INTERNATIONAL CIVIL AVIATION ORGANIZATION

Common Regional Virtual Private Network Task Force (CRV TF) Of Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG)

Operational Services and Environments Description (OSED)

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA-PACIFIC OFFICE

Document Change Record

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0.1	September 22, 2014	Initial Draft	All
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0.6	April 2, 2015	Australia's comments on annex 1 2.2 updated for Air Ground communications services Performance constraints on SUR, ATFM, DLK and Air Ground communications services amended (respectively by New Caledonia, Hong Kong China, ICAO RO and Singapore)	Annex 1 2.2 2.3
1.0	May 11, 2015	Review of all comments by CRV Safety preliminary analysis #6	All

Table of Contents

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to describe the ~~ATS services~~ Air Traffic Services, the Communication, Navigation and Surveillance Services, the Meteorological Services for Air Navigation, and the Aeronautical Information Services ~~-~~facilitated through CRV and their respective environments to allow allocating safety and performance requirements to the network services that the awarded Common Service Provider will have to meet.
As such this OSED is a reference document for the safety preliminary analysis and the users requirements developed in the framework of the CRV programme.

1.2 Structure of the document

Chapter 2 defines the description of services provided through CRV.
Chapter 3 defines the associated operating environments.
Chapter 4 defines units that are to be used by the CRV safety preliminary analysis.
Chapter 5 defines matrices of flows for each one of the services delivered through CRV.

2 Operational Services Description

2.1 Scope and Objective

As per CRV CONOPS, the Asia/Pacific VPN is anticipated to provide a broad range of benefits to the CRV Members, including (but not limited to):

- Cost efficiencies as compared to multiple point-to-point connections;
- Reduced procurement time and effort, as each ANSP will require only the initial connection to the CRV;
- Potential to carry new services (e.g., ATFM, SWIM, etc.);
- Transition from the current bandwidth limitations to an harmonized and homogeneous level of network performance and services delivered by the CRV Service Provider, including ease of growth, connectivity and modification;
- Potential for additional connectivity beyond the initial AFTN-like routing network, including both regional and inter-regional connectivity;
- Greater ease of handling of network service issues.

The objective of this chapter is to describe the ATS services supported by CRV.

2.2 Services Carried by the CRV Network

The Common Service Provider will carry[YC1]:

- AFTN data (Distress and Urgency messages, Flight safety and regularity messages, Meteorological messages, Aeronautical Information Services Messages, aeronautical administrative and service messages)
- AMHS data (FPL, NOTAM and MET): traditional FPL/NOTAM/MET messages are to be sent via the CRV over the AMHS rather than the AFTN
- Ground-ground voice ATM communications, referred to as voice communications
- Air-Ground Voice communications, referred to as air voice communications
- Air-ground Data Link communications (in case we have one day ATN routers in common), referred to as Data Link communications
- Ground-ground ATS surveillance data, referred to as surveillance data
- Ground-ground AIDC data, referred to as AIDC data
- Ground-ground AIM data, referred to as AIM data
- Ground-ground ATFM data, referred to as ATFM data
- Ground-ground SWIM data (AIXM, FIXM, IWXXM), referred to as SWIM data
- Miscellaneous data: other data not pertaining to the categories above, or carried for TEST purpose only

- Any other category as agreed later

Here follows a description of what the ANSP supported by CRV do (or will do) from an operational perspective:

CRV service	PREFIX	How the ANSP supported by CRV do (or will) typically use those data	Time horizon
AFTN/Distress messages	Distress Service	ANSP A sends applicable AFTN messages to ANSP B so aircraft operators can plan and maintain safe flights	Immediate[1]
AFTN/Urgency messages	Urgency		
AFTN/Flight safety messages	Flight safety		
AFTN/ Meteorological messages	Meteorological		
AFTN/ Flight regularity messages	Flight regularity		
AFTN/Aeronautical Information Services Messages	Aeronautical Information Services		
AFTN/ Administrative messages	Administrative		
AFTN/Service Messages	Service		
AMHS/FPL	FPL	ANSP A sends an ICAO 4444 Flight Plan to ANSP B through the CRV so aircraft operators can plan safe flights. FPL includes all flight plan and related messages defined in ICAO Doc 4444: FPL, DLA, CHG, CNL, DEP, and ARR.	Immediate
AMHS/NOTAM	NOTAM	ANSP A sends applicable NOTAM to ANSP B so aircraft operators can plan safe flights	Immediate
AMHS/MET	MET	ANSP A sends applicable MET data to ANSP B so aircraft operators can plan safe flights	Immediate
Ground-Ground Voice communications	VOICE	ANSP A manages with ANSP B the coordination and transfer of control of a flight between successive ATC units and control sectors through voice communications over IP. CRV may be used to carry voice communications between 2 points of the regional infrastructure.	Immediate

[1] Immediate means: when the CRV operations start

CRV service	PREFIX	How the ANSP supported by CRV do (or will) typically use those data	Time horizon
Air-Ground Voice communications	AIR-VOICE	ANSP 'A' decides to use VHF radio stations located in ANSP 'B' region to relay voice communication with pilots. They currently use VSAT and/or land lines to transport the voice traffic from the premises of ANSP 'A' to the VHF relay stations in ANSP 'B' region. The proposed CRV may replace the current VSAT and/or land lines in certain cases. ~~ATC from ANSP A communicates with aircrew through air ground voice communications over IP~~	Potential[2]
Data Link communications	DLK	ANSP A may provide Data Link services in its jurisdiction (category R, S or T airspace) based on Data Link communications and uses CPDLC as Primary or Supplemental means to exchange non critical communications with pilots, and ADS-C reports. ATS provided with the support of Data Link may be: • separation services to airspace users • flight information services • reroute services (UPR) • alert services. CRV may be used to forward ADS-C reports between 2 ANSPs (involved for example in a same area of common interest) or carry DLK transactions between 2 (or more) points of the regional infrastructure (if it was centralised).	Ground-ground forwarding of ADS-C reports CPDLC, 4D-TRAD, ADS-C: Potential[3]
Surveillance data	SUR	ANSP A provides SSR and/or ADS-B data to ANSP B through CRV. ANSP B uses the data provided by ANSP A to maintain an air situational display in the sectors covered by ANSP A's ground surveillance stations. ATS provided may be separation of aircraft using a 5 (or 10) nautical miles separation standard (tier 1), situational awareness to controllers and support of safety nets (tier 2), or position reporting service for improving flight operations and decreasing ATC workload (tier 3). CRV may be used to carry the shared surveillance data between 2 (or more) points of the regional infrastructure.	Immediate
AIDC data	AIDC	The AIDC application supports information exchanges between ATC application processes	Immediate

[2] Potential means: such type of data may be exchanged over CRV in the future

[3] At present there is no centralized architecture for the provision of Data Link services in APAC region, each State operating through a CSP. If In the future this changes to a more centralised architecture, CRV would be used to carry ground to ground communications for Data Link (to one or more common BIS routers) and should be allocated a performance budget accordingly.

CRV service	PREFIX	How the ANSP supported by CRV do (or will) typically use those data	Time horizon
		within automated ATS systems located at different ATSUs. This application supports the Notification, Coordination, and the Transfer of Communications and Control functions between these ATSUs.	
AIM data	AIM	The aim of the aeronautical information service (AIS) is to ensure the flow of aeronautical information/data necessary for safety, regularity, economy and efficiency of international air navigation. One ANSP exchanges AIS data to multiple ANPs through the CRV so that aircraft operators can plan safe flight.	Immediate
ATFM data[4]	ATFM	To increase the accuracy of the ATFM planning including strategic, pre-tactical and tactical planning, ANSP A will exchange ATFM data with ATFMUs of different ANSPs in the region in regular and on demand/request basis the following basic types of information pertaining to flow management:- • ATFM Daily Plan • Exchange of TOBT and CTOT • Swap of flight slots • Slot coordination • Declare airport capacity • Activities on airspace under restrictions or reservations CRV may be used to support web conference between multiple ATFMUs via the regional infrastructure.	Immediate
Miscellaneous data Other data not pertaining to the categories above, or carried for TEST purpose only	MISC	ANSP A wants to perform with ANSP B and C tests between ANSP's systems. ANSP A and B agree to run shared simulations over 2 or more systems and use CRV to exchange data ANSP A runs a FTP server with data remotely accessed by other ANSPs as agreed Etc	Immediate
AIXM data	AIXM[5]	One ANSP exchanges Aeronautical Information in AIXM format with multiple ANSPs through the CRV so aircraft operators can plan safe	Future

[4] Definition work is ongoing with APAC ATFM SG. See http://www.icao.int/APAC/Meetings/Pages/default.aspx
[5] See http://www.aixm.aero/public/subsite_homepage/homepage.html

CRV service	PREFIX	How the ANSP supported by CRV do (or will) typically use those data	Time horizon
		flights.	
FIXM data	FIXM[6]	One ANSP exchanges Flight Information in FIXM format with multiple ANSPs through the CRV so aircraft operators and ANSPs can plan and conduct safe flights. Information covers: - flight planning - trajectory management - AIDC messaging - ATFM - A-CDM - dangerous goods.	Future
WXXM data	IWXXM[7]	The Weather Information Exchange Model (WXXM) is designed to enable the management and distribution of weather data in digital format (XML). One ANSP exchanges Aeronautical Meteorological Information in IWXXM (ICAO Doc 10003) format with multiple ANSPs in a timely manner through the CRV so that aircraft operators can plan safe flights.	Future

2.3 Service Performance Constraints

Transactions supported by CRV contribute to ATS services which are subject to performance requirements. Each time such requirements involve human response time and technical systems performances outside of CRV scope, there will be a need to make relevant assumptions.

For each service:

- a procedure, which has the highest stringent operational constraint, is described and the end-to-end scenario established.
- Performance constraint as a result of the end-to-end scenario, and/or as arising from the ICAO provisions, or any other relevant documentation, is established
- A reference to the ICAO provisions and any other relevant documentation is given.

[6] See http://www.fixm.aero/
[7] See http://www.wxxm.aero/public/subsite_homepage/homepage.html

This is to make sure that such service performance constraints will be accounted for in the CRV safety preliminary analysis, in the case where they are more stringent than the requirements resulting from the analysis.

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
AFTN/Distress messages	ANSP A (mobile station) issues a distress message to ANSP B. SS category message	Message transmission priority: SS DD/FF GG/KK	AMHS message priority order as listed in Annex 10 Volume 2 section 4.4.1.2 AsiaPac Communication Performance for ATN First Edition, April 2005, part 4.1.2.f
AFTN/Urgency messages	ANSP A issues an urgency message to ANSP B. DD category message		
AFTN/Flight safety messages,	ANSP A issues a flight safety message to ANSP B. FF category message		
AFTN/ Meteorological messages	ANSP A issues a meteorological message to ANSP B. GG category message		
AFTN/ Flight regularity messages	ANSP A issues a flight regularity message to ANSP B. GG category message		
AFTN/Aeronautical Information Services Messages	ANSP A issues an aeronautical information message to ANSP B. GG category message		

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
AFTN/ Administrative messages	ANSP A issues an administrative message to ANSP B. KK category message		
AFTN/Service Messages	ANSP A issues a service message to ANSP B. Category is dependent on the content of the message		
AMHS/FPL	ANSP A provides ICAO Doc 4444 flight plans to ANSP B through CRV. [8] ~~Distress and Urgency messages~~ ~~Zaki and Kris to coordinate~~	~~TBD~~ Same as AFTN	ICAO Doc 4444 https://portal.icao.int/icao-net/ICAO%20Documents/4444
AMHS/NOTAM	ANSP A sends applicable NOTAM to ANSP B 8		ANNEX 15 – Aeronautical Information Services, Fourteenth Edition, July 2013 AIS-AIMSG9/-SN/4, Ninth meeting, April 2014
AMHS/MET	ANSP A sends applicable MET messages to ANSP B 8		ANNEX 3 – Meteorological Service for International Air Navigation, Sixteenth Edition, July 2007
Voice communications		~~TBD~~As per ED-136	ED-136 - VoIP ATM System Operational and Technical Requirements, edition February 2009

[8] AMHS message priority order as listed in Annex 10 Volume 2 section 4.4.1.2. The network QoS needs to ensure that the message priorities are considered.

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
Data Link communications	**Scenario 1 (category S)** ANSP A ~~delivers~~ transfers an aircraft to ANSP B using a silent transfer of control and communications with CPDLC, in compliance with the established LOA, in an en route environment with 10NM separation standard (category S) ~~TBD~~ **Scenario 2 (category R)** ANSP A provides separation assurance (SA) under 30 NM lateral, 30 NM longitudinal separation standards, using CPDLC and ADS-C in an oceanic environment	Performance: ~~CPDLC:~~ RCP 240~~,~~ ~~RCP 400~~ Communication process time shall be 240 seconds. 95% Transaction time shall be 180 seconds. ~~ADS-C: RSP 180~~ ~~TBD~~ Safety: for OHA/PSSA the most stringent requirements to consider are derived from operational hazards • H-ACL-9: Undetected misdirection of a message used for separation • H-ACL-12 Undetected corruption of a message used for separation Performance: RCP 240 Safety: For OHA/PSSA the most stringent requirements to consider are derived from operational hazards • H-CRD-8 Undetected misdirection of a message • H-CRD-9 Undetected corruption of a message	• ICAO Doc 4444 • ICAO Manual of Air Traffic Services Data Link Applications (Doc 9694) • ICAO Manual on datalink performance • APAC communication and surveillance strategy • ICAO Doc 9925 - Manual on the Aeronautical Mobile Satellite (Route) Service Edition 1 • Global Operational Data Link Document (GOLD) Edition 2 • SAFETY AND PERFORMANCE REQUIREMENTS STANDARD FOR AIR TRAFFIC DATA LINK SERVICES IN CONTINENTAL AIRSPACE (CONTINENTAL SPR STANDARD) change 2, October 2007 • RTCA DO-258A/Eurocae ED-100A, RTCA DO-306/Eurocae ED-122 change 1 • GUIDANCE MATERIAL FOR END-TO-END SAFETY AND PERFORMANCE MONITORING OF AIR TRAFFIC SERVICE (ATS) DATA LINK SYSTEMS IN THE ASIA/PACIFIC REGION Version 4.0 – February 2011
Surveillance data	UC#1 ANSP A provides ADS-B Category 20 or 21 to ANSP A through CRV to perform control service through either tier1 or radar separation	RSP 180 Network latency: The ADS-B network shall deliver reports to the User interface within 2 seconds of their output from the ADS-B ground station for 95% of the time. (Tier 1)	• ICAO Annex 11 • ICAO Annex 10 • ICAO Annex 2 • ICAO Cir 326 Assessment of ADS-B and MLAT services to supports ATS

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
	minima. ANSP B uses the data provided by ANSP A for providing in its airspace responsibility X down to 5 or 3 NM separation service (Tier 1) in the sectors covered by ANSP A's ground surveillance stations. Data are required and not redundant [YC2] . ANSP B is not performing contingency service control in ANSP A airspace. UC#2 ANSP B uses the data provided by ANSP A to implement Tier2 in its airspace responsibility. Data are required and not redundant. UC#3 ANSP B uses the data provided by ANSP A to implement Tier3 in its airspace responsibility.~~ANSP A provides ADS-B~~	Network latency: The ADS-B network shall deliver reports to the User interface within 15 seconds of their output from the ADS-B ground station for 95% of the time. (Tier 2) The Provider ADS-B system shall provide a MTBF (loss of ADS-B Service) to the User interface exceeding 50,000 hours. (Tier 1) The Provider ADS-B system shall provide a MTBF (loss of ADS-B Service) to the User interface exceeding 400 hours. (Tier 2) Availability : The service shall be provided with a service availability from each ground station site of better than 99.9%. In calculation of availability, planned outages shall be included. (Tier 1) Availability : The service shall be provided with a service availability from each ground station site of better than 95%. In calculation of availability, planned outages shall be included. (Tier 2) Integrity: Integrity of ADS-B data is critical to system safety. The ADS-B ground station, the data communication system, and any processing before the interface shall not introduce errors (compared to the received ADS-B messages) more frequent than 1 in	• ICAO Doc 4444 • ICAO Doc 9924 Aeronautical Surveillance Manual • ICAO Doc 9871 Technical Provisions for Mode S Services and Extended Squitter • ICAO Guidance Material on Building Safety Case for ADS-B separation V1 • AMC2024, RTCA/ Eurocae DO-260A/DO-260B -ED102A • Eurocae ED-126/RTCA DO-303 SPI ADS-B-NRA Application • Eurocae ED-161/RTCA DO-318 SPI ADS-B-RAD • ICAO ADS-B Implementation Guidance Document (AIGD) Ed.7 • WAM: Eurocae ED-142 • SAMPLE AGREEMENT FOR THE STANDARD USE OF ADS-B DATA Edition:1.0 Edition Date: 2008

