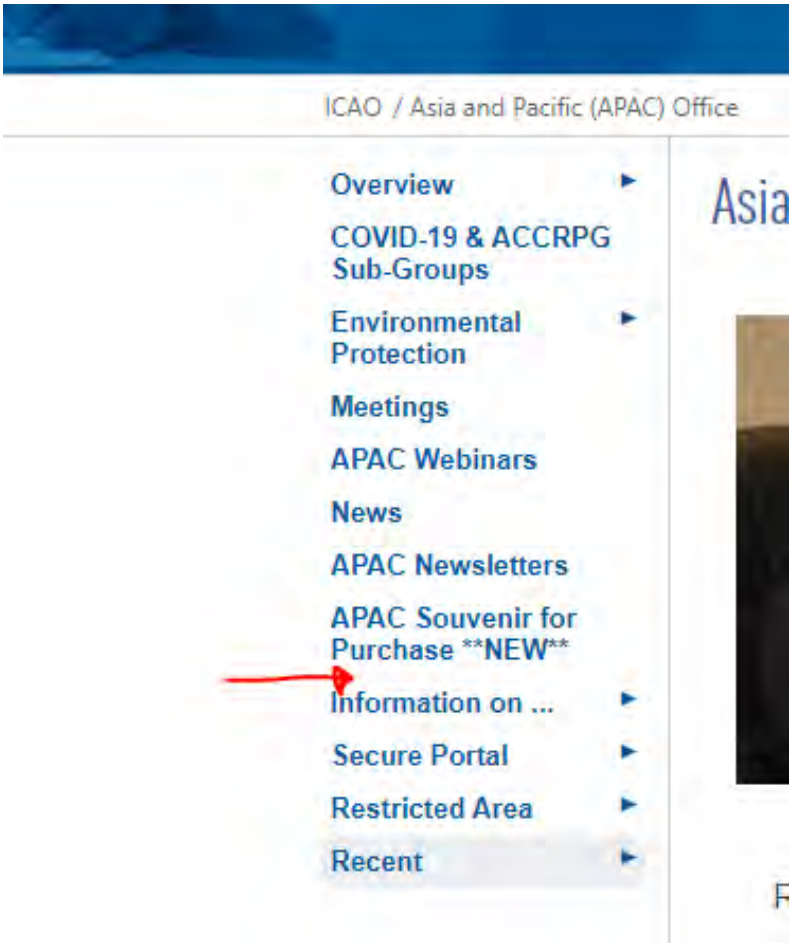


Appendix C – MID IPv4 Address Plan

Appendix B

No.	**State**	**Network IP Address**	**Hosts IP addresses**				
			Decimal Notation	Binary Notation			
				1st Byte	Region	State	Hosts
The information is restricted and can be accessed by New Zealand hosted CRV portal at https://airwayscorporation.sharepoint.com/teams/APAC-CRV/SitePages/Home.aspx or ICAO APAC **CRV** Secure Portal. If you are an ANSP wishing to connect to another ANSP or consume a service, please email the APAC CRV Portal administrator at vaughan.hickford@airways.co.nz. to get access to New Zealand hosted CRV portal If you are proposing the provision of a service be added to the CRV, please liaise through your sponsoring ANSP. To get access to ICAO Secure portal, please use group Name: **CRV**							

- **Location of Landing Page:**



- **The proposed wording for the Landing Page:**

Common Aeronautical Virtual Private Network (CRV)

Background

The CRV is an Asia-Pacific aeronautical network for Asia-Pacific and Middle East ICAO Members. A wholly dependable and reliable communications infrastructure for aeronautical communications, enabling the global roadmap (ASBU B0-FICE, B0-NOPS, VoIP and B1-SWIM modules).

The network utilizes PCCW Global's worldwide MPLS network to provide secure connectivity between ANSPs for the purposes of:

- Ground to Ground Voice Communications
- AFTN/AMHS Data
- ADS-B data sharing
- Future SWIM connectivity
- Other technologies and services as agreed

There are also services available to be consumed via the CRV network. At present these are:

- Aireon Space Based ADS-B
- PCCW IWXXM

CRV is managed by the Operations Group, made up of member ANSPs.

How to Join or Provide a Service

If you are an ANSP wishing to connect to another ANSP or consume a service, please email the APAC CRV Portal administrator at Vaughan.hickford@airways.co.nz.
If you are proposing the provision of a service be added to the CRV, please liaise through your sponsoring ANSP.
Any questions please contact one of the CRV OG co-chairs:

Asia

Mr. Vaughan Hickford
vaughan.hickford@airways.co.nz

Pacific

Mr. Kelepi Dainaki
KelepiD@fijiairports.com.fj

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LIST OF VOLUNTEERS TO CRV OG EXPERTS AD-HOC GROUP(S)

	State/name	Title/organization	Ad-hoc group (s)	Tel/fax/e-mail
1.	**AUSTRALIA (1)**			
	1. Ms. Brenda Buwu	Senior Network Engineer Airservices Australia	Service Operations	brenda.buwu@airservicesaustralia.com;
2.	**CHINA (1)**			
	2. Mr. Huang Zheng	Engineer Air Traffic Management Bureau of CAAC	Service Transition, Service Operations	huangzheng@catc.net.cn;
3.	**HONG KONG, CHINA (1)**			
	3. Mr. Gene Kwok	Electronics Engineer Civil Aviation Department Hong Kong, China	Service Design	gwhkwok@cad.gov.hk;
4.	**FIJI (1)**			
	4. Mr. Kelepi Dainaki	Manager Air Navigation Engineering Services Fiji Airport Limited	Service Strategy, Service Design, Service Transition, Service Operations	KelepiD@fijiairports.com.fj;
5.	**INDIA (2)**			
	5. Mr. Arvind Singh Yadav	Joint General Manager (CNS) Airports Authority of India, CHQ	Service Strategy	asyadav@AAI.AERO;
	6. Mr. Hemant Ramchandani,	Joint General Manager (CNS) Airports Authority of India, Mumbai	Service Operations	hemantr@AAI.AERO; hemantramchandani@yahoo.com;

	State/name	Title/organization	Ad-hoc group (s)	Tel/fax/e-mail
6.	**NEW ZEALAND (1)**			
7.	Mr. Vaughan Hickford	Team Leader Network Design Airways New Zealand	Service Strategy, Service Design, Service Transition, Service Operations	vaughan.hickford@airways.co.nz;
7.	**SINGAPORE (2)**			
8.	Mr. Augustine Lau	Senior Engineer (Communications) Civil Aviation Authority of Singapore	Service Strategy, Service Design	Augustine_LAU@caas.gov.sg;
9.	Mr. Zachary Seah	Engineer (Communications) Civil Aviation Authority of Singapore	Service Transition, Service Operations	Zachary_SEAH@caas.gov.sg;
8.	**USA (1)**			
10	Mr. Hoang Tran	International Telecommunications Lead Federal Aviation Administration	Service Strategy, Service Design	hoang.tran@faa.gov;

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ATN/AMHS/AIDC Implementation Status in the APAC Region

