Asia-Pacific
Economic Cooperation

Advancing Free Trade
for Asia-Pacific Prosperity

Enhancing Aviation Efficiency and Safety via Performance-based Communications and Surveillance (PBCS)

Virtual Workshop | 2-4 February 2021

APEC Transportation Working Group

June 2021

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Abbreviations and Acronyms List

Acronym/Abbreviation	**Meaning**
AAMA	Australian Airspace Monitoring Agency
AC	Advisory Circular
ACARS	Aircraft Communications, Addressing and Reporting System
ACID	Aircraft Identification
ACP	Actual Communication Performance
ACTP	Actual Communication Technical Performance
ADCC	Air Defense Control Centre
ADS	Automatic Dependent Surveillance
ADS-C	Automatic Dependent Surveillance-Contract
AEROTHAI	Aeronautical Radio of Thailand
AIP	Aeronautical Information Publication
AIMS	Airplane Information Management System
AIP	Aeronautical Information Publication
AMI	Aircraft Modifiable Information
ANS	Air Navigation Service
ANSP	Air Navigation Service Provider
AOC	Aeronautical Operational Control
APAC	Asia Pacific
APEC	Asia-Pacific Economic Cooperation
Apr	April
ARINC	Aeronautical Radio, Incorporated
ARMA	African and Indian Ocean Regional Monitoring Agency
ASP	Aviation Security Policy
ASP	Actual Surveillance Performance
ASPAC	Asia and Pacific
ASPIRE	Asia and Pacific Initiative to Reduce Emissions
ATC	Air Traffic Control
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSP	Air Traffic Service Provider
ATSU	Air Traffic Services Unit
Aug	August
Bn	Billion
CAA	Civil Aviation Authority
CAAS	Civil Aviation Authority of Singapore
CARSAMMA	Caribbean and South American Monitoring Agency
CMA	Continuous Monitoring Approach
CMF AMI	Communication Management Function Airline Modifiable Information
CMU	Communication Management Unit
CNS	Communication, Navigation and Surveillance
cnt	Count
COM	Communication
CPDLC	Controller Pilot Data Link Communication
CRA	Central Reporting Agency
CSP	Communication Service Provider

DARP	Dynamic Airborne Reroute Procedures
DCPC	Direct Controller-Pilot Communications
Dec	December
DLMA	Data Link Monitoring Agency
Doc	Document
DSP	Datalink Service Provider
DT	Delivery Time
EBIT	Earnings Before Interest and Taxes
Est	Estimated
Eur RMA	European Regional Monitoring Agency
ex	Example
FAA	Federal Aviation Administration
FANS	Future Air Navigation Systems
FANS-CRA	Future Air Navigation Systems-Central Reporting Agency
FDX	Flight Data Exchange
Feb	February
FIR	Flight Information Region (ICAO designators for Flight Information Regions include: KZAK, NFFF, NTTT, NZZO, PAZA, RJJJ, RPHI, VCCF, VOMM, VVTS, VYYF, WAAF, WMFC, WSJC, YBBB, YMMM, ZLLLM ZWWW)
FIT	FANS Interoperability Team
FL 330/320/310	Flight Level 330 (33,000 feet above mean sea level)
FMS	Flight Management System
FTK	Freight-Tonne Kilometres
GNSS	Global Navigation Satellite Systems
GDP	Gross Domestic Product
GOLD	Global Operational Data Link
Govt	Government
GPS	Global Positioning System
HF	High Frequency
HFDL	High Frequency Data Link
hr	Hour
HSP	HF Subnetwork Provider
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ITC	In-trail climb
ITP	In-trail procedure
ISPACG	Informal South Pacific ATS Coordinating Group
ITV	Interval
JANS	Japan Air Navigation Services
Jan	January
Jul	July
Jun	June
kg	Kilogram
km	Kilometers
KZAK	Oakland Oceanic Flight Information Region
LatSM	Lateral Separation Minimum
LongSM	Longitudinal Separation Minimum
Mar	March
MAAR	Monitoring Agency for Asia Region