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
	~~Category 21 to ANSP A through CRV.~~ ~~ANSP B uses the data provided by ANSP A for providing 5 NM separation service (Tier 1) in the sectors covered by ANSP A's ground surveillance stations.~~	every million messages (1* 10^{-6}). The provided service shall not deliver any received data to the interface which has not satisfied ADS-B downlink message cyclic redundancy checks (CRC). To be expanded with : UC#1 ED161 requirements for ADS-B in RAD plus safety requirements for data surveillance in Radar environment UC#2 : requirements for Tier2 UC#3 requirements for Tier3	

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
AIDC data	One ANSP exchanges AIDC data in AIDC format (Notification, Coordination and Transfer of Communication) with multiple ANSPs through the CRV so that ANSPs can coordinate with each other for safe flights.	The performance of the communications links should be such that 95% of all messages should be received within 12 seconds of transmission and 99.9% of all messages should be received within 30 seconds of transmission. In bilateral agreements, ATSUs, may agree on different performance requirements.[9] The timeout value Talarm associated with an application response shall be 180 seconds, Failure to receive an expected application response (i.e. a LAM or LRM) within Tr seconds (≤Talarm) shall result in a re-transmission (up to a maximum number Nr) of the original message.	• ICAO Annex 10 • ICAO Doc 4444 • APAC AIDC ICD v3 • PAN AIDC ICD v1.0, Sept. 2014 • Global Operational Data Link Document (GOLD) Edition 2
AIM data	One ANSP exchanges AIS data with multiple ANPs through the CRV so that aircraft operators can plan safe flight.	~~TBD~~Nil	Annex 15 ICAO Doc 4444 Global Air Navigation Plan (Doc 9750) Doc. 9854, Global Air Traffic Management Operational Concept

[9] Paragraph 3.3.2.2 of PAN ICD AIDC V1.0 refers

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
ATFM data	ATFMU A distributes CTOT to ATFMU B through CRV. ATFMU B advises the relevant Control Tower via internal channel.	~~Not longer than 1 min~~ ~~TBD~~The performance of the CRV communication links should be such that 95% of all types of ATFM messages should be received within 15 seconds of transmission and 99.9% should be received within 60 seconds of transmission between ATFMU A and ATFMU B. ATFMU may agree on different performance requirements	ATFM: • ICAO Manual on ATFM available in draft version. • APAC ATFM SG work A-CDM: • ICAO Doc 4444 • ICAO CDM Manual • ICAO Doc 9868 (PANS training) • US TBFM and EUROCONTROL A-CDM • Eurocae ED-141 Minimum technical specifications for airport collaborative decision making (airport-CDM) systems

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References

Miscellaneous data	Miscellaneous data comprise:
	• test data between ANSP's systems.
	• Simulation data or training data between ANSP's platforms
	• other types of data:
	  ○ FTP between servers etc)
	  ○ web conference between multiple ATFMUs via the regional infrastructure.
		• Test/simulation/training data are not be used for operational purpose, so as such no operational constraint applies However for the sake of mimicking an operational environment performance constraints may apply
		• Webconference streaming for ATFM (if confirmed): dedicated class of service
		• Other types: best effort
			Nil

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
AIXM data	~~TBD~~Pending more developed scenarios for AIXM, is considered to be equivalent to AIM	Nil (~~TBD~~Pending more developed scenarios for AIXM, considered equivalent to AIM)	• ICAO Annex 3, including Amendment 76 • Asia and Pacific regions air navigation plan • ICAO Manual of Aeronautical Meteorological Practices (Doc 8896) • ICAO Manual on Coordination between Air Traffic Services, Aeronautical Information Services & Aeronautical Meteorological Services (Doc 9377) • Handbook on the International Airways Volcano Watch – Operational Procedures and Contact List (Doc 9766) • Manual on Low Level Wind Shear (Doc 9817) • Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds (Doc 9691) • Regional guidance material including the Regional SIGMET Guide, ROBEX Handbook and OPMET Data Banks Interface Control Document. Note: • Amendment 76 to Annex 3 applicable on 14 Nov. 2013 • Draft manual on the Digital Exchange of Aeronautical Meteorological Information http://www.icao.int/safety/meteorology/MARIE-PT/Documents/Forms/AllItems.aspx • ICAO DOC (*Draft*) System Wide Information Management (SWIM) Concept • http://www.aixm.aero/public/subsite_homepage/homepage.html

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
FIXM data	One ANSP exchanges Flight Information in FIXM format with multiple ASPs through the CRV. In first analysis and pending ICAO provisions, the most safety critical part of FIXM is trajectory management and A-CDM, as the distance to the severity 1 and 2 effects of operational hazards is assessed the shortest (for A-CDM: runway incursion, for trajectory. management air collision or severe loss of separation).	~~TBD~~Assumption that performance constraints for FIXM are related to the data that is being transmitted using FIXM. The most safety critical part is trajectory management. So the performance constraints will be no less stringent than those imposed by AIDC.	• ICAO DOC 9965 Manual on Flight and Flow – Information for a Collaborative Environment (FF-ICE) • ICAO DOC (Draft) System Wide Information Management (SWIM) Concept • http://www.fixm.aero/
IWXXM data	One ANSP exchanges Aeronautical Meteorological Information in IWXXM with multiple ANSPs through the CRV.	~~TBD~~Nil	• ICAO DOC (Draft) System Wide Information Management (SWIM) Concept • ICAO DOC 10003 Manual on the Digital Exchange of Aeronautical Meteorological Information • http://www.wxxm.aero/public/subsite_homepage/homepage.html

CRV service	End-to-end scenario with the most stringent operational constraint	Performance Constraints	References
Air Ground communications	ANSP 'A' decides to use VHF radio stations located in ANSP 'B' region to relay voice communication with pilots. They currently use VSAT and/or land lines to transport the voice traffic from the premises of ANSP 'A' to the VHF relay stations in ANSP 'B' region. The proposed CRV may replace the current VSAT and/or land lines in certain cases. ~~TBD~~	End-to-End Network Latency 95%: < 1 seconds from Provider Edge to Provider Edge (PE to PE). Reliability - Comms Infrastructure Completely duplicated, no common point of failure Reliability - Total Service MTBF Total Service MTBF > 50,000 hrs Availability - Total DCPC Service Total Service Availability > 99.99% Integrity - Ground Station Ground Station shall be checked by Site Monitor and monitored by RCMS Integrity - Data Communications & Processing All systems up to the ATM system, errors < 1 x 10E-6~~TBD~~	•

3 Operational Environments

3.1 Scope and Objective

Operational environments are described only through those characteristics which are likely to affect the performance of the provision of services through CRV, or likely to affect the ANS-related units (per flight hour, per hour of ATS operations, etc) or units usable by the CRV Service Provider (per message, per IP packet etc).

Note: a same ANSP may have to refer (whether explicitly or implicitly through the use of derived requirements) to different environments for the same service.

For example, an ANSP uses coordination through voice communications to provide air traffic services in Category R airspace as it has a huge oceanic airspace, but also in Category S airspace. In this example, CRV may have to carry data for the voice communications for both types of airspace[10].

In order to reduce the complexity of the CRV safety preliminary analysis, there is a need to categorize airspaces where ATS services are provided, according to the demand which can be high, standard or low.

3.2 Categorization of airspace

As per [Seamless plan], the plan does not use 'continental', 'remote' and 'oceanic' areas to refer to an assumed geographical application area, as many Asia/Pacific States have islands or archipelagos that can support a higher density of Communications, Navigation, Surveillance (CNS) systems than in a purely 'oceanic' environment. In accordance with the CONOPS that air navigation services should be provided commensurate with the capability of the CNS equipment, it is important to categorise airspace in this manner, and simplify the numerous references to this capability throughout the Plan. Thus the Plan categorises airspace by reference to its CNS (Communications, Navigation and Surveillance) capability as:

a) Category R: remote en-route airspace within Air Traffic Services (ATS) [YC3] communications and surveillance coverage dependent on a third-party Communication Service Provider (CSP); or

b) Category S: serviced (or potentially serviced) en-route airspace – by direct (not dependent on a CSP) ATS communications and surveillance; or

c) Category T: terminal operations serviced by direct ATS communications and surveillance.

[10] Here probably the voice communications with ATC serving the Category S airspace, which is denser and would imply quicker interventions from ATC, will bear the most stringent requirements.

3.3 Performance profile

3.3.1 Definition of a performance profile

Different characteristics of operational environments are summarized in the following table: density, complexity and separation minima in use[11].
Density is characterized as follows (for the purpose of this OSED only):

- High density: 60 aircraft or more per sector and per hour
- Middle density: between 30 and 60 aircraft per sector and per hour
- Low density: 30 aircraft or less per hour

Complexity is characterized as follows (for the purpose of this OSED only):

- High complexity: with management of altitude transition, crossing traffic, speed and/or flexible tracks
- Middle complexity: with management of at least altitude transition, crossing traffic, speed or flexible tracks
- Low complexity: few or no of altitude transition, crossing traffic, speed management or flexible tracks

Separation Minima are defined as standard (as per ICAO provisions) or larger.

The performance profile - high demand, standard demand or low demand - is defined as a combination of traffic Complexity, traffic density and separation minima in the following table[12]:

Traffic Complexity	Weight	Traffic density	Weight	Separation Minima	Weight	Resulting weight	**Performance Profile**
H	3	H	3	S	2	18	High demand
H	3	H	3	L	1	9	High demand
H	3	M	2	S	2	12	High demand
H	3	M	2	L	1	6	Standard demand
H	3	L	1	S	2	6	Standard demand
H	3	L	1	L	1	3	Low demand
M	2	H	3	S	2	12	High demand
M	2	H	3	L	1	6	Standard demand

[11] See also Appendix G: Capacity Expectations of [Seamless Plan]
[12] The performance profile maps to a range of weights: high is 9+, Standard is 6-8, Low is 5 or less

Traffic Complexity	Weight	Traffic density	Weight	Separation Minima	Weight	Resulting weight	**Performance Profile**
M	2	M	2	S	2	8	Standard demand
M	2	M	2	L	1	4	Low demand
M	2	L	1	S	2	4	Low demand
M	2	L	1	L	1	2	Low demand
L	1	H	3	S	2	6	Standard demand
L	1	H	3	L	1	3	Low demand
L	1	M	2	S	2	4	Low demand
L	1	M	2	L	1	2	Low demand
L	1	L	1	S	2	2	Low demand
L	1	L	1	L	1	1	Low demand

It is noted that other factors may influence the performance profile required by a given environment such as the type of Control (procedural, tactical), FIR and ATC sector structure, type of sectorization, Special Use of Airspace, Topographic or weather Constraints etc, but those factors were not retained for the sake of simplicity.
However if their influence is strong enough the environment may be allocated a different profile.

3.3.2 Performance profiles of user environments in APAC Region

The performance profiles are allocated as follows for the sake of CRV services.

State/administration	Number of FIR (in total)	Number of high density FIR (in APAC)	Number of high density international aerodromes (in APAC)	**Performance Profile (HD/STD/LD)**
Afghanistan	1	0	0	STD
Australia	2	0	2	HD
Bangladesh	1	0	0	STD
Bhutan	0	0	0	LD
Brunei Darussalam	0	0	0	STD
Cambodia	1	0	0	STD
China	9	7	9	HD
Hong Kong, China	1	1	0	HD
Macao, China	1	0	0	STD

State/administration	Number of FIR (in total)	Number of high density FIR (in APAC)	Number of high density international aerodromes (in APAC)	Performance Profile (HD/STD/LD)
Cook Islands	0	0	0	LD
Democratic People's Republic of Korea	1	0	0	LD
Fiji	1	0	0	LD
French Polynesia, France	1	0	0	LD
India	4	2	2	HD
Indonesia	2	1	1	HD
Japan	1	1	2	HD
Kiribati	0	0	0	LD
Lao People's Democratic Republic	1	1	0	HD
Malaysia	2	1	1	HD
Maldives	1	0	0	STD
Marshall Islands	0	0	0	LD
Micronesia (Federated States of)	0	0	0	LD
Mongolia	1	0	0	HD
Myanmar	1	0	0	HD
Nauru	1	0	0	LD
Nepal	1	0	0	STD
New Caledonia, France	0	0	0	LD
New Zealand	2	0	0	STD
Pakistan	2	0	0	HD
Palau	0	0	0	LD
Papua New Guinea	1	0	0	STD
Philippines	1	1	1	HD
Republic of Korea	1	1	1	HD
Samoa	0	0	0	LD

State/administration	Number of FIR (in total)	Number of high density FIR (in APAC)	Number of high density international aerodromes (in APAC)	Performance Profile (HD/STD/LD)
Singapore	1	1	1	HD
Solomon Islands	0	0	0	LD
Sri Lanka	1	0	0	STD
Thailand	1	1	1	HD
Timor Leste	0	0	0	LD
Tonga	0	0	0	LD
United States	7	0	0	HD
Vanuatu	1	0	0	LD
Viet Nam	2	2	0	HD

3.3.3 Performance profiles of other users/environments

As/if other stakeholders join CRV (existing connections between APAC States and other ICAO regions, States from ICAO MID/EUR Regions etc) or need to be connected to the CRV network, this paragraph will document their performance profile.

State/administration	Number of FIR	Number of high density FIR	Number of high density international aerodromes	Performance Profile (HD/STD/LD)

Note: for the sake of SWIM exchanges, the aircrew/avionics is considered as a high demand profile as most exchanges with aircraft have a tactical purpose.

4 Units

4.1 Objective

This chapter defines Air Navigation Services related units (per flight hour, per hour of ATS operations, etc) to units usable by the CRV Service Provider (per message, per IP packet etc) and in relation with the different services.

4.2 Definition of units

All figures are rough orders of magnitude for the purpose of the CRV safety preliminary analysis only.

Performance Profile	Flight hours	ATSU hour	Service messages	Number of service messages per month	Number of IP packets per service per month (1 packet per 1024 bytes)
High demand	60 aircraft or more per sector and per hour 1 sector with international boundaries 1 flight hour to cross those sectors An ATSU accumulates an average of 6×10^5 flight hours per year (5×10^4 per month)	1×10^4 hours of continuous operation, this results in a ratio of 60 flight hours per ATSU hour	AFTN~~/Distress and Urgency~~ messages: ~~X~~ 35 messages per flight Assume 50 flights per airport per hr Messages per flight = 2,500,000 messages per month / 50 (flights per hr) x 2 (airport) x 24 hrs x 30 (days) ~~AFTN/Flight safety and regularity messages: X messages per flight~~ ~~AFTN/Aeronautical Information Services Messages: X messages per flight~~	AFTN For international connections an average of 2.5×10^6 messages per month [13]	AFTN For international connections an average of 9×10^5 IP packets per month (1 packet per 1024 bytes) [13]
			~~FPL~~AMHS messages: ~~X~~ 3 messages per flight Assume 50 flights per airport per	AMHS For international connections an average of 2×10^5	AMHS For international connections an average of 9×10^4

[13] The message quantities exchanged are applicable to Australia. Messages could not be broken into different services and are inclusive of FPL, NOTAM, MET. The estimates provided are based on receipt and transmission of AFTN messages only and include AIDC messages.