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
AFGHANISTAN					
AUSTRALIA	ATN tests were conducted. BIS Router and Backbone BIS Router and AMHS implemented. AMHS has been migrated to CRV. Connection with Singapore using AMHS was implemented October 2016; Another AMHS connections pending CRV (target date by March 2020) including both connection with New Zealand and USA. AMHS connection with Indonesia pending on CRV implementation AMHS connection with South Africa has been established Plan to upgrade AMHS support IWXXM traffic from Nov. 2020.	COMSOFT	AFTN/AMHS based AIDC Implemented between Brisbane and Melbourne, Oakland, Nadi and Auckland; Implemented between Melbourne and Johannesburg; AIDC is also in use between Melbourne and Mauritius; Operational trial between Brisbane and Ujung Pandang since May 2013. Implementation in July 2017. LOA needs to be updated.		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
BANGLADESH	In Q1/2013, Bangladesh installed ATN/AMHS and BIS Router at Dhaka (VGHS) with User Agents at Chittagong (VGEG) and Sylhet (VGSY).	COMSOFT	Tentative date of implementation of AIDC is Q4 of 2023 with Kolkata and Yangon.		Implementation of AIDC is included in the "Modernization of CNS-ATM System of CAAB" project which is going on G2G agreement with French Government and likely to be implemented by the end of 2023.
BHUTAN	ATN/AMHS circuits, using IP over VPN, with Thailand (Bangkok) and India (Mumbai) commissioned in June and July 2017 respectively. IOT and POT with Mumbai completed on 27th June 2017. IOT and POT with Thailand completed on 2nd May 2017. TMC signing with both countries signed.	AEROTHAI'S AMHS System	Currently not applicable. If required in the future, will decide after CRV implementation.		
BRUNEI DARUSSALAM	ATN BIS Router planned for 2015 and AMHS planned for 2015				

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
CAMBODIA	BIS Router and AMHS installed. Cambodia (CATS) AMHS connected with Bangkok via VSAT IP link since 10 December 2013	AVITECH	AIDC function and capability made available. Ready for testing with neighbors ATS Facilities starting from 2017 and target date of implementation with Bangkok in 4Q2019	THALES which supports AIDC ICD Version 1.	
CHINA	ATN Router and AMHS including NCC deployed in 2008 which is being upgraded to support ATN/IPS with target date of completion in December 2013. The Beijing-Hong Kong AMHS link was put into operation in 2018; With Thailand was put into operation in Q12020 AMHS/ATN technical tests with Macau completed in 2009. Plan for ATN/AMHS implementation with Macao China is TBD. ATN/AMHS circuit with ROK has been put into operation since June 2011.	IN-HOUSE (Aero-Info Technologies Co., Ltd)	AIDC between some of ACCs within China has been implemented. AIDC between several other ACCs are being implemented. AIDC between Sanya and Hong Kong China put into operational use since 8 Feb 2007. AIDC between Dalian and Incheon implemented in Nov. 2016;	ATN Router and AMHS including NCC deployed in 2008 which is being upgraded to support ATN/IPS with target date of completion in December 2013. The Beijing-Hong Kong AMHS link was put into operation in 2018; With Thailand is completed POT, after sign the TMC circuit	IN-HOUSE (Aero-Info Technologies Co., Ltd)

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	ATN/AMHS tests with India has been put into operation since 2016. ATN and AMHS IOT with Mongolia is completed in May 2018. Plan for commissioning after POT completion in 2021 Connection tests with Nepal is TBD. AMHS testing with Japan was completed in March 2021.It will put into operation after TMC is signed. AMHS testing with Russia in 2021.		AIDC between Shanghai/Guangzhou and Tapei put in to operational use since 2013. AIDC between Guangzhou and Hong Kong China put into operational use since May 2018. OLDI between Shenyang and Khabarovsk put into operational use since Oct.2019. For Beijing/Ulaanbaatar, Further testing is planned in 2020. Kunming/Yangon under test and progress since May 2017 Kunming/Vientiane under test and progress since Dec. 2018.	and was put into operation in Q12020 AMHS/ATN technical tests with Macau completed in 2009. Plan for ATN/AMHS implementation with Macao China in 2019. ATN/AMHS circuit with ROK has been put into operation since June 2011. ATN/AMHS tests with India has been put into operation since 2016. ATN and AMHS IOT with Mongolia is completed in May 2018. Plan for commissioning after POT completion in 2020 Connection tests with Nepal is TBD.	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			Sanya/Hanoi under test trial since 2019.	AMHS testing with Japan in 2020. AMHS testing with Russia in 2020	
HONG KONG, CHINA	**Manila / Philippines** CRV/AMHS circuit was put into operation in May 2019. **Beijing / China** ATN/AMHS circuit was put into operation in 2018. Plan to migrate to CRV in Q4 2020. Macao / China ATN/AMHS circuit was put into operation in December 2009. Wait for Macao to join CRV. **Bangkok / Thailand** ATN/AMHS circuit was put into operation use in 2014. Wait for Thailand to join CRV. **Fukuoka / Japan** Currently on AFTN. Plan to carry out IOT of CRV/AMHS in July 2020 and cut over to CRV/AMHS in Q3 or Q4 2020.	COMSOFT	AFTN-based AIDC with Sanya put into operational use in Feb 2007. AIDC with Taibei put into operational use in Nov 2012. AIDC with Guangzhou put into operational use in May 2018. AIDC with Manila put in operational use in May 2019.	Raytheon ATM system Support AIDC ICD Version 3 commissioned in November 2016.	Already support exchange of IWXXM messages based on FTBP. Support of IHE is planned for October 2020.

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	HoChiMinh / Vietnam Currently on AFTN. Simple AMHS IOT was conducted in Dec 2019. Wait for Vietnam to join CRV. **Taibei** CRV/AMHS circuit was put into operation in June 2020.				
MACAO, CHINA	ATN/AMHS interoperability test with Beijing commenced in March 2009. ATN/AMHS circuit with Hong Kong put into operational use in end Dec 2009. Upgrade of ATN/AMHS to support IPS and IWXXM planned with tentative target date of Q3 2021.	COMSOFT	[Not applicable for using AIDC, looking into the possible application between TWR and ACC/APP]		
COOK ISLANDS					
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	The ATN BIS Router and AMHS planned for in 2011.		With neighboring ACCs to be implemented		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
FIJI ISLANDS	ATN BBIS IPS router and AMHS implemented over CRV for connection to USA in April, 2019 with Australia planned for June, 2019. . For connections with sub-regional centers: For New Caledonia using AMHS since 2017; For connection with Kiribati using UA/AMHS implemented in 2015.	COMSOFT	AFTN based AIDC implemented between Nadi/ Brisbane, Auckland and Oakland.	- Support and implemented AIDC messaging: ABI, EST, CPL, CDN, ACP, TOC, AOC with all three centers - AIDC ICD version 2.0 implemented with Auckland and Oakland. - AIDC ICD Version 1.0 implemented with Brisbane	B2B connection between Nadi AMHS and Brisbane AMHS planned for Q3, 2021 as backup for CRV.
FRANCE *(French Polynesia Tahiti)*	Planned for implementation of AMHS in 2022 (T1). Using IP with New Zealand since 2017.		Implementation of AIDC (based on Version 3) with adjacent centers (Oakland and Auckland) since 2009.	THALES EUROCAT for AIDC	Alternate routing for backup between Tahiti and Christchurch via Tahiti/New Caledonia IP link
INDIA	Dual stack ATN/IP router and AMHS implemented at Mumbai in 2011. Operational AMHS connections with Bangkok, Dhaka, Singapore, Kathmandu, Karachi implemented. With Beijing implemented in 2016; With Colombo implemented in May2017; With Bhutan implemented in July 2017;	COMSOFT	Initially-15-May-2017, AIDC implemented between Chennai and Kuala Lumpur with ABI and EST messages. India is currently using APAC AIDC ICD version 3.		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	Planned for IOT with Nairobi and Muscat forQ4 2020.		**A. Implementation within India:** Trials have been carried out between various ATS units listed below I Delhi: Ahmedabad, Varanasi, Nagpur I. Chennai: Mumbai, Kolkata, Trivandrum, Mangalore, Trichy, Hyderabad, Bengaluru II. Kolkata: Chennai, Nagpur, Varanasi, Guwahati III. Mumbai: Chennai, Ahmedabad, Nagpur AIDC operations between Chennai and Mumbai have been put into regular operations. **B: Implementation with Neighbouring States:** The status on trails with following ATSUs of neighboring FIRs is as under:		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			I. **Chennai & Kuala Lumpur** (Malaysia) – ABI, EST successful. CDN is done with voice confirmation. TOC/AOC will be implemented later. LOA signed. II. **Chennai & Male (Maldives)** –Trails have been successful. LOA in process. III. **Chennai & Colombo** (Sri Lanka) - Colombo in process to address the syntax errors in ABI. Thereafter, trails will be conducted. LOA in IV. **Chennai & Yangon** (Myanmar) – Trials commenced in January 2018. Issues of incorrect reference number in Counter CDN from Yangon persists V. Mumbai & Male (Maldives) – Operational. LOA signed.		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			VI. Ahmedabad & Karachi (Pakistan) – Automatic message exchange (e.g. ABI, EST) happens for most of the East bound flights between Karachi & Ahmedabad. Karachi Automation system not generating auto ACP message in response of EST messages. VII Kolkata & Yangon (Myanmar) – Trials under process. Most of the message exchanges were successful **C. Under Planning** I. To conduct operational trials between Mumbai-Muscat, Kolkata-Dhaka, Mumbai Karachi (Pakistan), Delhi – Karachi (Pakistan), Delhi – Lahore (Pakistan), Chennai-Jakarta and Varanasi-Kathmandu subject to readiness from the concerned states.		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			II. AFTN (AMSS) system upgradation to IP based AMSS is underway at various stations to address the latency issues for exchange of AIDC data.		
INDONESIA	ATN BIS Router and AMHS with Singapore implemented since February 2018; AMHS Trial (IOT) with Brisbane pending for CRV implementation.	IDS	AIDC implementation in Ujung Pandang ACC conducted as follows: 1) Ujung Pandang ACC –Brisbane ACC: Implemented since July 2017. 2) Ujung Pandang ACC – Manila ACC: - Operational trial since October 2019; - Target date for implementation in 3Q2020. 3) Ujung Pandang ACC – Kota Kinabalu ACC: - Successfully tested and target date for operational trial in 4Q2020;	Thales TopSky in Makassar able to support ICD version 3 since December 2015.	For CRV, target of contract in 3Q2021 and implementation in 4Q2021.