MAS	Message Assurance
MEL	Minimum Equipment List
mi	Miles
Mid RMA	Middle East Regional Monitoring Agency
Min	Minimum
mph	Miles per hour
MTSAT	Multi-Functional Transport Satellite
NAARMO	North American Approvals Registry and Monitoring Organization
NAT	North Atlantic
NAT CMA	North Atlantic Central Monitoring Organization
NAT HLA	North Atlantic Track High Level Airspace
NAT OPS	North Atlantic Operations
NAT TIG	North Atlantic Technology and Interoperability Group
NAV	Navigation
NM	Nautical Mile
No	Number
Nov	November
OCS	Oceanic Control System
OPER	Note – cannot find this in monitoring presentation? Could be Operator?
Oct	October
OPS	Operations
ORT	Operator Requirement Table
OT	Overdue Time
P2	Flight Plan Code Indicating Required Communication Performance of 240 or better
PAC	Pacific
PANS	Procedures for Air Navigation Services
PANS-ATM	Procedures for Air Navigation Services- Air Traffic Management
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations
PARMO	Pacific Approvals Registry and Monitoring Organization
PBCS	Performance Based Communications and Surveillance
PBN	Performance Based Navigation
POA	Plain Old ACARS
PORT	Pilot Operational Response Time
RASMAG	Regional Airspace Safety Monitoring Advisory Group
RC	Required Communication
RCMP	Required Communication Monitored Performance
RCP	Required Communication Performance
RCTP	Required Communication Technical Performance
Reg	Registration
RGS	Remote Ground Station (note: moved FIR designators to own reference under FIR)
RMA	Regional Monitoring Agency
RN	Required Navigation
RNAV	Area Navigation
RNP	Required Navigation Performance
RPK	Revenue Passenger Kilometers
RSMP	Required Surveillance Monitored Performance
RSP	Required Surveillance Performance
RSTP	Required Surveillance Technical Performance

SARPS	Standards and Recommended Practices
SARS	Severe Acute Respiratory Syndrome
SAT	Satellite
SATCOM	Satellite Communications
SATMA	South Atlantic Monitoring Agency
SATVOICE	Satellite Voice
SBs	Software Bulletins
SBB	SwiftBroadband
SBD	Short Burst Data
sec	Seconds
Sep	September
SILs	Service Information Letters
SITA	Society of International Telecommunications Aeronautics
SPR	Safety and Performance
SSP	Satellite Service Provider
STIME	Sent Time
SUR	Surveillance
SWA	Southwest Airlines
TBO	Time Based Operations
TYP	Non-standard Aircraft Type on Field 18 of a Flight Plan
UPRs	User-Preferred Routes
USD	United States Dollar
USOAP	Universal Safety Oversight Audit Programme
VDL	Very High Frequency Digital Network
VHF	Very High Frequency
VSP	VHF Subnetwork Provider
WILCO	Will Comply

Executive Summary

The United States led a three-day virtual workshop series on Enhancing Aviation Efficiency and Safety via Performance Based Communications and Surveillance (PBCS). The workshop occurred 2-4 February 2021. The tailored program provided an overview of PBCS framework to deliver capacity building in PBCS implementation. The PBCS framework promotes efficiency of air traffic operations by supporting the safe application of air traffic management (ATM) initiatives that reduce aircraft spacing and streamline communication. If economies do not implement PBCS, they may

i) restrict their aircraft operators' ability to operate in parts of the global aviation network that require PBCS, negatively affecting connectivity, and/or

ii) restrict their Air Navigation Service Providers (ANSP's) ability to reduce aircraft spacing.

PBCS, which is not widely implemented in the region, provides an innovative approach to enhance airspace capacity safely. The workshop's purpose was to increase PBCS awareness, explain how regulators can establish PBCS policies for the aircraft operators and ANSPs, and highlight how ANSPs can provide PBCS-compliant services and monitor the performance of the operations enabled by PBCS in their airspace. Two economies and two guests (the International Air Transport Association (IATA), and the International Civil Aviation Organization, (ICAO)) presented on the topic.