Performance Profile	Flight hours	ATSU hour	Service messages	Number of service messages per month	Number of IP packets per service per month (1 packet per 1024 bytes)
			hr Messages per flight = 200,000 messages per month / 50 (flights per hr) x 2 (airport) x 24 hrs x 30 (days) ~~NOTAM: X messages per ATSU~~ ~~MET: X messages per ATSU~~	messages per month [13]	IP packets per month (1 packet per 1024 bytes) [13]
			IWXXM: Since IWXXM includes XML/GML-coded METAR and SPECI (including TREND), TAF and SIGMET, the individual file size of a report increases compared to the traditional alphanumerical code. VOICE: X messages per flight DLK: 8 messages per DLK equipped aircraft (3 CPDLC, 5 ADS-C reports per hour, 50% equipped)	AIDC: $2{,}5 \times 10^5$ messages per month FIXM: ~~2,5~~1.4 x 10^{5}~~6~~ messages per month: ATFM: Assume 50 arriving flights per airport per hr 1 x 50 (messages per hr) x 1 (airport) x 24	AIDC: $2{,}5 \times 10^4$ IP packets per month (100 bytes per message) FIXM: ~~2~~5.6~~,5~~ x ~~10^4~~–10^6 IP packets per month (Assuming an average of 4 kilobytes~~100 bytes~~ per message: Large= 7 kilobytes

Performance Profile	Flight hours	ATSU hour	Service messages	Number of service messages per month	Number of IP packets per service per month (1 packet per 1024 bytes)
			SUR: X messages per flight AIDC: 5 messages per flight per hour FIXM[14]: ~~10 (TBD Paul) messages per flight~~Assume 20 messages per flight Assume 50 flights per airport per hr Messages per flight = 1440000 messages per month / 50 (flights per hr) x 2 (airport) x 24 hrs x 30 (days) AIM: X messages per ATSU	hrs x 30 (days) = 36,000 messages per month	Medium = 3 kilobytes Small = 1 kilobyte) ATFM: Assume 100 bytes per message $3{,}6 \times 10^6$ packets per month per airport

[14] Since FIXM includes XML/GML-coded ATS messages, AIDC, TFM, Track data and etc, the individual file size of a report increases compared to the traditional alphanumerical code. Depending on the operational context, the performance of the supporting infrastructure and the number of reports to exchange, compression techniques could be considered. It should be noted that compression and decompression of reports requires infrastructural resources which could negatively impact the overall performance of the exchange.

Performance Profile	Flight hours	ATSU hour	Service messages	Number of service messages per month	Number of IP packets per service per month (1 packet per 1024 bytes)
			AIXM[15]: ATFM[16]: 1 message per ATSU MISC: X messages per ATSU		
Standard demand	between 30 and 60 aircraft per sector and per hour, say 40 aircraft per sector and per hour		ATFM[17]: 1 message per ATSU TBD for all other services	ATFM: Assume 30 arriving flights per airport per hr 1 x 30 (messages per hr) x 1 (airport) x 24 hrs x 30 (days) = 21,600 messages per month	ATFM: Assume 100 bytes per message 2,160,000 packets per month per airport

[15] Since AIXM includes XML/GML-coded AIP, NOTAM and etc, the individual file size of a report increases compared to the traditional alphanumerical code and publication. Same remark concerning compression as for FIXM.

[16] TBD: ~~TBD: o~~overall messages such as a the result of running a TMI or airport capacity, or messages related to a specific flight, such as a CTOT

[17] TBD: overall messages such as a the result of running a TMI or airport capacity, or messages related to a specific flight, such as a CTOT

Performance Profile	Flight hours	ATSU hour	Service messages	Number of service messages per month	Number of IP packets per service per month (1 packet per 1024 bytes)
Low demand	Less than 30, say 20 aircraft per sector and per hour		ATFM[18]: 1 message per ATSU TBD for all other services	Assume 15 arriving flights per airport per hr 1 x 15 (messages per hr) x 1 (airport) x 24 hrs x 30 (days) = 10,800 messages per month	Assume 100 bytes per message 1,080,000 packets per month per airport

[18] TBD: overall messages such as a the result of running a TMI or airport capacity, or messages related to a specific flight, such as a CTOT

5 Matrix of flows for the CRV services

5.1 Objective

The objective of this chapter is to define matrix of flows for each service delivered through CRV.

The aim is to define between which environments the services will be delivered and in turn, determine the high level safety and performance requirements for that service.

As an example, regarding the use of CRV to share surveillance data, ANSP A provides ADS-B data to ANSP B through CRV. ANSP B uses the data provided by ANSP A to maintain an air situational display in the sectors covered by ANSP A's ground surveillance stations. In this particular airspace, ANSP B uses a 5 nautical miles separation standard (tier 1) in an en route environment with an average of 60 aircraft per sector and per hour, with speed management but no crossing flows.

This can be considered as a high demand environment and appropriate care should be given to the sharing of surveillance data through commensurate performance and safety requirements.

The design and operations of the CRV should take care of those requirements: low latency, small jitter, strong integrity as much as possible. Later in its contract with the common service provider, ANSP B knows that it will have to choose the relevant set of performance and safety requirements to order the service and enforce the safety barriers as derived from its safety case.

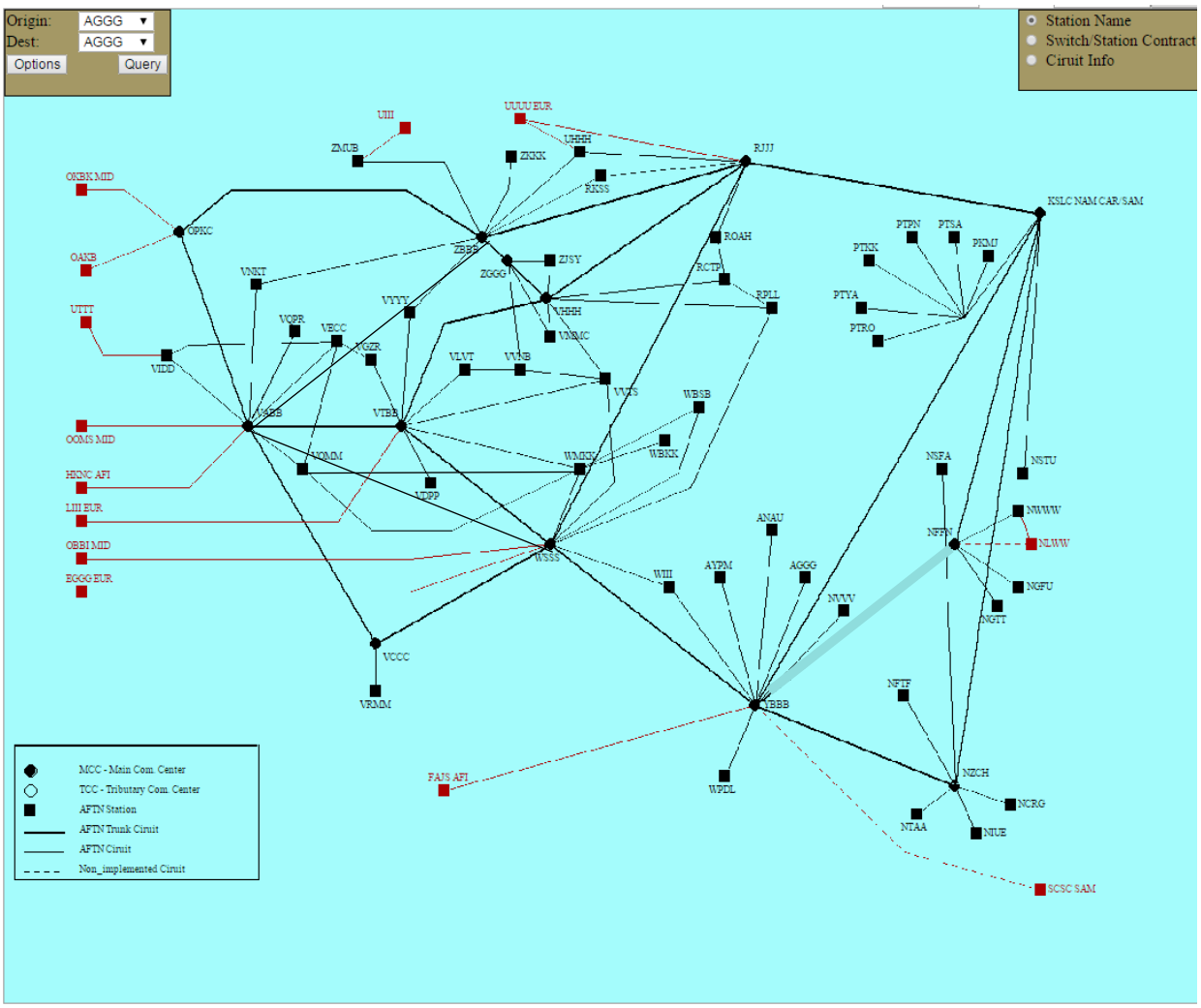
5.2 Matrix of flows for the CRV services

In this paragraph the matrices of flows are defined service by service.

5.2.1 AFTN

5.2.1.1 Current status (2014)

In 2014, AFTN messages are exchanged between those organizations:



For more details see Annex 1, chapter 1.

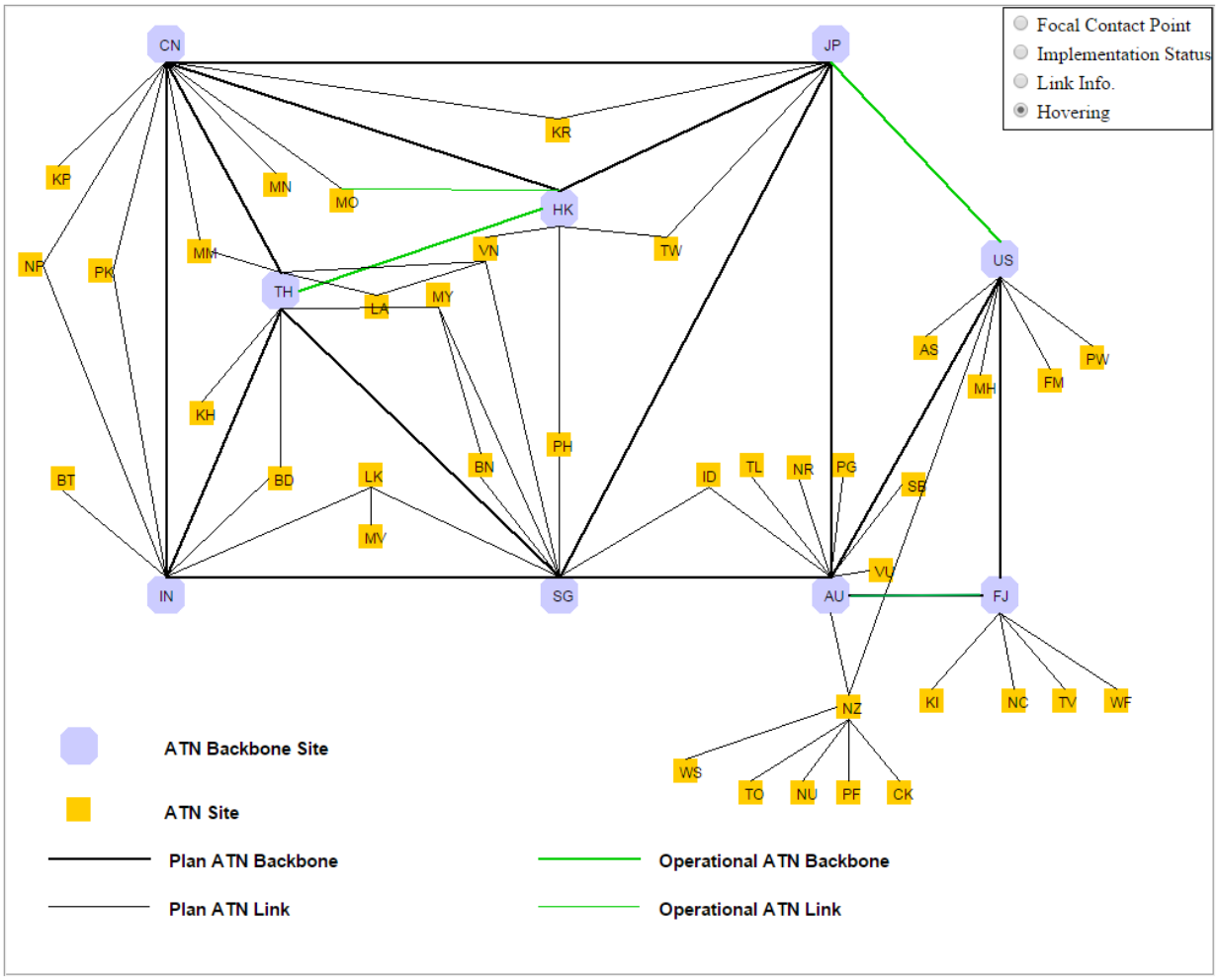
5.2.1.2 Future plans

The plan is to phase out AFTN communications as early as possible, so that AMHS becomes the only messaging service over CRV.

5.2.2 AMHS/FPL, AMHS/NOTAM and AMHS/MET

5.2.2.1 Current status (2014)

In 2014, AMHS services are planned or exchanged between those organizations as follows:



The interactive AMHS routing chart is available here:
http://cfapp.icao.int/apac_applications/atn/chart/atn_chart.asp

For the detailed matrix of flows, see Annex 1, chapter 2.

5.2.2.2 Future plans

AMHS will be expanded progressively to become the convergence layer for CRV. Meanwhile legacy AFTN applications may be accommodated through a gateway serviced by the Common Single Service Provider.

5.2.3 Voice communications

5.2.3.1 Current status (2014)

In 2014, the requirements for direct speech communications are as per Annex 1, chapter 3.

5.2.3.2 Future plans

A number of States/Administrations will migrate those direct speech communications to the CRV network using VoIP as follows: Australia, Japan, USA.

5.2.4 Air Ground communications

5.2.4.1 Current status (2014)

No exchanges.

5.2.4.2 Future plans

See Annex 1, chapter 4.

5.2.5 Data Link communications

5.2.5.1 Current status (2014)

TBD

5.2.5.2 Future plans

See Annex 1, chapter 5.

5.2.6 Surveillance data

5.2.6.1 Current status (2014)

~~TBD~~Australia and Indonesia are exchanging ADS-B data for situational awareness only - not likely to change in the near future.

5.2.6.2 Future plans

See Annex 1, chapter 6.

5.2.7 AIDC data

5.2.7.1 Current status (2014)

In 2014, AIDC exchanges are exchanged or planned as per Annex 1, chapter 7.

5.2.7.2 Future plans

AIDC is a top priority for the APAC region, and will be generalized.

5.2.8 AIM data

5.2.8.1 Current status (2014)

AIM is a replacement for AIS and currently status quo.

5.2.8.2 Future plans

See Annex 1, chapter 8.

5.2.9 ATFM data

5.2.9.1 Current status (2014)

No ATFM data are exchanged.

5.2.9.2 Future plans

See Annex 1, chapter 9.

5.2.10 Miscellaneous data

5.2.10.1 Current status (2014)

Test data are exchanged on diverse media.

5.2.10.2 Future plans

See Annex 1, chapter 10.

5.2.11 AIXM data

5.2.11.1 Current status (2014)

TBD

5.2.11.2 Future plans

See Annex 1, chapter 11.