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			- Target date for implementation 1Q2021. 4) Ujung Pandang ACC – Oakland ARTCC: - Successfully tested and target date for implementation in 4Q2020. 5) Ujung Pandang ACC – Port Moresby ACC: - Successfully tested on 7 July 2020; - Target date for operational trial in 3Q2020. - Target date for implementation 1Q2021. 6) Ujung Pandang ACC – Jakarta ACC (4Q2020); AIDC implementation in Jakarta ACC will be carried out with the following priorities: 1) Jakarta – Ujung Pandang (4Q2020); 2) Jakarta – Chennai (3Q2021);		Priority is in accordance with Hot Spot identified by RASMAG/23

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			3) Jakarta – Melbourne (4Q2021); 4) Jakarta – Colombo (2Q2022); 5) Jakarta – Singapore (3Q2022); 6) Jakarta - Kuala Lumpur (4Q2022); 7) Jakarta – Kota Kinabalu (4Q2022).		
JAPAN	ATN BBIS router and AMHS installed at **USA** in 2000. Connection tests with USA in 2000 - 2004 and put into operational use in 2005. ATN BBIS router (to apply to Dual Stack) and AMHS (to upgrade in 2015. The connection test with each country which is not currently connecting is started after update. Upgrading connection with Hong Kong and Singapore using VPN will be implemented in 2020 after implementation of CRV. Coordinating for all other circuits upgrading.	NEC	AIDC implemented between Fukuoka ATMC and Oakland ARTCC in 1998. AIDC implemented between Fukuoka ATMC and Anchorage ARTCC in 2005. AIDC implemented between Tokyo ACC/Fukuoka ACC and Incheon ACC in 2010. Implemented between Fukuoka and Incheon since June 2009.		Japan and USA conducting testing AIDC over AMHS and cutover date is 5 May 2017.

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	Connection tests with Hong-Kong and Singapore using AMHS/FTBP over CRV since Dec 2019 and testing is going. AMHS/FTBP over CRV implementation with Beijing/China in 4Q2020, and with Incheon/Korea in 1Q2021. Connection AMHS over CRV as below: - Singapore from Oct. 2020 - Hong Kong from Sep. 2020 - Beijing from Mar. 2021		AIDC implemented between Fukuoka ACC/Naha ACC and Taibei ACC implemented. AIDC between Fukuoka ACC and Shanghai ACC under negotiation.		
KIRIBATI	Connection with Nadi using UA/AMHS implemented in 2015.				
LAO PDR	ATN BIS Router and AMHS completed, planned for operation with Bangkok since 4Q 2016.	THALES	AIDC testing with Bangkok in 2017 and target for implementation in 4Q2019. Testing with Hanoi on-going since 2017; with Cambodia operational test again in June 2018, and implementation 2Q 2019. Testing with Kunming and Yangon ongoing.	THALES which is able to support ICD Version 2.	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
MALAYSIA	ATN BIS Router completed 2007. AMHS for Malaysia – Singapore implemented in March 2020. AMHS for Malaysia – Thailand implemented in Dec 2019.	FREQUENTIS	AIDC technical test between Kuala Lumpur ACC and Bangkok ACC conducted since November 2016 (ABI/EST/ACP/LAM/LRM/CDN/REJ/TOC/AOC). The operational trial commenced in August 2019 (EST/ACP/LAM/LRM). The operational implementation commenced on 14th March 2020 (EST/ACP/LAM/LRM). AIDC technical test between Kuala Lumpur ACC and Chennai OCC conducted since February 2013. The operational trial implemented in phases from September 2016	SELEX which is able to support ICD Version 3.	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			(ABI/EST/MAC/LAM/LRM/ACP). Review on the CDN message implementation conducted in August 2017. SOP signed 26 April, 2017. The MOU signed on March 2020. The operational implementation commenced on 1st April 2020 (ABI/EST/ ACP/LAM/LRM/CDN/REJ/MAC). The operational trial for TOC/AOC started on 1st July until 1st August 2020. AIDC technical test between Kuala Lumpur ACC and Singapore ACC conducted since April 2015 (ABI/EST/ ACP/LAM/LRM/CDN/REJ). The operational trial started on September		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			2018 (EST/ACP/LAM/ LRM). The operational implementation commenced on 1st November 2019 (EST/ ACP/LAM/LRM). AIDC technical test between Kuala Lumpur ACC and Ho Chi Minh ACC To Be Discussed (TBD). AIDC technical test between Kuala Lumpur ACC and Jakarta ACC TBD. AIDC technical test between Kota Kinabalu ACC and Manila ACC started on May 2019 (EST/ACP/ LAM/LRM). The operational trial plan to be started in 4Q2020 (EST/ACP/ LAM/LRM). The operational implementation plan to		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			be started in 1Q2021 (EST/ACP/LAM/ LRM). AIDC technical test between Kota Kinabalu ACC and Ujung Pandang ACC started on August 2019 (EST/ACP/LAM/ LRM). The operational trial plan to be started in 4Q2020 (EST/ACP/ LAM/LRM). The operational implementation plan to be started in 1Q2021 (EST/ACP/LAM/ LRM). AIDC technical test between Kota Kinabalu ACC with Jakarta ACC TBD. AIDC technical test between Kota Kinabalu ACC and Singapore ACC started on		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			November 2019 (EST/ACP/LAM/ LRM). The operational trial to be commenced on October 2020 (EST/ ACP/LAM/LRM). The operational implementation to be started in 1Q2021 (EST/ACP/LAM/ LRM). AIDC technical test between Kuching ACC and Singapore ACC started on November 2019 (EST/ACP/LAM/ LRM). The operational trial to be commenced on 20th July until 18th October 2020 (EST/ACP/LAM/ LRM). The operational implementation to be started in 4Q2020 (EST/ACP/LAM/		