1. Introduction

The PBCS virtual workshop was designed to provide an opportunity to increase PBCS awareness. The workshop also filled gaps in understanding for those economies that may not be familiar with the relatively new concept. It focused on sharing best practices for:

i) regulators of aircraft operators to establish PBCS policies, specifications and requirements;
ii) regulators of ANSPs that implement reduced separation standards, predicated on PBCS requirements to establish PBCS policies, specifications and requirements;
iii) ANSPs that implement reduced separation standards predicated on PBCS requirements to provide PBCS compliant services; and
iv) aircraft operators to obtain authorization to use reduced separation standards and mitigate safety risks.

The participants provided a lot of positive feedback on the workshop and indicated that their knowledge of PBCS increased. During the workshop and immediately following the conclusion of the workshop, the FAA encouraged APEC economies to implement PBCS. The FAA also asked APEC economies to reach out to the FAA if interested in implementing PBCS. No participants expressed such interest at that time; however, the FAA remains ready to help if asked for further assistance.

Although virtual, the FAA self-funded this project in the amount of $15,574.14.

Background

PBCS is the framework that enables implementation of reduced separation standards. PBCS accomplishes this by ensuring a baseline level of safety and performance through the application of policies for aircraft operators and ANSPs. PBCS also ensures continued safety and performance through an ongoing monitoring program. PBCS is similar to how Performance Based Navigation (PBN) ensures that the navigation systems are technically safe and perform at a required level (RNP) to support a particular separation or operation. PBCS ensure the communication and surveillance systems are

technically safe and perform at a required level (RCP and RSP) to support a particular separation or operation.

Data link services, based on controller pilot data link communication (CPDLC) and automatic dependent surveillance – contract (ADS-C), provide communications that are intended to support safer and more efficient air traffic management and increase airspace capacity. There are different and emerging communication and surveillance technologies for the air, ground, and network that enable data link services. These different technologies may be used to support various air traffic management (ATM) operations.

The PBCS concept is intended to provide objective operational criteria to evaluate and monitor various technologies ability to support specific ATM operations. The core of the PBCS concept is the required communication performance (RCP) and required surveillance performance (RSP) specifications. These specifications are developed to characterize the communication and surveillance capability and performance needed to support a specific ATM operation.

The RCP and RSP specifications are intended to be applied globally for identical or similar ATM operations. This will reduce training requirements and errors resulting from confusion in operations across airspace boundaries. This ensures that the operational communication and surveillance capabilities will be conducted in an acceptably safe manner wherever the respective ATM operation is conducted around the world.

Only three APEC economies have published PBCS implementation plans. This workshop encouraged APEC economies to implement PBCS with the aim to enhance the APEC region's capability to safely implement this technology and the air traffic process that helps expand airspace capacity.

3. Participation

All 21 economies were invited and a total number of 16 economies attended the webinar: Australia; Brunei Darussalam; Chile; Hong Kong, China; Indonesia; Japan; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; Singapore; Chinese Taipei; the United States; and Thailand. Two non-member participants also attended – from the International Air Transportation Association (IATA) and International Civil Aviation Organization (ICAO). A detailed list of participants to this workshop is attached.

4. Main Body/Agenda Discussion

The United States, IATA and ICAO provided briefings across the three-day workshop, as outlined below:

Day 1

8:00 AM – 8:10 AM **Opening Remarks**

Speaker: Lirio Liu*, Executive Director, Office of International Affairs, U.S. Federal Aviation Administration*

- Ms Lirio Liu welcomed the participants and explained that the three-day PBCS workshop series will cover the framework that enables implementation of reduced separation standards, explain the benefits of PBCS, and describe best practices to enhance the APEC economies' capability toward the objective to safely implement its technology and air traffic processes to help expand airspace capacity. Ms Liu indicated that the audience will hear key perspectives from an operator, regulator and an integrated perspective of both. She affirmed a shared

commitment to promoting a safe and secure airspace system, and emphasized that working with APEC economies to engage in technical, policy and commercial cooperation assists regional aviation experts and regulators to develop and operate a safe and efficient aviation infrastructure. Ms Liu concluded by thanking the participants for attending the webinar.

8:10 AM – 8:15 AM **Outline of Day 1, Introduction of Speakers**

***Speaker*: Riley Downing,** *Senior FAA Representative, Southeast Asia, Office of International Affairs*

- Mr Riley Downing introduced the speakers for the day, which included Mr Shane Sumner and Mr Michael Watkins, in addition to the facilitators, Ms Carol Siboni and Mr Walter Bogert. Mr Downing also provided a brief high-level overview of the content that Mr. Sumner and Mr Watkins would cover for Day 1.