5.2.12 FIXM data

5.2.12.1 Current status (2014)

No FIXM data exchanged.

5.2.12.2 Future plans

See Annex 1, chapter 12.

5.2.13 IWXXM

5.2.13.1 Current status 2014

No application at the moment.

5.2.13.2 Future plans

Data to be exchange between met offices to be bilaterally agreed.
See Annex 1, chapter 13.

ABBREVIATIONS

ABBREVIATION	DESCRIPTION
ACSICG	Aeronautical Communication Services Implementation Coordination Group
ADS-B	Automatic Dependent Surveillance-Broadcast
AFS	Aeronautical Fixed Service
AFTN	Aeronautical Fixed Telecommunication Network
AIDC	ATS Interfacility Data Exchange
AIXM	Aeronautical Information Exchange Model
AIM	Aeronautical Information Management
AMHS	Air Traffic Service Message Handling System
ANSP	Air Navigation Service Provider
APANPIRG	Asia/Pacific Air Navigation Planning and Implementation Regional Group
Asia/Pac	Asia/Pacific
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
BBIS	Backbone Boundary Intermediate System
BIS	Boundary Intermediate System
CAR	Caribbean Region
ConOps	Concept of Operations
CRV	Common Regional Virtual Private Network
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
NAT	Network Address Translation
OH	Operational Hazard
OOG	Operation Oversight Group
QoS	Quality of Service
RFI	Request for Information
RFP	Request for Proposal
SIP	Session Initiation Protocol
SME	Subject Matter Expert
ST	Sealed Tender
SWIM	System-Wide Information Management
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

ANNEX 1: matrixes of flows for CRV services

1 AFTN

In 2014, AFTN services are operational (O) or planned (P) as per the following matrix.

O means that exchanges are operational and P that exchanges are planned

When known, the bandwidth allocated to AFTN is indicated in the lower part of the matrix, in kbps.

The sources: ICAO survey (January 2014), http://apps.icao.int/aftn_routing/aftn_routing.html

Notes:

- Australia does have a 64k link with South Africa. Australia link with Nauru, Solomon Islands, Timor and Vanuatu is a CADAS link via the internet. If links with these countries are going to go via CRV then these countries will need to ensure the infrastructure is available to connect to the CRV otherwise the existing link will remain.
- China has a internal meshing: Beijing, Guangzhou, Sanya
- India has a national meshing: Delhi, Mumbai, Kolkata, Chennai
- Japan has a national meshing: Fukuoka, Naha
- Micronesia connections include Kosrae, Pohnpei, Yap and Weno
- Malaysia has an internal connection Kuala Lumpur Kota Kinabalu
- Samoa connections include Pago Pago and Faleolo
- VietNam has a national meshing: Hanoi, Ho Chi Minh

CRV service: AFTN (Distress and Urgency messages, Flight safety and regularity messages, Aeronautical Information Services Messages)

O means that exchanges are operational and P that exchanges are planned
When known (ICAO Survey Jan. 14), the bandwidth allocated to AFTN is indicated in the lower part of the matrix.

Version: 11 Nov. 14

	Afghanistan	Australia	Bangladesh	Bhutan	Brunei Darussalam	Cambodia	China	Cook Islands	Democratic People's Republic of Korea	Fiji	French Polynesia	Hong Kong China	India	Indonesia	Japan	Kiribati	Lao People's Democratic Republic	Macau	Malaysia	Maldives	Marshall Islands	Micronesia (Federated States of)	Mongolia	Myanmar	Nauru	Nepal	New Caledonia	New Zealand	Niue Islands	Pakistan	Palau	Papua New Guinea	Philippines	Republic of Korea	Samoa	Singapore	Solomon Islands	Sri Lanka	Thailand	Timor Leste	Tonga	Tuvalu	United States	Vanuatu	Vietnam	Wallis Island
Afghanistan																																													
Australia														O											O			O				O				O	O			O			O	O		
Bangladesh													O																										O							
Bhutan													O																																	
Brunei Darussalam																																			O											
Cambodia																																							O						
China							O		O			O			O			O					O			O			O				O										O		
Cook Islands																																													
Democratic People's Republic of Korea							O																																						
Fiji																											O															O			P
French Polynesia																												O																	
Hong Kong China							4.8								O			O																					O				O		
India			O	O									O						O							O			O								O	O						
Indonesia		64																																		O									
Japan							64+64					64			O																			O		O									
Kiribati																																													
Lao People's Democratic Republic																																													
Macau							O					64																																	
Malaysia					64								32																								O			O						
Maldives																																							O						
Marshall Islands																																											O		
Micronesia (Federated States of)																																											O		
Mongolia							19.2																																						
Myanmar																																								O					
Nauru		O																																										
Nepal							O						O																																
New Caledonia										O																																			O
New Zealand		64									64																								O							O			
Niue Islands																																													
Pakistan							O						O																																
Palau																																										O			
Papua New Guinea		64																																											
Philippines						O						64																										O							
Republic of Korea							O								9.6																															
Samoa																												O														O			
Singapore		O			O									O	64				9.6														O					O	O				O		
Solomon Islands		O																																											
Sri Lanka													O							O																O									
Thailand			O			O						64	O				O		64					O												O						O		
Timor Leste		O																																											
Tonga																																													
Tuvalu																																													
United States		64								O												O	O					2.4			O				O										
Vanuatu																																													
Vietnam												O																																O	
Wallis Island																																													

CRV service: AFTN (Distress and Urgency messages, Flight safety and regularity messages, Aeronautical Information Services Messages)

O means that exchanges are operational and P that exchanges are planned
When known, the bandwidth allocated to AFTN is indicated in the lower part of the matrix, in kbps.

Version: 11 Nov. 14
Source: ICAO survey, http://apps.icao.int/aftn_routing/aftn_routing.html

	Afghanistan	Australia	Bangladesh	Bhutan	Brunei Darussalam	Cambodia	China	Cook Islands	Democratic People's Republic of Korea	Fiji	French Polynesia	Hong Kong China	India	Indonesia	Japan	Kiribati	Lao People's Democratic Republic	Macau	Malaysia	Maldives	Marshall Islands	Micronesia (Federated States of)	Mongolia	Myanmar	Nauru	Nepal	New Caledonia	New Zealand	Niue Islands	Pakistan	Palau	Papua New Guinea	Philippines	Republic of Korea	Samoa	Singapore	Solomon Islands	Sri Lanka	Thailand	Timor Leste	Tonga	Tuvalu	United States	Vanuatu	Vietnam	Wallis Island
Afghanistan																																													
Australia										O				O												O			O				O			O	O			O			O	O		
Bangladesh													O																										O							
Bhutan													O																																	
Brunei Darussalam																																				O										
Cambodia																																							O							
China							O		O			O	O		O			O					O			O			O					O	O									O		
Cook Islands																												O																		
Democratic People's Republic of Korea							O																																						
Fiji		64																									O															O		P
French Polynesia																												O																	
Hong Kong China							4.8								O			O																					O				O		
India			64	O			64						O						O							O			O							O		O	O					
Indonesia		O																																		O									
Japan							64+64					64			O																				O	O									
Kiribati																																														
Lao People's Democratic Republic																																								O						
Macau							O					64																																		
Malaysia					64								32						O																	O			O						
Maldives																																									O					
Marshall Islands																																												O		
Micronesia (Federated States of)																																												O		
Mongolia							19.2																																							
Myanmar																																														
Nauru		O																																											
Nepal							O						64																																	
New Caledonia										O																																			O
New Zealand		2.4						2.4			64																								O					O		O			
Niue Islands																																														
Pakistan							O						O																																	
Palau																																											O		
Papua New Guinea		O																																											
Philippines						O	9.6					9.6																											O							
Republic of Korea							9.6								9.6																																
Samoa																												2.4															O			
Singapore		64			64								64	O	64				9.6															O					O	O				O		
Solomon Islands		O																																											
Sri Lanka													64							O																	64								
Thailand			64			64						64	64				64		64					64													64						O		
Timor Leste		O																																											
Tonga																												O																	
Tuvalu																																														
United States		O								O											O	O						2.4			O				O										
Vanuatu		O																																												
Vietnam							O					4.8					O		4.8																	O			138					O	
Wallis Island										P																		O																	P

2 AMHS

~~TBD~~

Australia has a 64k AMHS connection with Nadi (Fiji)

3 Voice communications

In 2014, the requirements for direct speech communications are as follows:

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
AMERICAN SAMOA (United States)							
PAGO PAGO APP	ALOFI	A	LTF	DIR			Note 3
	APIA/FALEOLO	A	LTF	DIR			
	NADI	A	LTF	DIR			Note 3
AUSTRALIA							
BRISBANE ACC	AUCKLAND	A	LTF	DIR		07/00	
	BALI	A	LTF	DIR			Note 4
	HONIARA	A	LTF	DIR			
	JAKARTA	A	LTF	DIR			Note 4
	NADI	A	LTF	SW	OAKLAND		
	OAKLAND	A	LTF	DIR			
	PORT MORESBY	A	LTF	DIR			Note 4
	UJUNG PANDANG	A	LTF	DIR			
MELBOURNE	BRISBANE	X	LTF	DIR	NETWORK OPERATION		Note 4
	COLOMBO	A	LTF	DIR			
	DIEGO GARCIA	A	LTF	DIR			
	JAKARTA	A	LTF	SW	BRISBANE		
	JOHANNESBERG	A	LTF	DIR			
	MALE	A	LTF	DIR			
	MAURITIUS	A	LTF	DIR			
PERTH APP	JAKATA ACC	A	LTF	DIR			
BANGLADESH							
DHAKA ACC	AGARTALA	A	LTF	TOLL		X	
	KOLKATA	A	LTF	DIR			Note 3

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	GUWAHATI	A	TOLL			X	
	YANGON	A	LTF	DIR			
BRUNEI DARUSSALAM							
BRUNEI ACC	KOTA KINABALU	A	LTF	DIR			
	LABUAN	A	LTF	DIR			
	LIMBANG	A	LTF	DIR			
	MIRI	A	LTF	DIR			
CAMBODIA							
PHNOM PENH ACC	BANGKOK	A	LTF	DIR			
	HO CHI MINH	A	LTF	DIR		I	VSAT
	VIENTIANE	A	LTF	SW	BANGKOK	<12/00	
CHINA							
BEIJING ACC	DALIAN	A	LTF	DIR		I	
	HOHHOT	A	LTF	DIR		I	
	JINAN	A	LTF	DIR		I	
	SHENYANG	A	LTF	DIR		I	
	TAIYUAN	A	LTF	DIR		I	
	ULAANBAATAR	A	LTF	DIR		I	
	ZHENGZHOU	A	LTF	DIR		I	
CHANGSHA ACC	GUANGZHOU	A	LTF	DIR		I	
	GUILIN	A	LTF	DIR		I	
	GUIYANG	A	LTF	DIR		I	
	WUHAN	A	LTF	DIR		I	
	NANCHANG	A	LTF	DIR		I	
CHENGDU ACC	GUIYANG	A	LTF	DIR		I	
	KUNMING	A	LTF	DIR		I	
	LANZHOU	A	LTF	DIR		I	
	LHASA	A	LTF	DIR		I	
	WUHAN	A	LTF	DIR		I	
	XI'AN	A	LTF	DIR		I	
DALIAN ACC	BEIJING	A	LTF	DIR		I	
	PYONGYANG	A	LTF	DIR		I	
	QINGDAO	A	LTF	DIR		I	
	SEOUL	A	LTF	DIR		X	
	SHENYANG	A	LTF	DIR		I	
GUANGZHOU ACC	CHANGSHA	A	LTF	DIR		I	
	GUILIN	A	LTF	DIR		I	
	HAIKOU	A	LTF	DIR		I	
	HONG KONG	D	LTF	DIR		I	

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	MACAO	A	LTF	DIR		I	
	NANCHANG	A	LTF	DIR		I	
	NANNING	A	LTF	DIR		I	
	SANYA	A	LTF	DIR		I	
	TAIBEI	A	LTF	DIR		X	
	XIAMEN	A	LTF	DIR		I	
GUILIN ACC	CHANGSHA	A	LTF	DIR		I	
	GUANGZHOU	A	LTF	DIR		I	
	GUIYANG	A	LTF	DIR		I	
	NANNING	A	LTF	DIR		I	
GUIYANG ACC	CHANGHSA	A	LTF	DIR		I	
	CHENGDU	A	LTF	DIR		I	
	GUILIN	A	LTF	DIR		I	
	KUNMING	A	LTF	DIR		I	
	NANNING	A	LTF	DIR		I	
HAIKOU ACC	GUANGZHOU	A	LTF	DIR		I	
	HA NOI	A	LTF	DIR		X	
	HONG KONG	A	LTF	DIR		I	
	NANNING	A	LTF	DIR		X	
	SANYA	A	LTF	DIR		I	
HAILAR ACC	CHITA	A	LTF	DIR		I	
	HARBIN	A	LTF	DIR		I	
	SHENYANG	A	LTF	DIR		I	
HARBIN ACC	KHABAROVSK	A	LTF	DIR		I	
	HAILAR	A	LTF	DIR		I	
	SHENYANG	A	LTF	DIR		I	
	VLADIVOSTOK	A	LTF	DIR		I	
HEFEI ACC	JINAN	A	LTF	DIR		I	
	NANCHANG	A	LTF	DIR		I	
	SHANGHAI	A	LTF	DIR		I	
	ZHENGZHOU	A	LTF	DIR		I	
	WUHAN	A	LTF	DIR		I	
HOHHOT ACC	BEIJING	A	LTF	DIR		I	
	LANZHOU	A	LTF	DIR		I	
	TAIYUAN	A	LTF	DIR		I	
	ULAANBAATAR	A	LTF	DIR		I	

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
JINAN ACC	BEIJING	A	LTF	DIR		I	
	HEFEI	A	LTF	DIR		I	
	QINGDAO	A	LTF	DIR		I	
	SHANGHAI	A	LTF	DIR		I	
	TAIYUAN	A	LTF	DIR		I	
	ZHENGZHOU	A	LTF	DIR		I	
KUNMING ACC	CHENGDU	A	LTF	DIR		I	
	GUIYANG	A	LTF	DIR		I	
	HA NOI	A	LTF	DIR		X	
	NANNING	A	LTF	DIR		I	
	VIENTIANE	A	LTF	DIR		I	
	YANGON	A	LTF	DIR		I	
LANZHOU ACC	CHENGDU	A	LTF	DIR		I	
	HOHHOT	A	LTF	DIR		I	
	LHASA	A	LTF	DIR		I	
	ULAANBAATAR	A	LTF	DIR		I	
	URUMQI	A	LTF	DIR		I	
	XI'AN	A	LTF	DIR		I	
LHASA	CHENGDU	A	LTF	DIR		I	
	KATHMANDU	A	LTF	DIR		I	
	LANZHOU	A	LTF	DIR		I	
	URUMQI	A	LTF	DIR		I	
NANCHANG ACC	CHANGSHA	A	LTF	DIR		I	
	GUANGZHOU	A	LTF	DIR		I	
	HEFEI	A	LTF	DIR		I	
	WUHAN	A	LTF	DIR		I	
	XIAMEN	A	LTF	DIR		I	
NANNING	GUANGZHOU	A	LTF	DIR		I	
	GUILIN	A	LTF	DIR		I	
	GUIYANG	A	LTF	DIR		I	
	HAIKOU	A	LTF	DIR		I	
	HA NOI	A	LTF	DIR		X	Note 3
	KUNMING	A	LTF	DIR		I	
QINGDAO ACC	DALIAN	A	LTF	DIR		I	
	JINAN	A	LTF	DIR		I	
	SHANGHAI	A	LTF	DIR		I	
	TAEGU	A	LTF	DIR		I	
SANYA ACC	GUANGZHOU	A	LTF	DIR		I	
	HAIKOU	A	LTF	DIR		I	
	HA NOI	A	LTF	DIR		10/01	
	HO CHI MINH	A	LTF	DIR		10/01	
	HONG KONG	A	LTF	DIR		10/01	