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			LRM). AIDC between Kuching ACC and Jakarta ACC TBD.		
MALDIVES	In the process of replacing the existing operational AFTN system by AMHS. It is expected to complete the installation before the end of 2019. With the new AMHS, it is planned to establish a new IP connection between an additional neighboring ATSU as the current link is an X.25 connection between Colombo. Also will look for the possibility of implementing the CRV network to use with AMHS and AIDC during the same phase.		Connection established with all the adjacent ATSUs. Interoperability tests successfully completed in 2017. LOA signed for operational trials between Mumbai, Chennai, and Trivandrum. Operational trials were also successful with these ATSUs, while several issues were resolved from both ends. Ready to sign LOA with Melbourne and is expected during the 2nd quarter of 2019. Trials with Colombo had few issues, which Colombo is working to	SELEX which is able to support ICD Version 3.	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			resolve it on their end with the automation system supplier. Connections between all 5 ATSUs are turned ON in the ATS automation system to conduct pre-notified operational trials.		
MARSHALL ISLANDS					
MICRONESIA (EDERATED STATES OF)					
Chuuk					
Kosrae					
Pohnpei					
Yap					
MONGOLIA	AMHS/AFTN gateway implemented 2012. ATNBIS router implemented in 2014. ATN and AMHS IOT with China was completed in May 2018. Plan for	COMSOFT	ATM automation system supports both AIDC and OLDI. Coordinating with Russia on OLDI connection in target date 2016.	INDRA Aircon 2100 supporting AIDC ICD Version 2.	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	commissioning after POT completion in 2019.		Coordinating with China on AIDC connection between Beijing/Ulaanbaatar technical trials in progress. Planned date of testing in 2019.		
MYANMAR	AMHS including AFTN/AMHS gateway implemented in Nov 2011. Connection with Thailand implemented in 4Q2016. Planned for AMHS connection with Beijing. Target date TBC.	THALES	AIDC connection pre-operation test with Thailand conducted in 4Q2017 and Target date of implementation 4Q2020; AIDC testing with Chennai, Kolkata and Vientiane conducted in 2020. Myanmar improved ATS Surveillance Coverage at coordination point with China and will start AIDC test again with Kunming ACC in 2020.	THALES Automation system (Topsky ATC) supports APAC AIDC ICD Ver. 2.	AMHS including AFTN/AMHS gateway implemented in Nov 2011. Connection with Thailand implemented in 4Q2016. Planned for AMHS connection with Beijing. Target date TBC.
NAURU					

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
NEPAL	AFTN/AMHS Gateway implemented in 2012. AMHS implemented with India since June 2014. AFTN connection with China. Plan to test AMHS connection soon.	COMSOFT	Nepal uses custom built ATM system from NEC. Some issues regarding ICD need to be resolved in order to proceed ahead with AIDC testing with India and China.		
NEW CALEDONIA	New router and AMHS commissioned December 2016	COMSOFT			
NEW ZEALAND	AMHS connection with the USA over CRV was implemented in April 2019. AMHS connection to Australia over CRV is scheduled for June 2019.	COMSOFT	AIDC implemented between New Zealand, Australia, Fiji, Tahiti, Chile and USA.	Supported the Basic 5 message set. ATM systems are LEIDOS and ADACEL	
PAKISTAN	ATN/AMHS connections with Mumbai since 2015. Planning for AMHS connection with Beijing and Kuwait after upgrading existing facilities between the Countries. Target dates for implementation TBC.	COMSOFT	Implemented between Karachi and Lahore ACCs Further testing to be conducted between Delhi/Karachi & Delhi/Lahore after system upgradation at Indian end; Mumbai/Karachi &AHM/Karachi on trial	ATM system from Intra AIRCON 2100	Existing Radar system being upgraded.

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			operation. For testing with Muscat planned for 4Q2019. Coordination for testing with Tehran is in progress.		
PAPUA NEW GUINEA	Currently AFTN over IP. AMHS implementation is planned for after successful implementation of CRV this year. AMHS implementation planned for 2020.	COMSOFT is the supplier of PNG AFTN/AMHS system	AIDC using AFTN operational with Australia, testing/trial with Oakland (USA) started late last year and in progress. AIDC implementation with Indonesia to happen after CRV implementation this year.	New ATM System from Thales (TopSky-ATC) implemented and operational now supports AIDC V3.	
PHILIPPINES	New ATN/AMHS was installed at the New CNS/ATM Center in Manila. Site Acceptance was successfully done on October 2015. The new AMHS commissioned and operational in March 2018. The AMHS Implemented over CRV with **HONG KONG** - May 2019. The AMHS Implemented over CRV with	**Frequentis - Comsoft**	**MANILA with:** **HONG KONG** – Implemented May 2019 via CRV; **SINGAPORE** – Implemented November 2019 via X25; Implemented December 2020 via CRV;	THALES which is able to support ICD Version 2.	New ATN/AMHS was installed at the New CNS/ATM Center in Manila. Site Acceptance was successfully done on October 2015. The new AMHS commissioned and operational in

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	TAIPEI - September 2019. The AMHS implemented over CRV with**SINGAPORE** - December 2020. The AMHS implemented over CRV with **OAKLAND, USA** - April 2021.		**TAIPEI** – Implemented December 2019 via CRV; **UJUNG PANDANG** - Operational Trial since April 2020 via **SINGAPORE** (X25); Implemented since December 2020 via **SINGAPORE** AMHS; **HO CHI MINH** – Tests conducted on October 2019. For further tests; **KOTA KINABALU** – Tests conducted on May and October 2019 via **SINGAPORE** (X25). For further tests; **OAKLAND** – Planned AIDC tests after AMHS successful implementation.		March 2018. The AMHS Implemented over CRV with **HONG KONG** - May 2019. The AMHS Implemented over CRV with **TAIPEI** - September 2019. The AMHS implemented over CRV with **SINGAPORE** - December 2020. The AMHS implemented over CRV with **OAKLAND, USA** - April 2021.

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
REPUBLIC OF KOREA	Plan to upgrade AMHS support IWXXM from 2023 over CRV Frequentice 1) AMHS/CRV IOT with China and Japan in 4Q of 2021 2) AMHS/CRV POT with China and Japan in 4Q 2022 3) Cutover to AMHS/CRV with Chi na and Japan in Q1 2023 after POT 4) Implementation of AMHS/CRV with Japan Q1 2023	FREQUENTIS	AIDC implemented between ACC and Fukuoka ATMC in 2010 AIDC between Incheon and Dalian implemented in Nov. 2016.	Rockheed Martin System	
SINGAPORE	AMHS implemented with: 1) AMHS circuit with India put into operational use in Mar 2011. 2) AMHS circuit with UK put into operational use in Mar 2012. 3) AMHS circuit with Thailand put into operational use in Dec 2014. 4) AMHS circuit with Australia put into operational use in Oct 2016. 5) AMHS circuit with Indonesia put into operational use in Feb 2018. 6) AMHS circuit with Malaysia put into operational in Mar 2020. 7) AMHS circuit with Japan put into operational in Dec 2020. 8) AMHS circuit with Philippines put into operational in Dec 2020.	FREQUENTIS COMSOFT	1) Operational with Ho Chi Minh implemented Jul 2014. 2) Kuala Lumpur operational trial started since Sep 2018 and is implemented Nov 2019. 3) Implemented with Kuching ATCC in Feb 2021. 4) Operational trial ongoing with Kota Kinabalu ATCC since Nov 2020 and	THALES supports ICD Version 3 since December 2018	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	Inter-Operability Test (IOT) with Vietnam started in 2019. IOT with Sri Lanka, Bahrain and Brunei to be confirmed.		implementation planned in Jun 2021. 5) Manila operational trial started in Feb 2019. Implementation Nov 2019. 6) Technical trials with Jakarta ACC will be initiated once the Jakarta ACC ATMS renewal is completed.		
SRI LANKA	ATN BIS Router Planned for 2013. IP based AMHS implemented by Oct. 2017. - Mumbai tested May 2017 operational planned for Q4 2017; - Singapore testing in Q4 2017 operational for 2018; - Male testing and operational date TBD.	IDS	Trials with Male planned for in 3Q2019. Trial with Chennai on-going. Plan for implementation in 2018 and with Melbourne plan for 1Q2018.	INTELCAN which is able to support ICD Version 3.	
THAILAND	BBIS/BIS Routers already implemented. AMHS has been implemented since July 2011. Connection with Bangladesh, Bhutan, Cambodia, China, India, Lao PDR, Myanmar, Singapore, Hong Kong China, and Malaysia implemented.	AEROTHAI's AMHS System	The implementation with · Malaysia has done on 14th March 2020 · Lao PDR has done on 14th	THALES which supports AIDC feature, APAC AIDC ICD V.3.	T HAILAND