8:15 AM – 9:00 AM **What is Performance-Based Communications and Surveillance (PBCS)?**

***Speaker: Shane Sumner,** Regional Officer, Air Traffic Management, ICAO*

- Mr Shane Sumner begin his presentation by introducing the concept of PBCS. After defining Performance-Based Navigation (PBN), Area Navigation (RNAV) Specification, Required Navigation Performance (RPN) Specification, he explained performance-based standards, procedures and specification to support overall system safety and efficiency. Mr Sumner discussed what PBCS is and the reasons to implement it. He reviewed the applicable ICAO provisions for PBCS and its framework, provided an overview of PBCS implementation monitoring and associated monitoring programs, described ICAO Asia Pacific PBCS regional implementation, and provided an overview of the PBCS Charter.

9:00 AM – 9:45 AM **What are the benefits of Performance-Based Communications and Surveillance (PBCS)?**

***Speaker: Michael Watkins,** FAA's Senior Representative for Air Traffic Organization in Asia Pacific, U.S. Federal Aviation Administration*

- Mr Michael Watkins briefed the benefits of implementing PBCS, how it improves safety and efficiency and supports future airspace developments. He provided an overview of air mass, jet stream, air route structure, and ASPIRE partners. Mr Watkins noted that actions are required, even if you are not managing PBCS airspace, and emphasized that failure to implement PBCS will result in less efficient routes for aircraft operators.

9:45 AM – 9:55 AM **Recap of PBCS: Putting it All Together**

***Speaker: Michael Watkins,** FAA's Senior Representative for Air Traffic Organization in Asia Pacific, U.S. Federal Aviation Administration; Shane Sumner, Regional Officer, Air Traffic Management, ICAO*

- Mr Watkins provided a recap of the Day 1 presentations. He summarized that the PBCS framework addresses the need for appropriate means to quantify, measure and improve system performance while mitigating safety risks. He also emphasized the benefits of PBCS, including:
  - aircraft flying with PBCS approvals and lower RSP and RCP values can fly closer together;
  - more aircraft can optimize flight paths for winds, routing, flight levels and weather avoidance;
  - improves airspace efficiency, capacity and safety;
  - reduces aircraft fuel burn and carbon emissions;
  - reduces system delay and improves schedule performance; and
  - enhances safety, saves money and time, and helps preserve the global environment.

9:55 AM – 10:00 AM **Brief Concluding Remarks from Moderator**
Speaker: FLLI Facilitator

- The workshop facilitator, Ms Carol Siboni, thanked the participants for joining and reminded them to join Day 2 of the Workshop.

Day 2

8:00 AM – 8:05 AM **Outline of Day 2, Introduction of Speakers**

Speaker: Riley Downing, *Senior FAA Representative, Southeast Asia, Office of International Affairs*

- Mr Riley Downing introduced the speakers for the day, which included Ms Theresa Brewer, Mr Blair Cowles, Mr Shawn Silverman and Mr Scott Bender, and provided a brief high-level overview of the content that each presenter would cover for Day 2.

8:05 AM – 8:20 AM **PBCS: An Implementation Outline**

Speaker: Theresa Brewer, *ICAO PBCS Project Team Lead, Office of NextGen, U.S. Federal Aviation Administration*

- Ms Theresa Brewer provided a presentation consisting of the following:
  - an overview of the PBCS framework;
  - an outline of the implementation tasks by stakeholder type
    - civil aviation authority (CAA)
    - air navigation service provider (ANSP)
    - aircraft operator
  - information to help each stakeholder determine their PBCS responsibilities;
  - a brief introduction to the importance of monitoring; and
  - information on how the communication service provider (CSP) is addressed in the PBCS framework.
- Mr Brewer emphasized that stakeholders should carefully assess their PBCS responsibilities and identify applicable group(s) of PBCS implementation tasks, and that monitoring is an integral component of the overall PBCS framework. She also discussed the PBCS Global Charter and that it is an important tool in achieving initial compliance for CSP oversight, and ensuring continued compliance of end-to-end system performance.