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	MANILA	A	LTF	DIR		10/01	
SHANGHAI ACC	FUKUOKA	A	LTF	DIR		I	
	HEFEI	A	LTF	DIR		I	
	JINAN	A	LTF	DIR		I	
	NANCHANG	A	LTF	DIR		I	
	NAHA	A	LTF	DIR		X	Note 2, 4
	QINGDAO	A	LTF	DIR		I	
	TAEGU	A	LTF	DIR		X	
	TAIBEI	A	LTF	DIR		X	
	XIAMEN	A	LTF	DIR		I	
SHENYANG ACC	BEIJING	A	LTF	DIR		I	
	DALIAN	A	LTF	DIR		I	
	HAILAR	A	LTF	DIR		I	
	HARBIN	A	LTF	DIR		I	
	PYONGYANG	A	LTF	DIR		I	
	VLADIVOSTOK	A	LTF	DIR		I	
SHENZHEN	HONGKONG	A	LTF	DIR		I	
	MACAO	A	LTF	DIR		I	
TAIBEI ACC	GUANGZHOU	A	LTF	DIR		X	
	HONG KONG	D	LTF	DIR		I	
	MANILA	A	LTF	DIR		I	
	NAHA	D	LTF	DIR		I	
	SHANGHAI	A	LTF	DIR		X	
	TAEGU	A	LTF	DIR		I	
	XIAMEN	A	LTF	DIR		X	
TAIYUAN ACC	BEIJING	A	LTF	DIR		I	
	HOHHOT	A	LTF	DIR		I	
	JINAN	A	LTF	DIR		I	
	XI'AN	A	LTF	DIR		I	
	ZHENGZHOU	A	LTF	DIR		I	
URUMQI ACC	ALMA-ATA	A	RTF	DIR		I	
	BARNUAL	A	RTF	DIR		I	
	BISHEKEK	A	RTF	DIR		I	
	KHOVD	A	RTF	DIR		I	
	LAHORE	A	LTF	DIR		I	
	LANZHOU	A	LTF	DIR		I	
	RAWALPIND	A	LTF	DIR		I	
	ULAANBAATAR	A	LTF	DIR		X	
WUHAN ACC	CHANGSHA	A	LTF	DIR		I	
	CHENGDU	A	LTF	DIR		I	
	HEFEI	A	LTF	DIR		I	
	NANCHANG	A	LTF	DIR		I	

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	ZHENGZHOU	A	LTF	DIR		I	
XIAMEN ACC	GUANGZHOU	A	LTF	DIR		I	
	NANCHANG	A	LTF	DIR		I	
	SHANGHAI	A	LTF	DIR		I	
	TAIBEI	A	LTF	DIR		X	
XI'AN ACC	CHENGDU	A	LTF	DIR		I	
	LANZHOU	A	LTF	DIR		I	
	TAIYUAN	A	LTF	DIR		I	
	ZHENGZHOU	A	LTF	DIR		I	
ZHENGZHOU ACC	BEIJING	A	LTF	DIR		I	
	JINAN	A	LTF	DIR		I	
	TAIYUAN	A	LTF	DIR		I	
	WUHAN	A	LTF	DIR		I	
	XI'AN	A	LTF	DIR		I	
ZHUHAI APP	HONG KONG	A	LTF	DIR		I	
	MACAO	A	LTF	DIR		I	
COOK IS.							
RAROTONGA	AUCKLAND	A	LTF	DIR			Note 4
	TAHITI/PAPEETE	A	LTF	DIR			Note 3, 4
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA							
	DALIAN	A	LTF	DIR		I	
	SHENYANG	A	LTF	DIR		I	
	TAEGU	A	LTF	DIR		I	
	VLADIVOSTOK	A	LTF	DIR		I	RTF
FIJI							
NADI ACC	ALOFI	A	LTF	DIR			Note 3
	APIA	A	LTF	DIR			Note 3
	AUCKLAND	A	LTF	DIR			
	BRISBANE	A	LTF	SW	AUCKLAND		Note 4
	HONIARA	A	LTF	SW	SYDNEY		
	NOUMEA	A	LTF	DIR			Note 3
	OAKLAND	A	LTF	DIR			Note 3
	PAGO PAGO	A	LTF	DIR			Note 3
	PORT VILA	A	LTF	DIR			
	VAVA'U	A	LTF	DIR			Note 3
	WALLIS	A	LTF	DIR			Note 3
FRENCH POLYNESIA (France)							

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
TAHITI/PAPEETE ACC	AUCKLAND	A	TOLL				
	ISLA DE PASCUA	A	LTF	DIR			Note 3
	OAKLAND	A	LTF	DIR			Note 3
	RAROTONGA	A	LTF	DIR			
GUAM (United States)							
GUAM I.	MOEN	A	LTF	DIR			Note 3
	YAP	A	LTF	DIR			Note 3
HONG KONG, China							
HONG KONG ACC	GUANGZHOU	D	LTF	DIR		I	
	MACAO	D	LTF	DIR		I	
	MANILA	A	LTF	DIR		I	
	SANYA	A	LTF	DIR		10/01	
	SHANTOU	A	LTF	DIR		I	
	SHENZHEN	A	LTF	DIR		I	
	TAIBEI	D	LTF	DIR		I	
	ZHUHAI	A	LTF	DIR		I	
INDIA							
AGARTALA APP	KOLKATA	A	LTF	DIR			
	DHAKA	A	TOLL			X	
AHMEDABAD APP	MUMBAI	A	LTF	DIR		I	
	KARACHI	A	LTF	DIR		I	
AMRITSAR APP	DELHI	A	LTF	DIR		I	
	LAHORE	A	LTF	DIR		I	Note 3
KOLKATA ACC	AGARTALA	A	LTF	DIR		I	
	MUMBAI	A	LTF	DIR		I	
	DHAKA	A	LTF	DIR		I	Note 3
	DELHI	A	LTF	DIR		I	
	GUWAHATI	A	LTF	DIR		I	
	KATHMANDU	A	LTF	DIR		I	Note 3
	CHENNAI	A	LTF	DIR		I	
	NAGPUR	A	LTF	DIR		I	
	VARANASI	A	LTF	DIR		I	
	YANGON	A	LTF	DIR		I	
CHENNAI ACC	MUMBAI	A	LTF	DIR		I	
	KOLKATA	A	LTF	DIR		I	
	COLOMBO	A	LTF	DIR		I	
	KUALA LUMPUR	A	LTF	DIR		I	
	MEDAN	A	LTF	DIR		X	Note 3

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	TIRUCHCHIRAPPALLI	A	LTF	DIR		I	
	TRIVANDRUM	A	LTF	DIR		I	Note 3
	YANGON	A	TOLL			I	
DELHI ACC	AMRITSAR	A	LTF	DIR		I	
	MUMBAI	A	LTF	DIR		I	
	KOLKATA	A	LTF	DIR		I	
	KARACHI	A	LTF	DIR		I	
	KATHMANDU	A	TOLL	DIR		I	Note 3
	LAHORE	A	LTF	DIR		I	
	VARANASI	A	LTF	DIR		I	
GUWAHATI	KOLKATA		LTF	DIR			
	DHAKA		TOLL			X	Note 3
MUMBAI ACC	AHMEDABAD	A	LTF	DIR		I	
	KOLKATA	A	LTF	DIR		I	
	DELHI	A	LTF	DIR		I	
	KARACHI	A	LTF	DIR		I	
	CHENNAI	A	LTF	DIR		I	
	MALE	A	TOLL			I	
	MAURITIUS	A	TOLL			I	Note 2
	MOGADISHU	A	TOLL			I	Note 2
	MUSCAT/SEEB	A	LTF	DIR		I	
	NAGPUR	A	LTF	DIR		I	
	SEYCHELLES	A	LTF	DIR			Note 2
NAGPUR APP	MUMBAI	A	LTF	DIR		I	
	KOLKATA	A	LTF	DIR		I	
TIRUCHCHIRAPPALLI APP	CHENNAI	A	LTF	DIR		I	
TRIVANDRUM ACC	CALICUT	A	LTF	DIR		I	
	COLOMBO	A	TOLL			I	Note 3
	CHENNAI	A	LTF	DIR		I	
	MALE	A	LTF	DIR		I	Note 3
VARANASI ACC	KOLKATA	A	LTF	DIR		I	
	DELHI	A	LTF	DIR		I	
	KATHMANDU	A	LTF	DIR		X	Note 3

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
INDONESIA							
BALI ACC	BRISBANE	A	LTF	DIR			Note 3, 4
	JAKARTA	A	LTF	DIR			
	KUPANG	A	LTF	DIR			
	MANADO	A	LTF	DIR			
	SURABAYA	A	LTF	DIR			
	UJUNG PANDANG	A	LTF	DIR			Note 4
BATAM TWR	JAKARTA	A	LTF	DIR			
	SINGAPORE	D	LTF	DIR			
	TANJUNG PINANG	D	LTF	DIR			
BIAK APP	DARWIN	A	LTF	DIR			
	JAYAPURA	A	LTF	DIR			
	MANILA	A	LTF	DIR			
	OAKLAND	A	LTF	DIR			Note 3
	UJUNG PANDANG	A	LTF	DIR			
JAKARTA ACC	BALI	A	LTF	DIR			
	BATAM	A	LTF	DIR			
	KOTA KINABALU	A	LTF	SW	SINGAPORE		
	KUALA LUMPUR	A	LTF	SW	SINGAPORE		
	MANILA	A	LTF	DIR			
	MEDAN	A	LTF	DIR			
	PADANG	A	LTF	DIR			
	PEKAN BARU	X	LTF	DIR			
	PERTH	A	LTF	DIR			
	PONTIANAK	A	LTF	DIR			
	RANAI	A	LTF	DIR			
	SINGAPORE	A	LTF	DIR			
	SYDNEY	X	LTF	DIR			
	TANJUNG PINANG	A	LTF	DIR			
	UJUNG PANDANG	A	LTF	DIR			
JAYAPURA APP	BIAK	A	LTF	DIR			
	PORT MORESBY	A	LTF	DIR			
	VANIMO	A	LTF	DIR			
							Note 3
KUPANG APP	BALI	A	LTF	DIR			
	DARWIN	A	LTF	DIR			
MANADO	BALI	A	LTF	DIR			
	UJUNG PANDANG	A	LTF	DIR			
MEDAN ACC	COLOMBO	A	LTF	DIR			Note 3
	JAKARTA	A	LTF	DIR			
	KUALA LUMPUR	A	LTF	DIR			
	CHENNAI	A	LTF	DIR		X	Note 2

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	PADANG	A	LTF	DIR			
	SINGAPORE	A	LTF	SW	JAKARTA		
PADANG	JAKARTA	A	LTF	DIR			
	MEDAN	A	LTF	DIR			
	PEKAN BARU	A	LTF	DIR			
PEKAN BARU APP	JAKARTA	X	LTF	DIR			
	KUALA LUMPUR	A	LTF	DIR			
	MALACCA	A	LTF	DIR			
	MEDAN	A	LTF	DIR			
	SINGAPORE	A	LTF	DIR			
PONTIANAK TWR	JAKARTA	A	LTF	DIR			
	KUCHING	A	RTF	DIR			
	RANAI	A	LTF	DIR			
	SINGAPORE	A	LTF	DIR			
	TANJUNG PINANG	A	LTF	DIR			
RANAI	JAKARTA	A	LTF	DIR			
	KUCHING	A	LTF	DIR			
	PONTIANAK	A	LTF	DIR			
SURABAYA	BALI	A	LTF	DIR			
TANJUNG PINANG	BATAM	D	LTF	DIR			Note 2
	JAKARTA	A	LTF	DIR			
	PONTIANAK	A	LTF	DIR			
	SINGAPORE	D	LTF	DIR			
UJUNG PANDANG	BALI	D	LTF	DIR			Note 4
	BIAK	A	LTF	DIR			Note 4
	BRISBANE	A	LTF	DIR			Note 3, 4
	JAKARTA	A	LTF	DIR			
	KOTA KINBALU	A	LTF	DIR			
	MANADO	A	LTF	DIR			
	MANILA	A	LTF	SW	JAKARTA		
	PORT MORESBY	A	LTF	SW	JAKARTA, SYDNEY		Note 3, 4
	OAKLAND	A	LTF	DIR			Note 3
JAPAN							
FUKUOKA ACC	TAEGU	A	LTF	DIR			
	SHANGHAI	A	LTF	DIR			
NAHA ACC	MANILA	A	LTF	DIR			
	OAKLAND	A	LTF	DIR			
	SHANGHAI	A	LTF	DIR			Note 2, 4
	TAEGU	A	LTF	DIR			

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	TAIBEI	A	LTF	DIR			
SAPPORO ACC	KHABAROVSK	D	LTF	DIR			
	VLADIVOSTOK	A	LTF	DIR			Note 2
	YUZHNO SAKHALINSK	A	LTF	DIR			
TOKYO ACC	ANCHORAGE	A	LTF	SW	OAKLAND		
	ANCHORAGE	D	LTF	DIR			
	OAKLAND	A	LTF	DIR			
	TAEGU	A	LTF	DIR			
JOHNSTON I. (United States)							
JOHNSTON I. TWR	OAKLAND	A	LTF	DIR			Note 3
KIRIBATI							
TARAWA	OAKLAND	A	LTF	DIR			Note 3
KIRITIMATI I.	OAKLAND	A	LTF	DIR			Note 3
LAO PEOPLE'S DEMOCRATIC REPUBLIC							
VIENTIANE FIC	BANGKOK	A	LTF	DIR		I	
	HA NOI	A	LTF	DIR		I	
	HO CHI MINH	A	LTF	DIR		I	
	KUNMING	A	LTF	DIR		I	
	PHNOM PENH	A	LTF	SW	BANGKOK		
	YANGON	A	LTF	SW	BANGKOK		
MACAO, China							
MACAO	SHENZHEN	A	LTF	DIR		I	
	HONG KONG	D	LTF	DIR			
	ZHUHAI	A	LTF	DIR		I	
MALAYSIA							
JOHOR BAHRU APP	SINGAPORE	D	LTF	DIR			
	KUALA LUMPUR	A	LTF	DIR			
KOTA KINABALU ACC	BRUNEI	A	LTF	DIR			
	JAKARTA	A	LTF	SW	SINGAPORE		
	KUALA LUMPUR	A	LTF	DIR			
	KUCHING	A	LTF	DIR			
	MANILA	A	LTF	DIR			
	MIRI	A	LTF	DIR			
	SINGAPORE	A	LTF	DIR			

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	TAWAU	A	LTF	DIR			
	UJUNG PANDANG	A	LTF	DIR			
KUALA LUMPUR ACC	BANGKOK	A	LTF	DIR			VSAT
	HO CHI MINH	A	LTF	DIR		12/00	VSAT
	JAKARTA	A	LTF	SW	SINGAPORE		
	JOHOR BAHRU	A	LTF	DIR			
	KUANTAN	A	LTF	DIR			
	KOTA KINABALU	A	LTF	DIR			
	CHENNAI	A	LTF	DIR			
	MALACCA	A	LTF	DIR			
	MEDAN	A	LTF	DIR			VSAT
	PEKAN BARU	A	LTF	DIR			
	SINGAPORE	D	LTF	DIR			VSAT
KUANTAN APP	SINGAPORE	A	LTF	DIR			
	KUALA LUMPUR	A	LTF	DIR			
KUCHING APP	KOTA KINABALU	A	LTF	DIR			
	PONTIANAK	A	LTF	DIR			RTF
	RANAI	A	LTF	DIR			
	SINGAPORE	A	LTF	DIR			
LABUAN	BRUNEI	A	LTF	DIR			
LIMBANG	BRUNEI	A	LTF	DIR			
MALACCA APP	KUALA LUMPUR	A	LTF	DIR			
	PEKAN BARU	A	LTF	DIR			
MIRI	BRUNEI	A	LTF	DIR			
	KOTA KINABALU	D	LTF	DIR			
TAWAU APP	KOTA KINABALU	A	LTF	DIR			
MALDIVES							
MALE FIC	COLOMBO	A	LTF	DIR			Note 3
	MUMBAI	A	TOLL				
	CHENNAI	A	LTF	DIR			Note 3
	MAURITIUS	A	LTF	DIR			Note 3
	MELBOURNE	A	LTF	DIR			Note 3, 4
	TRIVANDRUM	A	LTF	DIR			Note 3
MARSHALL IS.							
MAJURO APP	OAKLAND	A	LTF	DIR			Note 3
KWAJALEIN APP	OAKLAND	A	LTF	DIR			Note 3