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
	Bangkok -Viet Nam Circuit · IOT Test: Done · POT Test: Planned for end of 3Q2021 Bangkok - Rome Circuit · IOT Test: Planned for 3Q2021 Connection with SITA (SITA AMHS Gateway inter-connections) implemented.		July 2020 · Cambodia has done on 22nd February 2021 In addition, it is planned to implement AIDC with Myanmar		
TONGA	AMHS planned for 2008. The provider is linked to the New Zealand AFTN				CPDLC and ADS-C is not considered for lower airspace
UNITED STATES	- Australia - Fiji - New Zealand - Japan - Philippines - Papua New Guinea (2021) - Indonesia (2022)	IN-HOUSE	- Fiji, Japan, New Zealand - Tahiti (via New Zealand), - Papua New Guinea via Australia (Direct planned for 2021) - Philippines (2021) - Indonesia via Australia (Direct planned for 2022)	IN-HOUSE which is able to support APAC and NAT ICDs currently Version 2.	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			- Russian Federation (pending joining CRV)		
VANUATU					
VIET NAM	AMHS (basic) implemented. Trial phase from 4Q/2015 to 3Q/2018. IOT with Thailand in progress from 4Q/2017 Plan to use AMHS in 4Q/2018; Planned for IOT with Hong Kong, Singapore and Thailand in 2019 For IOT with Laos PDR and Cambodia in 2019.	IN-HOUSE	Operational between Ho Chi Minh and Singapore since July 2014. Trial for additional messages sets since 2018. Implementation between Ho Chi Minh with Philippines planned for 4Q2020; Technical testing with Cambodia already done; Trials between Hanoi and Vientiane, Lao. PDR on going. with Malaysia TBC	Support ICD Version 1.0 with THALES at Ho Chi Minh ATM system. Support ICD Version 3.0 with Selex at Hanoi ATM System.	

State/Organization	ATN G/G Boundary Intermediate System (BIS) Router/AMHS	AMHS Vendors Selected	AIDC	ATM System selected to support AIDC and Associated ICD (Implementation Status of the Basic 5 message set supported)	Remarks
			Testing with Cambodia on – going; For operation trial TBC.		
Wallis and Futuna (FRANCE)	AMHS implementation planned for end of 2017			COMSOFT	

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CRV IMPLEMENTATION TABLE

State/ Administration	Intended date for CRV cut-over	Applications targeted	Migration scheme	Prerequisites/ dependencies
Australia	Contract in May2018 and service readiness in 3Q 2018	AFTN, ADS-B, AMHS, Voice With: **Australia** February,2019(AMHS/AIDC), March,2019(Voice) **Fiji** March,2019 (AMHS June 2019/AIDC, Voice completed April) **New Zealand,** February, 2019 (AMHS June 2019, AFTN May 2019/AIDC), March, 2019 (Voice April 2019 completed) **Indonesia** 4Q2019 (TBC) (AMHS/AIDC, Voice, ADS-B); **PNG** 4Q2019(TBC), (AMHS/AIDC, Voice) **Singapore** 2Q2019 TBC (AMHS/AIDC, Voice); **South Africa TBC** 3Q2019 TBC (AMHS/AIDC, Voice); **Japan** would be end of 2019.	staged approach	Termination of current COM contract
Bhutan	Contract signed on Oct 2019. CRV installed successfully in Dec 2021. CRV P2P Test between Paro-Mumbai & Paro-Bangkok to be done once India and Thailand join CRV	AMHS first and Voice & ADS-B will follow up after AMHS.		Dependent on India and Thailand for utilization of CRV network.

State/ Administration	Intended date for CRV cut-over	Applications targeted	Migration scheme	Prerequisites/ dependencies
Cambodia	As early as convenient, dependent on neighboring countries			Internal decision making
China	Contract signed on 21 June 2020.	Applications targeted: Data(AMHS) With: Hong Kong 3Q2020; Japan 4Q2020; Thailand TBD; India TBD. Republic of Korea 4Q2020 ATFM test with Japan and ROK at Sep 2020 over CRV	staged approach	
DemocraticPeople's Republic of Korea	Contract in 3Q2018 and service readiness in 4Q2018	AFTN and VoIP		
Hong Kong, China	Contract signed on 6 April 2018. Connection was installed successfully in June 2018.	**With Manila** CRV-Voice put into operation in August 2018 CRV-AMHS put into operation in May 2019 **With Taibei** CRV-AMHS put into operation in May 2020 **With Fukuoka** CRV-AMHS put into operation in September 2020 **With Beijing** CRV - AMHS POT in March and operation in April 2021	staged approach	Need to coordinate with relevant CAAs/ANSPs in joining CRV in a harmonized manner, etc.

State/ Administration	Intended date for CRV cut-over	Applications targeted	Migration scheme	Prerequisites/ dependencies
		Bangkok and Hochiminh Subject to their readiness		
Macao, China	Service readiness in Q4 2021	To be confirmed	Staged approach	Migration from X.25 to IPS
Fiji	Contract in May 2018 and service readiness in 3Q 2018.	Data (AMHS) and VoIP With: Australia ATS voice April 2019 completed, AMHS completed in July 2019, NZ ATS voice completed April 2019 and USA ATS voice completed in March 2019 and AMHS completed in April 2019.	Staged approach	CBA, safety case
France (New Caledonia and French Polynesia)	2023 is target for DNSA to sign contract subject to internal security assessment (done).	ATS Voice, AMHS with Fiji & AIDC, AMHS with USA, AIDC/AMHS with NZ.		CBA, cost must be affordable *Wallis and Futuna: no dedicated connection to CRV*
India	Contract for CRV implementation with M/s PCCW in India will be signed in 3Q of 2021 and CRV Service will be ready in 4Q of 2021.	AFTN/AMHS,ADS-B,AIDC,ATS Voice	staged approach	Internal Administrative approvals & safety case

State/ Administration	Intended date for CRV cut-over	Applications targeted	Migration scheme	Prerequisites/ dependencies
Indonesia	Contract in 3Q2021 and service readiness in 4Q2021.	AFTN, AMHS, ADS-B and voice		CBA completed
Japan	Contract signed in Nov.2017 and service readiness in1Q 2018for Fukuoka	Data first with: Hong Kong completed 3Q2020 USA completed 1Q2019 Singapore completed 4Q2020 China completed 1Q2021 Voice Plan with: USA 2Q2021 Daegu and Incheon (R.O.K) started in1Q2021	staged approach	
Malaysia	Contract to be signed 4Q 2020 and service readiness in 1Q 2021	AFTN, AMHS, ADS-B and ATS voice	staged approach	New ATC centre operational in 2021 Contract issue with the new ATC main contractor. COM Project is part of the main contract.
Myanmar	Contract will be signed 4Q2020.	AFTN/AMHS, AIDC, ADS-B and voice	staged approach	One of counterparts join in
Nepal	Nepal intends to join CRV on staged approach with AMHS data connectivity as first priority and intends to sign the contract with PCCW within 2020.			

State/ Administration	Intended date for CRV cut-over	Applications targeted	Migration scheme	Prerequisites/ dependencies
New Zealand	Contract signed in July 2018 and service implemented December 2018	Australia Voice Completed March 2019 and AMHS June 2019 Completed USA Voice Completed March 2019 and AMHS March 2019 Completed Fiji Voice Completed April 2019 French Polynesia AMHS and Voice Chile AMHS (SAM regional network REDDIG)	Awaiting French Polynesia joining. Awaiting outcome of inter-regional network connectivity discussion. For Chile	CBA attractive if all counterparts join in.
Philippines	Contract signed in March 2018 and service readiness in 2Q2018	Completed: with **HONG KONG** AIDC - 2Q2019; AMHS - 2Q2019; Voice - 3Q2018. with **TAIPEI** AIDC 4Q2019; AMHS 3Q2019; Voice 1Q 2019. with **SINGAPORE** AIDC – 4Q2019; AMHS –4Q2020; Voice – 1Q2020. with **USA** AMHS – 2Q2021; Voice – 4Q2019;	staged approach	Success transition to the New ATM centre in 4Q2018

State/ Administration	Intended date for CRV cut-over	Applications targeted	Migration scheme	Prerequisites/ dependencies
		with **INDONESIA** AIDC – 4Q2020.		
Republic of Korea	Contract in 3Q 2019 and service readiness in 4Q 2019	Completed: with Japan Voice –March 2021 Planned; With Japan Voice additional lines-from 2022 to 2023 AMHS-4Q 2022 With China Data(AMHS)-4Q 2022	staged approach	
Singapore	Contract signed in May 2019 and service readiness in Dec 2019	Data (AMHS over IP) with: Australia Dec 2020 (completed); Japan Nov 2020 (completed); and Philippines Dec 2020 (completed);and Malaysia Q3 2021. Voice with: Philippines Mar 2020 (completed).	Staged approach	**Singapore**
Sri Lanka	As soon as CRV is available	AMHS connectivity with Mumbai, Singapore and Male. Direct Speech facilities with Chennai, Trivendrum, Mumbai, Male, Jakarta, Melbourne, Singapore	Phased approach with the implementation of CRV	CBA

State/ Administration	Intended date for CRV cut-over	Applications targeted	Migration scheme	Prerequisites/ dependencies
Thailand	Contract in 3Q2021 and service readiness in 1Q2022	Data first Then voice, subject to safety case: China 1Q2022 Hong Kong 1Q2022; Singapore 1Q2022; India 2022.	Staged approach	
United States	Contract in January 2018	1) AMHS with Australia Fiji Japan Philippines New Zealand Papua New Guinea (2021) Indonesia (2022) 2) AIDC with Fiji Japan New Zealand Papua New Guinea (Direct planned 2021) Tahiti (via New Zealand) Indonesia (Direct planned 2022) Russia (when join CRV) 3) VoIP with Fiji Japan Philippines New Zealand Papua New Guinea (direct planned 2021) Indonesia (2022) Russia (when join CRV)	Staged approach	

State/ Administration	Intended date for CRV cut-over	Applications targeted	Migration scheme	Prerequisites/ dependencies
Viet Nam	To be confirmed later (After discussed with PCCW Global)			

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Reference	Who	What	Due date	Status	Completed on	Result	Comment
1	ICAO RO	After inclusion by ICAO TCB of the revised budget and procurement clauses, ICAO Regional Office to send an ICAO State letter to all Pioneer States in order to propose the draft of revised annex 1 for acceptance. CRV OG/6 made Decision OG/6/3 to develop SOW for the concrete proposal.	22-Jan-22		The revised annex 1 had been developed in CNS SG/21 report but no concrete proposal.		CRV OG/2 has agreed to first explore the possible solutions through a small working group - action posponed to 1 Dec 17. The TCB expects more concrete proposal for the 2nd phase. OG chair seeking comments from poineers states for be reviewed at CRV OG/6 meeting
3	All member States	Complete contract with PCCW Global by no later than 12/2020	31-Dec-21	Open	on-going		Report on the status at each CRV OG meeting & update the CRV Implementation status table
4	CRV OG co-chair (Asia) and & poineer CRV member States	To investigate use the MSA funds to undertake the independent satety assessment and seek approval from Pioneer States	1-Jan-22	Open	on-going		same as item serial no. 1-1
5	China, Nepal, PCCWG	Study on use of existing VSAT infrastructure linking with CRV	Jan-22	Open	on-going		feasiblity on use the existing infrastructure
6	PCCW Global & New Zealand	Pacific solution on inter-connection with PASNET	May-22	Open	on-going		Feasiblity for interconnection
8	PCCWG & USA,Australia	maintain APAC dial plan and posted on CRV OG portal	Jan-22	Open	on-going		consolidated by PCCWG and posted on the portal
9	AFSSP WG	encourging member states of CRV to participate	20-Jan-22	Open			Inform Administration to participate and contribute
10	Hong Kong China	SWIM demonstration over mini-CRV by HK, Singapore and Thailand	01-Jan	Open	on-going		present the outcome of the demo to ACSICG/7 and SWIMTF/4
14	Co chairs, ICAO RO, USA, PCCW	CRV webinar	20-Jul-21	Open			Promote CRV implementation
15	ICAO RO, USA, HKCAD	Timeframe for CRV supporting SWIM	Jan-22	Open			Explore a timeframe for CRV planning to support SWIM
16	Bhutan, Hong Kong China, Singapore, India, Thailand, USA, Co-chairs, ICAO RO, concerned parties	Use CRV to support AMHS traffic for Bhutan	21-Jun-21	Open			As concerned BBIS in the process to implement CRV, Bhutan request to reroute its AMHS traffic through Hong Kong temporarily till CRV implemented in Mumbai or Bangkok.
17	ICAO RO, PCCW, co-chairs	State Letter to inform States about the additional charges may apply to new users with billing start date later than 31 December 2022.	Jan-22	Open			
18	Co-Chairs, ICAO RO, Singapore, USA	Continue the feasibility study on inter-regional connection to support business case analysis	Jan-22	Open			
19	Fiji, PCCW	submit a paper to ACSICG/8	21-Jun-21	Open			PCCW Network Based IWXXM Translation and Exchange Services
20	USA, co chairs, PCCW, ICAO RO, concerned parties (ad hoc)	Cyber threats protection for CRV	Jan-22	Open			Look for common minimum requirements on cyber protection for CRV users including available ICAO guidances and industrial standards.

LIST OF PARTICIPANTS

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
1.	**AUSTRALIA (1)**			
	1.	Ms. Brenda Buwu	Senior Network Engineer Airservices Australia	brenda.buwu@airservicesaustralia.com;
2.	**BHUTAN (2)**			
	2.	Ms. Devi Maya Adhikari	Senior Communications Officer Department of Air Transport	dmadhikari@doat.gov.bt;
	3.	Mr. Karma Gayley	CNS Officer Bhutan Civil Aviation Authority (BCAA)	Kgayley@bcaa.gov.bt;
3.	**CAMBODIA (3)**			
	4.	Mr. Neang To	Chief of CNS Bureau of Air Navigation Standard and Safety Department(ANS) State Secretariat of Civil Aviation of Cambodia (SSCA)	neangto.ans@gmail.com;
	5.	Mr. Heng Meng Kong	Deputy Chief of CNS Bureau of ANS State Secretariat of Civil Aviation of Cambodia (SSCA)	hengmengkong@gmail.com;
	6.	Mr. Khorn Veasna	CNS official of ANS Secretariat of Civil Aviation of Cambodia (SSCA)	khornveasna82@gmail.com;
4.	**CHINA (3)**			
	7.	Mr. Cao Siming	Engineer Air Traffic Management Bureau of CAAC	caosiming@catc.net.cn;
	8.	Mr. Huang Zheng	Engineer Air Traffic Management Bureau of CAAC	huangzheng@catc.net.cn;