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
MICRONESIA, FEDERATED STATES OF							
KOSRAE APP	OAKLAND	A	LTF	DIR			Note 3
MOEN APP	GUAM I.	A	LTF	DIR			Note 3
	OAKLAND	A	LTF	DIR			Note 3
POHNPEI APP	OAKLAND	A	LTF	DIR			Note 3
YAP APP	GUAM I.	A	LTF	DIR			Note 3
	OAKLAND	A	LTF	DIR			Note 3
MONGOLIA							
ULAANBAATAR ACC	ABAKAN	A	LTF	DIR		I	
	BARNAUL	A	LTF	DIR		I	
	BEIJING	A	LTF	DIR		I	
	HUHHOT	A	LTF	DIR		I	
	IRKUTSK	A	LTF	DIR		I	
	KYZYL	A	LTF	DIR		I	
	LANZHOU	A	LTF	DIR		I	
	MUREN	A	LTF	DIR		I	
	URUMQI	A	LTF	DIR		I	
MYANMAR							
YANGON ACC	BANGKOK	A	LTF	DIR			
	KOLKATA	A	LTF	DIR			
	DHAKA	A	LTF	DIR			
	KUNMING	A	LTF	DIR			
	CHENNAI	A	TOLL			I	
	VIENTIANE	A	LTF	SW	BANGKOK		
NAURU							
NAURU FIC	HONIARA	A	LTF	SW	SYDNEY		Note 3
	NADI	A	LTF	DIR			
	PORT MORESBY	A	LTF	SW	SYDNEY		Note 4
NEPAL							
KATHMANDU	KOLKATA	A	LTF	DIR			Note 3
	DELHI	A	TOLL			I	
	LASHA	A	LTF	DIR			
	VARANASI	A	LTF	DIR			Note 3

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
NEW CALEDONIA (France)							
NOUMEA/LA TONTOUTA APP	HONIARA	A	LTF	SW	SYDNEY, NADI		Note 4
	NADI	A	LTF	DIR	NADI		
	PORT VILA	A	LTF	SW			
NEW ZEALAND							
AUCKLAND	ALOFI	A	TOLL	DIR			Note 3
	CHRISTCHURCH	A	LTF	DIR			
	ISLA DE PASCUA	A	TOLL	DIR			Note 3
	NADI	A	LTF	DIR			
	OAKLAND	A	TOLL	DIR			
	RAROTONGA	A	TOLL	DIR			
	BRISBANE	A	LTF	DIR			Note 3
	TAHITI/PAPEETE	A	TOLL	DIR		07/2000	Note 4
NIUE (New Zealand)							
ALOFI APP	AUCKLAND	A	TOLL	DIR			Note 3
	NADI	A	LTF	DIR			Note 3
	PAGO PAGO	A	LTF	DIR			Note 3
NORTHERN MARIANA IS. (United States)							
SAIPAN APP	OAKLAND	A	LTF	DIR			Note 2
PAKISTAN							
KARACHI ACC	AHMEDABAD	A	LTF	SW	MUMBAI		Note 3
	MUMBAI	A	LTF	DIR			Note 3
	DELHI	A	LTF	DIR		I	
	KABUL	A	LTF	DIR			
	MUSCAT	A	LTF	DIR			Note 3
	TEHRAN	A	LTF	DIR			Note 3
LAHORE ACC	AMRITSAR	A	LTF	DIR			Note 3
	DELHI	A	LTF	DIR			Note 3
	DUSHANBE	A	LTF	DIR			Note 3
	KABUL	A	LTF	DIR		12/2000	
	URUMQI	A	LTF	DIR			Note 2
PAPUA NEW GUINEA							
PORT MORESBY ACC	BRISBANE	A	LTF	DIR			
	CAIRNS	A	LTF	DIR			Note 4
	HONIARA	A	LTF	DIR			Note 3
	JAYAPURA	A	LTF	DIR			

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	OAKLAND	A	LTF	DIR			Note 3
	UJUNG PANDANG	A	LTF	SW	SYDNEY, JAKARTA		Note 3
PHILIPPINES							
DAVAO APP	MACTAN	A	LTF	DIR		I	
	MANILA	A	LTF	DIR		I	
LAOAG APP	MANILA	A	LTF	DIR		I	
MACTAN APP	DAVAO	A	LTF	DIR		I	
	MANILA	A	LTF	DIR		I	
	ZAMBOANGA	A	LTF	DIR		I	
MANILA ACC	BIAK	A	LTF	SW	JAKARTA	X	Note 2
	DAVAO	A	LTF	DIR		I	
	HO CHI MINH	A	LTF	DIR		I	
	HONG KONG	A	LTF	DIR		I	
	KOTA KINABALU	A	LTF	DIR		I	Note 2
	JAKARTA	A	LTF	DIR		X	Note 2
	LAOAG	A	LTF	DIR		I	
	MACTAN	A	LTF	DIR		I	
	NAHA	A	LTF	DIR		I	
	OAKLAND	A	LTF	DIR		I	
	SANYA	A	LTF	DIR		10/01	
	SINGAPORE	A	LTF	DIR		I	
	SUBIC BAY	A	LTF	DIR		I	
	TAIBEI	A	LTF	DIR		I	
	UJUNG PANDANG	A	LTF	SW	JAKARTA	I	
SUBIC BAY APP	MANILA	A	LTF	DIR		I	
REPUBLIC OF KOREA							
DAEGU ACC	DALIAN	A	LTF	DIR			
	FUKUOKA	D	LTF	DIR			
	GIMHAE	A	LTF	DIR			
	INCHEON						
	JEJU	A	LTF	DIR			
	NAHA	A	LTF	DIR			
	PYONGYANG	A	LTF	DIR			
	QINGDAO	A	LTF	DIR			
	SHANGHAI	A	LTF	DIR			
	TAIBEI	A	LTF	DIR			
	TOKYO	A	LTF	DIR			
GIMHAE	DAEGU	A	LTF	DIR			
INCHEON ACC	DALIAN	D	LTF	DIR			

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	FUKUOKA	D	LTF	DIR			
	NAHA	D	LTF	DIR			
	PYONGYANG	D	LTF	DIR			
	QINGDAO	D	LTF	DIR			
	SHANGHAI	A	LTF	DIR			
	TOKYO	D	LTF	DIR			
JEJU APP	DAEGU	D	LTF	DIR			Note 3
SAMOA							
APIA/FALEOLO	AUCKLAND	A	LTF	DIR			
	PAGO PAGO	A	LTF	DIR			
	NADI	A	LTF	DIR			
	TONGATAPU	A	LTF	DIR			
SINGAPORE							
SINGAPORE ACC	BANGKOK	A	LTF	DIR			
	BATAM	D	LTF	DIR			
	HO CHI MINH	A	LTF	DIR			
	JAKARTA	A	LTF	DIR			
	JOHOR BAHRU	D	LTF	DIR			
	KOTA KINABALU	A	LTF	DIR			
	KUALA LUMPUR	D	LTF	DIR			
	KUANTAN	A	LTF	DIR			
	KUCHING	A	LTF	DIR			
	MANILA	A	LTF	DIR			
	MEDAN	A	LTF	SW	JAKARTA		
	PEKAN BARU	A	LTF	DIR			
	PONTIANAK	A	LTF	DIR			
	TANJUNG PINANG	D	LTF	DIR			
SOLOMON IS.							
HONIARA ACC	BRISBANE	A	LTF	DIR			
	NADI	A	LTF	SW	SYDNEY		
	NAURU	A	LTF	SW	SYDNEY		
	NOUMEA	A	LTF	SW	SYDNEY, NADI		
	OAKLAND	A	LTF	SW			Note 3, 4
	PORT MORESBY	A	LTF	DIR			
SRI LANKA							
COLOMBO ACC	BRISBANE	A	LTF	DIR			Note 1, 4
	CHENNAI	A	LTF	DIR			Note 3
	MALE	A	LTF	DIR			Note 1
	MEDAN	A	LTF	DIR			Note 3
	TRIVANDRUM	A	LTF	DIR			

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
THAILAND							
BANGKOK ACC	HA NOI	A	LTF	DIR		I	
	HO CHI MINH	A	LTF	DIR		I	
	KUALA LUMPUR	A	LTF	DIR		I	
	PHNOM PENH	A	LTF	DIR			
	SINGAPORE	A	LTF	DIR		I	Note 3
	VIENTIANE	A	LTF	DIR		I	
	YANGON	A	LTF	DIR		I	Note 3
TONGA							
TONGATAFU APP	AUCKLAND	A	LTF	DIR			
	NADI	A	LTF	DIR			
VAVA'U	NADI	A	LTF	DIR			
TUVALU							
FUNAFUTI APP	NADI						
UNITED STATES							
ANCHORAGE ACC	ANADYR	A	LTF	DIR			
	MAGADAN	A	LTF	DIR			
	OAKLAND	A	LTF	DIR			
	TOKYO	A	LTF	SW	OAKLAND		
	TOKYO	D	LTF	DIR			
	VANCOUVER	A	LTF	DIR			
	PETROPAVLOVSK-KAMCHATSKY	A	LTF	DIR			
	VANCOUVER	D	LTF	DIR			
OAKLAND	AUCKLAND	A	TOLL	DIR			
	BIAK	A	LTF	DIR			
	BRISBANE	A	LTF	DIR			
	KIRITIMATI I. TWR	A	LTF	DIR			
	GUAM I.	A	LTF	DIR			
	HONIARA	A	LTF	DIR			
	JOHNSTON I. TWR	A	LTF	DIR			
	KOROR	A	LTF	DIR			
	KOSRAE	A	LTF	DIR			
	KAWJALEIN	A	LTF	DIR			
	MAJURO ATOLL	A	LTF	DIR			
	MANILA	A	LTF	DIR			
	MOEN	A	LTF	DIR			
	NADI	A	LTF	DIR			
	NAHA	A	LTF	DIR			
	NAURU	A	LTF	DIR			
	PAGO PAGO APP	A	LTF	DIR			

ATS requirements for speech communications		Circuit				Status of implementation	Remarks
Terminal I	Terminal II	Type	Service	D/S	To be switched via		
1	2	3	4	5	6	7	8
	POHNPEI	A	LTF	DIR			
	PORT MORESBY	A	LTF	DIR			
	SAIPAN	A	LTF	DIR			
	SAPPORO	A	LTF	DIR			
	TAHITI	A	LTF	DIR			
	TARAWA TWR	A	LTF	DIR			
	TOKYO	A	LTF	DIR			
	UJUNG PANDANG	A	LTF	DIR			
	VANCOUVER	D	LTF	DIR			
	YAP	A	LTF	DIR			
VANUATU							
PORT VILA							
	NADI	A	LTF	DIR	NADI		
	NOUMEA	A	LTF	SW			
VIET NAM							
HA NOI ACC	BANGKOK	A	LTF	DIR		I	
	NANNING	A	LTF	DIR		X	Note 3
	HO CHI MINH	A	LTF	DIR		I	
	KUNMING	A	LTF	DIR		X	
	SANYA	A	LTF	DIR		10/01	
	VIENTIANE	A	LTF	DIR		I	
HO CHI MINH ACC	BANGKOK	A	LTF	DIR		I	
	HA NOI	A	LTF	DIR		I	
	HONG KONG	A	LTF	DIR		I	
	KUALA LUMPUR	A	LTF	DIR		12/00	VSAT
	MANILA	A	LTF	DIR		I	
	PHNOM PENH	A	LTF	DIR		I	
	SANYA	A	LTF	DIR		10/01	
	SINGAPORE	A	LTF	DIR		I	
	VIENTIANE	A	LTF	DIR		I	
WALLIS AND FUTUNA IS. (France)							
WALLIS	NADI	A	LTF	DIR			Note 3

State or Air Navigation Service	Contact	Obsolescence	Reliability	Voice telephone service

Provider			Frequency of disruptions you experience in the last 2 years	Need for telecommunication backup or diversity	Have only one circuit for international telecommunication?	
Australia, Airservices Australia	Communication Centre National Operation Centre Level 3 , Alan Wood Building 25 Constitution Ave Canberra, ACT, 2600 02 6268 4150	IPL circuits are not a preferred delivery method all though Australian Services Providers can still deliver the services. Current IndoSAT service to Indonesia is ageing and requires replacement.	Fiji 13 New Zealand 12 Papua New Guinea 6 South Africa 34 Singapore 8 United States of America 9 Indonesia 14 Most faults relate to Carrier backbone.	Airservices operates two enroute centres, one in Brisbane and one in Melbourne. Each centre backs up the other, so connections need to be made to both.	Airservices has 9 stand alone international circuits which carrier Voice and Data	Airservices has voice intercoms to international ANSP's as indicated in Question 2. We already mix voice and data together on many of our lines and we see this as necessary for the success of the CRV. Without voice on the CRV the cost/benefit is much poorer as we would then need to establish a separate solution for the voice."
Fiji (Airports Fiji Limited)	Nadi Air Traffic Management Center, Airports Fiji Limited, Private Mail Bag, Nadi Airport. Main Phone No. 679-6725 777 ext. 4195, 679 - No. 679-6724 600	IPLC is phasing out as some service providers are not supporting this technology. Voice /data multiplexer has become difficulty to support as spare parts are obsolete.	In the last 2 years, the circuit has been performing statisfactory. There were outages relate to the international circuits due to link problems. Traffic to adjacent Communication Centres was diverted via alternate paths when encountering link problems and no delay to traffic was recorded.	Yes. We have only one center wihout any redudant international link for communication diversity.	AFL has 4 dedicated international IPLC circuit that carry voice & data traffic.	We have voice intercom to adjacent FIR centters (Brisbaneia, Auckland, Oakland) and ANSP (New Caledonia) using the voice/data mux and telephone circuit to Vanuatu, Kiribati & Tuvalu)

Hong Kong China	Room 203, 2/F., Air Traffic Control Complex, 1 Control Tower Road, Hong Kong International Airport, Lantau, Hong Kong. +852 2910 6222 (Duty Supervisor)	Obsolescence of telecom equipment and modem at Philippines side resulting in unstable IASC/AFTN performance affecting effective ATC coordination and inducing prolonged service outage.	In the last 2 years, covering the period from January 2012 to December 2013, the performance of the international links was satisfactory. There were 6 interruptions for over 60 minutes on the international circuits due to link problems and AAG/SMW3 network cable problems. Traffic to adjacent Communication Centres was diverted via alternate paths when encountering link problems and no delay to traffic was recorded.	There are normally main and standby circuits for local tails due space diversity of local main/backup communication centres. Resilience arrangements are solicited from teleco for international connections to oversea counterparts, e.g. ring, satellite and submarine, two backbone circuits, etc. for network protection in the form of Service Level Agreement with CAD.	There is only one backbone circuit subscribed for each international data connection, more than one circuits are arranged for IASC telephone connection with each counterpart.	CAD has IASC telephone connections to Guangzhou, Haikou, Macao, Taipei and Manila, respectively. IDD phones are the backup systems for IASC phones.