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
	9.	Mr. Wang Tian Yu	Engineer Air Traffic Management Bureau of CAAC	wangtianyu@atmb.net.cn;
5.	**HONG KONG, CHINA (5)**			
	10.	Mr. Vincent Wong	Acting Chief Electronics Engineer (Technical Support) Civil Aviation Department Hong Kong, China	vplwong@cad.gov.hk;
	11.	Mr. Gene Kwok	Electronics Engineer Civil Aviation Department Hong Kong, China	gwhkwok@cad.gov.hk;
	12.	Mr. Henry Chan	Electronics Engineer Civil Aviation Department Hong Kong, China	hhlchan@cad.gov.hk;
	13.	Mr. Simon Lau	Aeronautical Communications Supervisor Civil Aviation Department Hong Kong, China	scllau@cad.gov.hk;
	14.	Mr. Luk Chung Man, Benny	Aeronautical Communications Officer Civil Aviation Department Hong Kong, China	cmluk@cad.gov.hk;
6.	**FIJI (4)**			
	15.	Ms. Sereima Bolanavatu	ANS Inspector CNS Civil Aviation Authority of Fiji	sereima.bolanavatu@caaf.org.fj;
	16.	Mr. Kelepi Dainaki	Manager Air Navigation Engineering Services Fiji Airport Limited	KelepiD@fijiairports.com.fj;
	17.	Mr. Shivam Naicker	Senior Aeronautical Technical Officer Fiji Airport Limited	shivamn@fijiairports.com.fj;
	18.	Mr. Akariva Rabakewa	Aeronautical Technical Officer II Fiji Airport Limited	akarivar@fijiairports.com.fj;
7.	**FRANCE (French Polynesia) (3)**			

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
	19.	Mr. Didier Yvetot	Chef de Subdivision ATM Service de la Navigation Aérienne du SEAC-PF- Division Technique	didier.yvetot@aviation-civile.gouv.fr;
	20.	Mr. Jean Marc Valentin	ATM Expert DSNA France	jean-marc.valentin@aviation-civile.gouv.fr;
	21.	Mr. Patrick Luchini	ATSEP Expert Confirmé SEAC-PF / SNA / DT /ATM	patrick.luchini@aviation-civile.gouv.fr;
8.		**INDIA (6)**		
	22.	Mr. Umesh Yadav	CNS Inspector Directorate General of Civil Aviation, India	umeshyadav@AAI.AERO;
	23.	Mr. Ajay Kumar Kapur	General Manager (CNS-COM) Airports Authority of India, CHQ	akkapur@AAI.AERO;
	24.	Mr. Arvind Singh Yadav	Joint General Manager (CNS) Airports Authority of India, CHQ	asyadav@AAI.AERO;
	25.	Mr. Ajay Kumar	Assistant General Manager (CNS) Airports Authority of India, CHQ	ajaykumarcom@AAI.AERO;
	26.	Mr. Hemant Ramchandani,	Joint General Manager (CNS) Airports Authority of India, Mumbai	hemantr@AAI.AERO; hemantramchandani@yahoo.com;
	27.	Mrs. Kiran S. Kale	Assistant General Manager (CNS) Airports Authority of Indi, Mumbai	kirankale@AAI.AERO;
9.		**INDONESIA (8)**		
	28.	Ms. Waya Fadini	Air Navigation Inspector Directorate General Civil Aviation	waya_fadini@dephub.go.id;

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
	29.	Ms. Henna Nurdiansari	CNS Inspector Directorate General Civil Aviation	hennanurdiansari@gmail.com;
	30.	Mr. Zainal Arifin Harahap	VP Information Technology AirNav Indonesia	zainal.arifin@airnavindonesia.co.id;
	31.	Mr. Ronald Halasan Sibarani	Inspector of Safety AirNav Indonesia	ronald.airnav@gmail.com;
	32.	Mr. Alit Yuliawan Prihadhi	Manager of Compliance and Safety Information AirNav Indonesia	alit.gpa@gmail.com;
	33.	Ms. Diah Setiorini	Facilities Readiness Junior Manager AirNav Indonesia	d.setiorini@gmail.com;
	34.	Mr. Dedy Iskandar	Junior Manager of Surveillance and ATM Facility Readiness - Head Office AirNav Indonesia	dedy.nav7@gmail.com;
	35.	Mr. Iwan Prasetio Joko Nugroho	System and Facility Flight Communication Junior Manager AirNav Indonesia	zhokione@gmail.com;
10.	**JAPAN (5)**			
	36.	Mr. Kenji Sekitani	Special Assistant to the Director Japan Civil Aviation Bureau	sekitani-k02mm@mlit.go.jp;
	37.	Mr. Hideaki Murakata	Operations and Flight Inspection Division Japan Civil Aviation Bureau	murakata-h446b@mlit.go.jp;
	38.	Mr. Shintaro Morimune	Air Navigation Services Engineering Division Chief of facility 4th section	morimune-s01f6@mlit.go.jp

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
	39.	Mr. Hiroshi Okochi	Senior Engineer Japan Radio Air Navigation Systems Association	ookouchi@jransa.or.jp;
	40.	Mr. Ryuichi Nagai	Senior Engineer Japan Radio Air Navigation Systems Association	nagai-r194@jransa.or.jp;
11.		**MALAYSIA (2)**		
	41.	Mr. Sahrol Nizal Ab Rashid	Principal Assistant Director Civil Aviation Authority of Malaysia	sahrol@caam.gov.my;
	42.	Mr. Syahroni Bin Chek Rus	Assistant Director (CNS) Civil Aviation Authority of Malaysia	syahroni@caam.gov.my;
12.		**MONGOLIA (2)**		
	43.	Mr. Erdenesukh Magsarjav	Director CNS division of Air Navigation Service Department Civil Aviation Authority of Mongolia	erdenesukh.m@mcaa.gov.mn;
	44.	Ms. Saikhantsetseg Ulzii	Communication Engineer Civil Aviation Authority of Mongolia	saikhantsetseg@mcaa.gov.mn;
13.		**NEPAL (3)**		
	45.	Mr. Mukul Mishra	Deputy Director, CNS Department Civil Aviation Authority of Nepal	mukulmishra@fulbrightmail.org;
	46.	Ms. Reenu Mool	Deputy Director, CNS Department Civil Aviation Authority of Nepal	rmool@hotmail.com;
	47.	Mr. Samit Kumar Singh	Manager, Communications and Navigation Aids Section Tribhuvan International Airport Civil Aviation Authority of Nepal	samit.sing@gmail.com;

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
14.	**NEW ZEALAND (1)**			
	48.	Mr. Vaughan Hickford	Team Leader Network Design Airways New Zealand	vaughan.hickford@airways.co.nz;
15.	**PAKISTAN (8)**			
	49.	Mr. Engr. Raza Ur Rahman	Additional Director Networks Civil Aviation Authority of Pakistan	adld.networks@caapakistan.com.pk;
	50.	Mr. Shabbir Ahmed	Additional Director AANS Civil Aviation Authority of Pakistan	Shabbir.atc@gmail.com;
	51.	Mr. Syed Munir Mahmood	Sr. Joint Director (Technical Standards) Civil Aviation Authority of Pakistan	Muneer.mehmood@caapakistan.com.pk;
	52.	Mr. Syed Mufazzal Sajid	Sr. Joint Director CNS Civil Aviation Authority of Pakistan	mufazzal.sajid@caapakistan.com.pk;
	53.	Mr. Shahid Hussain	Sr. Joint Director COM-OPS Civil Aviation Authority of Pakistan	shahid.hussain@caapakistan.com.pk;
	54.	Mr. Muhammad Sanaullah	Assistant Director (Communication OPS) Civil Aviation Authority of Pakistan	sana.ullah@caapakistan.com.pk;
	55.	Mr. Muhammad Adnan	Assistant Director (Communication OPS) Civil Aviation Authority of Pakistan	muhammadAdnan@caapakistan.com.pk;
	56.	Mr. Khalid Bin Yousuf	Assistant Director AIS Civil Aviation Authority of Pakistan	Khalid.Byousuf@caapakistan.com.pk;
16.	**PHILIPPINES (6)**			
	57.	Ms. Jesseelyn P. Heje	Facility Chief. Manila Aeronautical Data Communication Centre (MADC) Civil Aviation Authority of the Philippines	ats_madcc@caap.gov.ph; jellane27@yahoo.com;

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
	58.	Ms. Mary Lyn C. Santamaria	Assistant Chief, Manila Aeronautical Data Communication Centre (MADC) Civil Aviation Authority of the Philippines	santamariamarylyn@yahoo.com;
	59.	Ms. Susan S. Aguinaldo	Air Traffic Management Officer III Civil Aviation Authority of the Philippines	susancandoval2018@gmail.com;
	60.	Mr. Elmer E. Gomez	Division Chief III Civil Aviation Authority of the Philippines	elm_gomez@yahoo.com;
	61.	Mr. Florante B. Bañaria	CNSS Officer IV Civil Aviation Authority of the Philippines	florante_bb@yahoo.com;
	62.	Mr. Gilmar D. Tiro	CNS Systems Supervisor Civil Aviation Authority of the Philippines	gilmar.tiro@gmail.com;
17.	**REPUBLIC OF KOREA (7)**			
	63.	Mr. Kyungjoom Jang	Assistant Director Ministry of Land, Infrastructure and Transport (MOLIT)	skyjian@korea.kr;
	64.	Ms. Da In Kim	Assistant Director Ministry of Land, Infrastructure and Transport (MOLIT)	kimdiane90@korea.kr;
	65.	Mr. Jeong Kyu-chang	Assistant Director Ministry of Land, Infrastructure and Transport (MOLIT)	huinari@korea.kr;
	66.	Ms. Min Sol	Assistant Director Ministry of Land, Infrastructure and Transport (MOLIT)	smin12@korea.kr;

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
	67.	Mr. Yeonghun Yeo	Assistant Officer Ministry of Land, Infrastructure and Transport (MOLIT)	dudgns1216@korea.kr;
	68.	Mr. Kim Won Joong	Manager Korea Airports Corporation	togran1684@airport.co.kr;
	69.	Mr. Younwon Choi	Assistant Manager Korea Airports Corporation	younwon@airport.co.kr;
18.		**RUSSIAN FEDERATION (1)**		
	70.	Mr. Oleg Tregubenkov	Head of Moscow COM Centre State ATM Corporation	olegtr@rto.ru;
19.		**SINGAPORE (4)**		
	71.	Mr. Augustine Lau	Senior Engineer (Communications) Civil Aviation Authority of Singapore	Augustine_LAU@caas.gov.sg;
	72.	Mr. Zachary Seah	Engineer (Communications) Civil Aviation Authority of Singapore	Zachary_SEAH@caas.gov.sg;
	73.	Mr. Joe Chua	Chief (Systems Planning) Civil Aviation Authority of Singapore	Joe_CHUA@caas.gov.sg;
	74.	Mr. Joel Ng	Senior ATC Manager (Systems Planning) Civil Aviation Authority of Singapore	Joel_NG@caas.gov.sg;
20.		**THAILAND (7)**		
	75.	Mr. Chavalit Ithiapa	ANS Officer Civil Aviation Authority of Thailand	chavalit.i@caat.or.th;
	76.	Mr. Nattaporn Pornsawat	ANS Officer Civil Aviation Authority of Thailand	nattaporn.p@caat.or.th;

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
	77.	Mr. Sutthisan Tansuwanwong	Air Traffic Engineering Manager Civil Aviation Authority of Thailand	sutthisan.th@aerothai.co.th;
	78.	Mr. Dhivatbodi Sivajdhanachoti	Strategic Planning Assistant Manager (Engineering)	dhivatbodi.si@aerothai.co.th;
	79.	Mr. Jatuporn Nootapong	Executive Air Traffic Systems Engineer Aeronautical Radio of Thailand Ltd.	jatuporn.no@aerothai.co.th;
	80.	Ms. Kanisa Jaemit	System Engineer Aeronautical Radio of Thailand Ltd.	kanisa.ja@aerothai.co.th;
	81.	Mr. Chingcheep Burirak	Director, Flight Operations Safety Department Thai International Public Company Limited	chingcheep.b@thaiairways.com;
21.		**USA (4)**		
	82.	Mr. Michael Watkins	Senior Air Traffic Representative, Asia Pacific Federal Aviation Administration	michael.w.watkins@faa.gov;
	83.	Mr. Hoang Tran	International Telecommunications Lead Federal Aviation Administration	hoang.tran@faa.gov;
	84.	Mr. Albert O'Neill	Enterprise Product Support Federal Aviation Administration	al.oneill@faa.gov;
	85.	Mr. Will Turner	NEMC Operations Support – Contract Support Federal Aviation Administration FAA Atlanta NEMC	will.ctr.turner@faa.gov;
22.		**VIET NAM (1)**		
	86.	Mr. Nguyen Hong Hiep	IT Specialist Viet Nam Air Traffic Management Corporation (VATM)	nguyenhonghiepbk@vatm.vn;
23.		**ICCAIA (1)**		

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
	87.	Mr. Gregory Dunstone	Sales Engineer AIREON International Coordinating Council of Aerospace Industries Associations (ICCAIA)	greg.dunstone@aireon.com;
24.		**FREQUENTIS (1)**		
	88.	Mr. Michael Hamsik	Domain Sales Manager Frequentis Comsoft GmbH	michael.hamsik@frequentis.com;
25.		**PCCW Global (9)**		
	89.	Mr. Eddy Lee	Assistant Vice President, Presales PCCW Global	elee@pccwglobal.com;
	90.	Mr. Benny Cheng	Assistant Vice President PCCW Global	benny.hf.cheng@pccw.com;
	91.	Ms. Mandy Keung	Assistant Vice President PCCW Global	mkeung@pccwglobal.com;
	92.	Mr. Chun Kwong Mak	Programme Director – CRV Network Implementation PCCW Global	ckmak@pccwglobal.com;
	93.	Ms. Lorraine Kwan	Head of Service Management, Strategic Accounts PCCW Global	lwykwan@pccwglobal.com;
	94.	Mr. Bono Ng	Business Development Manager PCCW Global	bcng@pccwglobal.com;
	95.	Mr. David Hao Wang	Product Development Manager PCCW Global	dhwang@pccwglobal.com;
	96.	Ms. Bowie Lam	Sales Manager PCCW Global	bowiel@pccwglobal.com;

	STATE/NAME		TITLE/ORGANIZATION	TEL/FAX/E-MAIL
	97.	Mr. Robbert Poon	Solution Consultant PCCW Global	ryppoon@pccwglobal.com;
26.		**ICAO (3)**		
	98.	Mr. Luo Yi	Regional Officer CNS International Civil Aviation Organization Asia and Pacific	yluo@icao.int;
	99.	Ms. Soniya Nibhani	Regional Officer CNS International Civil Aviation Organization Asia and Pacific Office	snibhani@icao.int;
	100.	Ms. Bhabhinan Sirapongkosit	Programme Assistant (CNS/MET/ENV) International Civil Aviation Organization Asia and Pacific	bsirapongkosit@icao.int;

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WP/05	4	CRV Landing Page	New Zealand
WP/06	6	Update the AMHS/ATN Implementation Status Table and the APAC CRV Implementation Table	Secretariat
WP/07	8	Updates on CRV Pioneer State Contribution To the ICAO Managed Service Agreement (MSA)	Secretariat
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IP/11	6	Fiji's Experience in Providing Voice and AMHS Services Over the CRV Network Using SLA Package D	Fiji
IP/12	7	Presentation of PCCW Network based IWXXM Translation and Exchange Services	PCCW Global and Fiji
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