Japan	(1) Air Traffic Management Center (ATMC) 1302-17 Nata Higashi-ku Fukuoka-city Fukuoka-Pref 811-0204 Japan (2) Systems Development, Evaluation and Contingency Management Center (SDECC) 2-2 Kuko Ikeda-city Osaka-pref 563-0034 Japan	We have to spend the cost and period when we need to change the type of circuit, by the system upgrade, the end of legacy circuit service.	The disruptions against 38 leased circuits have been occurred 7 times in the last 2 years under the responsibility of our contracting provider, because of transmission equipment failure, urgent maintenance work, fiber damage, and network terminal unit(NTU) failure.	We have to establish 2 access lines to CRV in Japan. The one will be used at ATMC for operational purpose, the other will be done at SDECC(Systems Development Evaluation and Contingency Management Center) in Osaka there are backup features when ATMC is suffered or lost the feature by the disaster .	None	We expect the CRV to use voice over Internet Protocol(VoIP).Instead of installing the voice router maintenance, we have to install the monitoring equipment of voice router.

<table>
<tr>
<td>India</td>
<td>Executive Director (CNS-OM)
Airports Authority of India
Rajiv Gandhi Bhawan
New Delhi -110003
91-11-24652075 / 91-11-24654142 (Fax)</td>
<td>a) Difficulty in Availabilty of half circuits.
b) Phasing out of certain type of medias like satellite to submarine cable (e.g in case of Nairobi)
c) Obsolescence of low speed circuits.
d) Maintenance of circuits is with Communication service provider .</td>
<td>
<table>
<tr><th>S.No.</th><th>Circuit Name</th><th>Circuit Type</th><th>Average % Serviceability for 2012</th><th>Average % Serviceability for 2013</th></tr>
<tr><td>1.</td><td>Mumbai – Bangkok</td><td>AFTN</td><td>100</td><td>84.14</td></tr>
<tr><td>2.</td><td>Mumbai – Colombo</td><td>AFTN</td><td>100</td><td>99.33</td></tr>
<tr><td>3.</td><td>Mumbai – Karachi</td><td>AFTN/DSC</td><td>99.95</td><td>97.05</td></tr>
<tr><td>4.</td><td>Mumbai – Muscat</td><td>DSC</td><td>99.85</td><td>100</td></tr>
<tr><td>5.</td><td>Mumbai –Nairobi</td><td>AFTN</td><td>100</td><td>80.99</td></tr>
<tr><td>6.</td><td>Mumbai – Kathmandu</td><td>AFTN</td><td>100</td><td>49.41</td></tr>
<tr><td>7.</td><td>Mumbai – Singapore</td><td>AFTN</td><td>100</td><td>99.87</td></tr>
<tr><td>8.</td><td>Mumbai – Beijing</td><td>AFTN</td><td colspan="2">NOT YET IN OPERATION</td></tr>
<tr><td>9.</td><td>Mumbai - Paro</td><td>AFTN</td><td>100</td><td>88.18</td></tr>
<tr><td>10.</td><td>Kolkata - Dhaka</td><td>AFTN/DSC</td><td>100</td><td>98.27</td></tr>
<tr><td>11.</td><td>Kolkata - Yangon</td><td>DSC</td><td>100</td><td>87.58</td></tr>
<tr><td>12.</td><td>Chennai - Kualalumpur</td><td>AFTN/DSC</td><td>99</td><td>99.15</td></tr>
<tr><td>13.</td><td>Delhi - Karachi</td><td>DSC</td><td>99.25</td><td>98.19</td></tr>
<tr><td>14.</td><td>Delhi - Lahore</td><td>DSC</td><td>41.76</td><td>98.45</td></tr>
<tr><td>15.</td><td>Amritsar –Lahore</td><td>DSC</td><td>96.49</td><td>----</td></tr>
<tr><td>16.</td><td>Delhi – Karachi</td><td>IDD HOTLINE</td><td>----</td><td>----</td></tr>
<tr><td>17.</td><td>Delhi - Lahore</td><td>IDD HOTLINE</td><td>----</td><td>----</td></tr>
<tr><td>18.</td><td>Varanasi – Kathmandu</td><td>IDD HOTLINE</td><td>98.49</td><td>91.92</td></tr>
<tr><td>19.</td><td>Amritsar –Lahore</td><td>IDD HOTLINE</td><td>95.54</td><td>----</td></tr>
<tr><td>20.</td><td>Kolkata - Kathmandu</td><td>IDD HOTLINE</td><td>----</td><td>95.78</td></tr>
<tr><td>21.</td><td>Kolkata – Dhaka</td><td>IDD HOTLINE</td><td>----</td><td>----</td></tr>
<tr><td>22.</td><td>Guwahati - Dhaka</td><td>IDD HOTLINE</td><td>96.45</td><td>100</td></tr>
<tr><td>23.</td><td>Agartala - Dhaka</td><td>IDD HOTLINE</td><td>84.23</td><td>96.54</td></tr>
<tr><td>24.</td><td>Chennai - Colombo</td><td>IDD HOTLINE</td><td>99.67</td><td>99.27</td></tr>
<tr><td>25.</td><td>Chennai - Median</td><td>IDD HOTLINE</td><td>99.30</td><td>100</td></tr>
<tr><td>26.</td><td>Chennai - Yangon</td><td>IDD HOTLINE</td><td>87.66</td><td>98.98</td></tr>
<tr><td>27.</td><td>Trivandrum - Colombo</td><td>IDD HOTLINE</td><td>100</td><td>100</td></tr>
<tr><td>28.</td><td>Mumbai – Karachi</td><td>IDD HOTLINE</td><td>100</td><td>94.88</td></tr>
<tr><td>29.</td><td>Ahmedabad - Karachi</td><td>IDD HOTLINE</td><td>97.67</td><td>----</td></tr>
</table>
</td>
<td>Yes definitely backup is required as it will ensure enhanced service levels</td>
<td>No</td>
<td>Yes voice circuits are already in use. Issues similar to data circuits.</td>
</tr>
</table>

Macau	ADA- Administraiton of Airports Macau International Airport PAC on Talpa Macao, China Tel number: (+853) 2886 1111	International telecommuncaiot ncircuits are stable	4 times in the last 2 years, due to service enhancement works or maintenance activities by Telecommunication Service Provider	Yes we need	have more than 1 circuit for international telecommunicat ion with connecions to Zhuhai and Hong Kong	Yes, needed. However, service will be interrupted when maintenance work is performed by Telecom SP. Cooridnation with end users has to be carried out to minimize impact

Malaysia	Kuala Lumpur FIR Kuala Lumpur Air Traffic Control Centre (KL ATCC) Air Traffic Control Centre Block B, ATCC Complex Sultan Abdul Aziz Shah Airport 47200 Subang Selangor Darul Ehsan Tel.: +603 78473573 Fax : +603 78473572 Kota Kinabalu FIR Kota Kinabalu Air Traffic Control Centre Bangunan ATCC 88618 Kota Kinabalu Sabah Tel : +6088 224911 Fax : +6088 219198 Kuching Sub-Centre Kuching Air Traffic Control Centre Kuching International Airport 93728 Kuching Sarawak Tel : +6082 455572 Fax : +6082 453199	Most of direct speech circuits between Kuala Lumpur ATCC and its neighbouring ATCC (as listed in Para 2 above) are analogue circuits. The service providers at both ends are facing obsolescence issues with the network equipment used to provision these circuits. All international circuits are on half circuit arrangement whereby each ANSP will subscribe the required circuit from their preferred telecommunication service provider.	The service disruptions occurred almost every month on certain circuits and it took a very long to restore. Among the circuits that used to have long outages are: • Kota Kinabalu – Manila • Kota Kinabalu – Ujung Pandang (VSAT) • Kuala Lumpur – Chennai The problem could originate from either side and mostly due to the last mile cable cut or equipment obsolescence issues	There is a backup service over VSAT available for Kuala Lumpur – Bangkok only. The diversity or backup is required since a single circuit especially in digital platform are normally carrying both data and voice traffic. Line failure will affect total failure of communication between both ANSPs, hence affecting the efficiency of traffic coordination and safety.	There are multiple circuits available between Malaysian FIRs and neighbouring FIRs.	Voice telephone service (or also known as International Direct Dialling – IDD) is essential as alternative communication to direct speech circuit. There is no issue with regards to the availability and maintenance support for voice telephone service in Malaysia
Mongolia	UB-17120, Communication Navigation Surveillance section, Civil Aviation Authority of Mongolia, Khan-Uul district, 10th khoroo,	Currently we have no issues on our international telecommunication circuits for: Beijing (cisco 3825) with VSAT and optic Irkutsk (SDM 9880)	No issues except solar interference, during the solar interference the AFTN is switched to optic.	We have Optic and VSAT for both Beijing and Irkutsk.	We have 2 international telecommunication circuits such as Irkutsk (Russia), and Beijing (China)	Both of our AFTN terminals have voice telephone services. No issue in maintenance support.

	Buyant-Ukhaa, Ulaanbaatar, Mongolia Phone:+976 11 281603 Fax: +976 1170049785 Email: engineershift@mcaa.gov.mn	with VSAT and optic				
MYANMAR, DEPARTMENT OF CIVIL AVIATION	ATC Tower Building, Yangon Int'l Airport Airport Road, (11021), Mingaladon Tsp: Yangon, Myanmar. 95-1-533045	The maintenance of Circuit and associated equipment for Yangon-Bangkok V-SAT link which conveyed AFTN and three DSC lines to Bangkok are done by AEROTHAI.' The land line (E1) connection to Beijing is new and under installation which is substituted to old Yangon-Beijing V-SAT link.	Nil	telecommunication link to India for ADSB data sharing, AFTN, AIDC and DSC	Nil	Nil

New Zealand	• Main Site: 20 Sir William Pickering Drive, Russley, Christchurch, New Zealand • Contingency site: Cyrill Kay Road, Auckland Airport, Auckland, New Zealand	• We have experienced sever outages with the connection to Rarotonga, one that took 6months to resolve due to the hardware used on the last mile being obsolete and the replacement was unable to be configured. We ended up sending one of our technicians to assist in the resolution. • Tonga used to suffer multiple outage so we installed our own satellite dish and equipment. The circuit to Tonga is on an Airways owned Satellite link, leasing Bandwidth from a satellite Service provider. Airways is planning an expansion of satellite services in the Pacific in the next Financial Year, including Rarotonga and Samoa	• Tonga suffers every year due to Solar events but this is manageable and the local technician is excellent. • We continue to have several outages a year with Rarotonga that appear to be a combination of backbone and last mile issues.	• Within New Zealand yes. We currently have a connection point at our Main operations centre in Christchurch and another connection at our operations centre in Auckland. These two are linked via our own network and form part of a ring network with other states.	• We have 6 circuits	• We have voice services off our Voice Communication System (VCS) to Tonga, USA, Australia and Fiji. • We utilize PABX phone lines to Tahiti, Rarotonga and Samoa
Republic of Korea	AFTN Center Address : 62, Haneul-Gil Gangseo-Gu Seoul, 157-711, Korea Phone : 82226602931 ACC Address : P.O.B No 29, 272, Gonghangno jung-gu Inchon 400-340, Korea	Nil	Nil	Nil	Nil	Nil

	Phone : 82328800335					
Philippines	Civil Aviation of the Philippines, Old Mia Road, Pasay City, Philippines, 1300, +63-2-8799255	Yes	6 outages/month (average in the last two years) on Hong Kong AFTN 5 outages/month (average in the last two years) on Singaore Hotline and AFTN 2 outages/month (average in the last two years) on Oakland, Ujung Pandang, Kota Kinabalu, Ho Chi Minh, Taipei, 1 outage/month (average in the last two years) on Naha, Fukuoka, Hong Kong	Yes	- No for Oakland, Ujung, Kota, Ho Chi Minh, Taiei,Hong Kong - Yes for Naha, Fukuoka, Singapore	Yes, also expericning maintenance support on voice telephone service
Singapore	Singapore Air Traffic Control Centre, LORADS II Building, 60, Biggin Hill Road, Singapore Postal Code 509950, Telephone No: 6214 8050 / 6214 8065 / Fax: 6545 9370	It is getting more difficult to lease slow speed internaiotnal telecom. Circuits (64kbps and below) from Telecom Service Providers in Singapore. Some Telcos have notified that they are only able to provide services for 2Mbps (E1) and above. This is a potential problem as there is no immediate need for higher bandwidth to support existing applications. Therefore bilateral counterparts may not be willing to match the higher bandwidth due to higher cost involved.	Disruptions of services vary from one country to another, ranging from no or very little disruption to almost everyday experiencing circuit issues. Faults are also varied: last mile infrastrcuture like modems, servers; international link outages etc	Yes, both. Our backup is usually additional/redundant link which we can fall back on if the main circuit goes down. As for diversity, we can either send/receive AFTN/AMHS messages from more than one routing based on the routing tables if the main route has problem.	Not Applicable.	Yes we do need to coordinate with adjacent FIRs and ATC centre. Currently we don't have any issue with maintenance support

<table>
<tr>
<td>Thailand</td>
<td>Aeronautical Radio Of Thailand LTD. 102 Ngamduplee Tungmahamek sathorn Bangkok Thailand 10120 Tel 0-2287-3531-41</td>
<td>AEROTHAI provide the ATS-satellite communication services to our neighbors. We have annual maintenance procedure in place and we will inform our users (neighbors) about the maintenance. As for the ATS lease lines service, the service provider are maintaining the circuits. However, we have not received any coordination from them with regards to maintenances. The contract that we have did not require the service provider to inform us before, however, we would like to have coordination with service provider with regards to maintenance in order to plan our alternative services accordingly.</td>
<td>
<table>
<tr><th>Site</th><th>Link Type</th><th>No. of failure
1-jan-2013 to 1-jan-2014</th><th>Cause</th></tr>
<tr><td>Rome</td><td>Lease Line</td><td>20</td><td>cable fail</td></tr>
<tr><td>Singapore</td><td>Lease Line</td><td>4</td><td>cable fail</td></tr>
<tr><td>Mumbai</td><td>Lease Line</td><td>22</td><td>cable fail</td></tr>
<tr><td>Hongkong</td><td>Lease Line</td><td>4</td><td>cable fail</td></tr>
</table>
<table>
<tr><th>Site</th><th>Link Type</th><th>No. of failure
1-jan-2012 to 1-jan-2014</th><th>Cause</th></tr>
<tr><td>Dhaka</td><td>Satellite</td><td>9</td><td>maintenance ,electrical and equipment fail</td></tr>
<tr><td>Yangon</td><td>Satellite</td><td>5</td><td>maintenance and equipment fail</td></tr>
<tr><td>Hochiminh</td><td>Satellite</td><td>5</td><td>maintenance and equipment fail</td></tr>
<tr><td>Kuala</td><td>Satellite</td><td>4</td><td>maintenance and equipment fail</td></tr>
<tr><td>lumpur</td><td>Lease Line</td><td>17</td><td>submarine communications cable fail
and maintenance submarine communications cable</td></tr>
<tr><td>Vientiane</td><td>Satellite</td><td>6</td><td>maintenance ,electrical and equipment fail</td></tr>
<tr><td>Phnom Penh</td><td>Satellite</td><td>4</td><td>maintenance ,electrical and equipment fail</td></tr>
</table>
</td>
<td>We wish to have backup / diversity for all ATS links to reduce the single point of failure. The redundancy line should follow common rule that all paths / equipments of the line should be duplicated and separate, e.g. fiber used for each line should be different, lines coming in our facility should be separated, equipments should be duplicated and separate, termination points should be separated, etc.</td>
<td>Not Applicable.</td>
<td>We do need to have voice telephone service. Furthermore, for those voice telephone services, we truly need to have the maintenance procedure in place due to its importance.</td>
</tr>
</table>

United States (Salt Lake City)	Salt Lake City Network Enterprise Management Center 2150 W. 700 N. Salt Lake City UT 84116 Main Phone Number; 801-320-2172 Oakland Air Route Traffic Control Center 5125 Central Avenue Fremont, CA 94536-6531 Main Phone Number; 510-745-3000	The Voice/Data Multiplexer has become difficult to maintain as the industry has moved to Voice over Internet Protocol (VoIP) standard. The spare part can no longer be obtained from industry.	The circuits have not had any issues yet. The equipment is maintained using in-house maintenance personnel and spare part. It is noted that by the end of 2014, the industry will not offer additional bandwidth nor new dedicated circuit. This will impact support for future requirement	Yes.	No. FAA has 6 dedicated circuits to Asia/Pacific region in addition to multiple connections to Pacific region using public internet or internal telecommunication network.	Yes. FAA has many voice services to Asia/Pacific region. The FAA is in the process to replace the voice service that is based on voice/data multiplexer to VoIP.

United States (Oakland)	Oakland Air Route Traffic Control Center 5125 Central Avenue Fremont, CA 94536-6531 Main Phone Number; 510-745-3000	The Voice/Data Multiplexer has become difficult to maintain as the industry has moved to Voice over Internet Protocol (VoIP) standard. The spare part can no longer be obtained from industry.	The circuits have not had any issues yet. The equipment is maintained using in-house maintenance personnel and spare part. It is noted that by the end of 2014, the industry will not offer additional bandwidth nor new dedicated circuit. This will impact support for future requirement	Yes.	No. FAA has 6 dedicated circuits to Asia/Pacific region in addition to multiple connections to Pacific region using public internet or internal telecommunication network	Yes. FAA has many voice services to Asia/Pacific region. The FAA is in the process to replace the voice service that is based on voice/data multiplexer to VoIP.

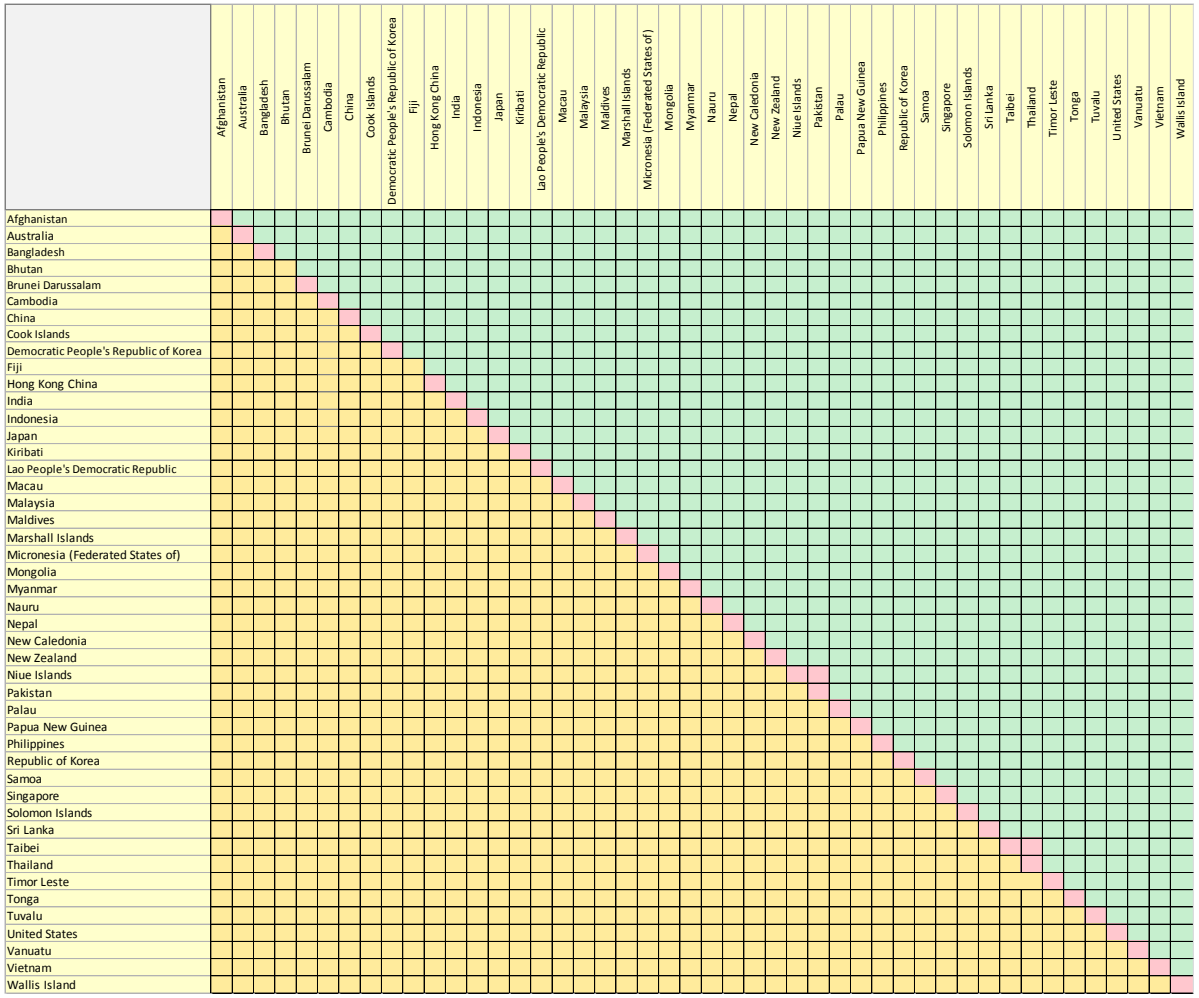
4 Air Ground Communications

TBD

5 Data Link communications

TBD

6 Surveillance data



7 AIDC

In 2014, AIDC exchanges are exchanged or planned as follows:

State/Administration	Location of AIDC end system	AIDC between…	…and…	AIDC standard used	Target date of Implementation
AUSTRALIA	Brisbane ACC	Oakland ARTCC	USA	AFTN	Implemented
				AFTN/AMHS	TBD
		Auckland ACC	New Zealand	AFTN	Implemented
				AFTN/AMHS	TBD
		Melbourne	Australia	AFTN	Implemented
				AFTN/AMHS	TBD
		Makassar ACC	Indonesia	AFTN	~~2010~~Implemented
				AFTN/AMHS	TBD
		Nadi ACC	Fiji	AFTN	~~Implemented~~Decommissioned
				AFTN/AMHS	Implemented~~TBD~~
	Melbourne ACC	Brisbane ACC	Australia	AFTN	Implemented
				AFTN/AMHS	TBD
		Jakarta ACC	Indonesia	AFTN	TBD
				AFTN/AMHS	TBD
		Mauritius ACC	Mauritius	AFTN	Implemented
				AFTN/AMHS	TBD
BANGLADESH	Dhaka ACC	Kolkata ACC	India	AFTN/AMHS	TBD
		Yangon ACC	Myanmar	AFTN/AMHS	2012
BHUTAN					
BRUNEI DARUSSALAM					
			Not Required		
CAMBODIA	Phnom Penh ACC	Bangkok ACC	Thailand	AFTN	2010

State/Administration	Location of AIDC end system	AIDC between…	…and…	AIDC standard used	Target date of Implementation
CHINA	Beijing ACC	Incheon ACC	Republic of Korea	AFTN	TBD
	Sanya ACC	Hong Kong ACC	Hong Kong, China	AFTN	Implemented
		Ho Chi Minh ACC	Vietnam	AFTN	TBD
	Guangzhou ACC	Hong Kong ACC	Hong Kong, China	AFTN	TBD
	Taibei ACC	Hong Kong ACC	China	TBD	2012
	Shanghai ACC	Fukuoka ATMC	Japan	TBD	TBD
HONG KONG, CHINA	Hong Kong ACC	Guangzhou ACC	China	AFTN	TBD
		Sanya ACC	China	AFTN	Implemented
		Manila ACC	Philippines	AMHS	TBD
		Taibei ACC	China	TBD	2012
MACAO, CHINA					
COOK ISLANDS					
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA					
FIJI	Nadi ACC	Auckland ACC	New Zealand	AFTN	Implemented
				AFTN/AMHS	2010
		Brisbane ACC	Australia	AFTN	~~Implemented~~Decommissioned
				AFTN/AMHS	~~2010~~Implemented

State/Administration	Location of AIDC end system	AIDC between…	…and…	AIDC standard used	Target date of Implementation
		Oakland ARTCC	USA	AFTN	Implemented
				AFTN/AMHS	2010
FRANCE **French Polynesia** **New Caledonia**					
	Papeete ACC	Auckland ACC	New Zealand	AFTN	Implemented
INDIA	Kolkata ACC	Dhaka ACC	Bangladesh	AFTN	TBD
	Mumbai ACC	Karachi ACC	Pakistan	AFTN	TBD
				AFTN/AMHS	TBD
INDONESIA	Jakarta ACC	Melbourne	Australia	AFTN	2010
				AFTN/AMHS	TBD
	Makassar ACC	Brisbane ACC	Australia	AFTN	~~2010~~Implemented
				AFTN/AMHS	TBD
JAPAN		Anchorage ACC	USA	AFTN	Implemented
	Fukuoka ATMC	Incheon ACC	Republic of Korea	AFTN	Implemented
		Oakland ARTCC	USA	AFTN	Implemented
		Taibei ACC	Taibei, China	AFTN	2012
KIRIBATI					
LAO PEOPLE'S DEMOCRATIC REPUBLIC	Vientiane ACC	Bangkok ACC	Thailand	AFTN	2010
MALAYSIA	Kuala Lumpur ACC	Bangkok ACC	Thailand	AFTN	2011
		Singapore	Singapore	AFTN	2011
		Kota Kinabalu	Manila	AFTN	2011
		Kota Kinabalu	Ujung Padang	AFTN	2011

State/Administration	Location of AIDC end system	AIDC between…	…and…	AIDC standard used	Target date of Implementation
MALDIVES	Male ACC	Colombo ACC	Sri Lanka	AFTN	2010
MARSHALL ISLANDS					
MICRONESIA (FEDERATED STATE OF)					
MONGOLIA					
MYANMAR	Yangon ACC	Bangkok ACC	Thailand	AFTN	2015-16
		Kolkata ACC	India	AFTN	2016
		Chennai ACC	India	AFTN	2016-17
		kunming ACC	China	AFTN	2016
		Vientiane ACC	Lao PDR	AFTN	2016-17
		Dhaka ACC	Bangladesh	AFTN	2016-17
NEPAL		Kolkata ACC	India	AFTN	2010
				AFTN/AMHS	
	Kathmandu ACC	Banaras ACC	India	AFTN	2010
				AFTN/AMHS	
		Lhasa ACC	China	AFTN	2010
				AFTN/AMHS	
NAURU	Brisbane ACC	Oakland ARTCC	USA	AFTN	Implemented

State/Administration	Location of AIDC end system	AIDC between…	…and…	AIDC standard used	Target date of Implementation
				AFTN/AMHS	TBD
		Nadi ACC	Fiji	AFTN	Implemented
				AFTN/AMHS	2010
NEW ZEALAND	Auckland ACC	Brisbane ACC	Australia	AFTN	Implemented
				AFTN/AMHS	2010
		Nadi ACC	Fiji	AFTN	Implemented
				AFTN/AMHS	2010
		Oakland ARTCC	USA	AFTN	Implemented
				AFTN/AMHS	2010
		Papeete ACC	French Polynesia	AFTN	Implemented
PAKISTAN	Karachi	Mumbai ACC	India	AFTN	TBD
				AFTN/AMHS	
		Muscat ACC	Oman	AFTN	TBD
				AFTN/AMHS	
		Tehran ACC	Iran	AFTN	TBD
				AFTN/AMHS	
		Delhi ACC	India	AFTN	TBD
				AFTN/AMHS	
		Ahmadabad ACC	India	AFTN	TBD
				AFTN/AMHS	
		Kabul ACC	Afghanistan	AFTN	TBD
				AFTN/AMHS	
	Lahore	Delhi ACC	India	AFTN	TBD

State/Administration	Location of AIDC end system	AIDC between…	…and…	AIDC standard used	Target date of Implementation
		Urumqui	China	AFTN/AMHS	
		Tajakistan	Tajakistan	AFTN	TBD
		Kabul ACC	Afghanistan	AFTN/AMHS	
	Karachi	Lahore	Pakistan between Domestic ACCs Karachi and Lahore	AFTN	end 2010
PALAU					
PAPUA NEW GUINEA					
PHILIPPINES		Hong Kong ACC	Hong Kong, China	AMHS	TBD
		Singapore ACC	Singapore	AMHS	2011
		Taibei	Taibei, China	AMHS	2011
		Makassar A CC	Indonesia	TBD	2011
	Manila ACC	Ho Chi Minh ACC	Viet Nam	TBD	2011
		Oakland ARTCC	USA	TBD	2011
REPUBLIC OF KOREA	Incheon ACC	Fukoka ATMC	Japan	AFTN	Implemented
		Beijing	China	AFTN	TBD
SAMOA					
SINGAPORE	Singapore ACC	Ho Chi Minh ACC	Vietnam	AFTN/AMHS	2014
				ATN	TBN

State/Administration	Location of AIDC end system	AIDC between…	…and…	AIDC standard used	Target date of Implementation
		Manila ACC	Philippines	AFTN/AMHS	2015
				ATN	TBN
		Jakarta ACC	Indonesia	AFTN/AMHS	2016
				ATN	TBN
		Kuala Lumpur ACC	Malaysia	AFTN/AMHS	2015
				ATN	TBN
		Kota Kinabalu ACC	Malaysia	AFTN/AMHS	2014
				ATN	TBN
		Kuching	Malaysia	AFTN/AMHS	2015
				ATN	TBN
SOLOM ISLANDS					
SRI LANKA	Colombo ACC	Male ACC	Maldives	AFTN/AMHS	Dec 2015
		Chennai ACC	India	AFTN/AMHS	January 2015
TIMOR LESTE		Melbourne ACC	Austrlia	AFTN/AMHS	March 2015
THAILAND	Bangkok ACC	Hochiminh ACC	Viet Nam	AFTN	2010
		Kuala Lumpur ACC	Malaysia	AFTN	2010
		Phnom Penh ACC	Cambodia	AFTN	2010
		Vientiane ACC	Lao PDR	AFTN	2010
		Yangon ACC	Myanmar	AFTN	2010
TONGA					

State/Administration	Location of AIDC end system	AIDC between…	…and…	AIDC standard used	Target date of Implementation
UNITED STATES	Oakland ARTCC	Auckland OAC	New Zealand	AFTN	Implemented
		Fukuoka ATMC	Japan	AFTN	Implemented
		Nadi ATMC	Fiji	AFTN	Implemented
		Brisbane ATSC	Australia	AFTN	Implemented
		Tahiti ACC	Tahiti	AFTN	Implemented
		Anchorage ARTCC	United States	AFTN	Implemented
	Anchorage ARTCC	Fukuoka ATMC	Japan	AFTN	Implemented
		Oakland ARTCC	United States	AFTN	Implemented
		Oakland ARTCC	United States	AFTN	Implemented
VIET NAM	Ho Chi Minh ACC	Sanya ACC	China	AFTN	2007
				AFTN/AMHS	TBD
		Pnom Penh ACC	Cambodia	AFTN/AMHS	TBD
		Vientiane ACC	Lao PDR	AFTN/AMHS	TBD
	Ho Chi Minh ACC	Singapore ACC	Singapore	AFTN/AMHS	2011
		Manila	Philippines	TBD	2011
		Bangkok ACC	Thailand	AFTN	2010

8 AIM

TBD

9 ATFM

TBD

10 Miscellaneous data

TBD

11 AIXM

TBD

12 FIXM

TBD

13 IWXXM

TBD