8:20 AM – 9:05 AM **PBCS: An Operators Perspective**

Speaker: Blair Cowles, *Regional Director, Safety and Flight Operations, IATA*

- Mr Blair Cowles briefed that the airline industry is in crisis due to the negative impact of COVID-19, and that airlines are in an extremely perilous financial position. He encouraged ANSPs and regulators to do everything they possibly could to help airlines save costs and stay in business. He noted that PBCS is a key efficiency enabler that helps airlines to fly as cost effectively as possible, that the absence of a PBCS regulatory framework may put an economy's airlines at a competitive disadvantage, and emphasized the potential impact of the system as a whole if PBCS generated efficiencies cannot be fully utilized by other airlines. Mr Cowles concluded by encouraging the region economies to do everything possible to create an aviation ecosystem that allows operators to save every dollar/mile/kg possible.

9:05 AM – 9:50 AM **PBCS: A Flight Operations Regulators Perspective**

Speakers: Shawn Silverman and Scott Bender, *Flight Standards, U.S. Federal Aviation Administration*

- Mr Shawn Silverman and Mr Scott Bender explained PBCS requirements as it pertains to authorization from a flight operations regulators perspective. They discussed requirements as established by ICAO documents, operational authorization, aircraft manufacturer/equipment supplier requirements and compliance, and operator eligibility. They mentioned that Civil Aviation Authorities should establish guidance for PBCS implementation, and noted that ICAO and FAA have examples of comprehensive job aides that should make the process easier. The following key points were emphasized:
  - Original Equipment Manufacturer's (OEM) Statement of Compliance (SOC) is a basis for aircraft's capability;
  - PBCS Global Charter is vital to the success of the PBCS framework;
  - training, procedures and proper flight plan filing/coding are the operator's primary responsibilities; and
  - addressing poor monitoring performance is important to the success and safety of the PBCS process.

9:50 AM - 10:00 AM **PBCS: Putting it all together from the Operator and Flight Operations Regulator Perspective**

Speakers: Shawn Silverman and Scott Bender, *Flight Standards, U.S. Federal Aviation Administration; Blair Cowles, Regional Director, Safety and Flight Operations, IATA*

- Mr Shawn Silverman recapped the following:
  - the airline industry is in crisis due to the negative impact of COVID-19;
  - Civil Aviation Authorities should develop a process and publish guidance for operators that desire to obtain a PBCS Operational Authorization;
  - ICAO and FAA have examples of comprehensive job aides that should make implementing a process easier;
  - Original Equipment Manufacturer's (OEM) Statement of Compliance (SOC) is a basis for aircraft's capability;
  - the PBCS Global Charter is vital to the success of the PBCS framework;
  - training, procedures and proper flight plan filing/coding are the operator's primary responsibilities; and

- addressing poor monitoring performance is important to the success and safety of the PBCS process.

Day 3

8:00 AM – 8:05 AM **Outline of Day 3, Introduction of Speakers**

Speaker: Riley Downing, *Senior FAA Representative, Southeast Asia, Office of International Affairs*

- Mr Riley Downing introduced the speakers for the day, which included Mr Paul Radford, Ms Theresa Brewer, and Ms Jennifer Kileo. Mr Downing also provided a brief high-level overview of the content that Mr Radford, Ms Brewer, and Ms Kileo would cover for Day 3.

8:05 AM – 8:50 AM **PBCS: An Air Navigation Service Provider's Perspective**

Speaker: Paul Radford, *Oceanic Systems Development Specialist, Airways (NZ)*

- Mr Paul Radford provided an overview of an ANSP's implementation of PBCS and a summary of guidance material and aids available to ANSPs when implementing PBCS. He also provided a roadmap for ANSPs on PBCS, including the need to register on the CRA website, establish means to extract analysis data using the ICAO guidance, perform analysis at a suitable interval, investigate any performance degradation identified in analysis, report non-compliance, and support CRA non-compliance investigations. Mr Radford also discussed ATM system modifications for PBCS, SPR safety requirements, the online PBCS analysis tool, and post implementation monitoring. In concluding, he encouraged the participants to utilize the guidance material and examples he presented to support their PBCS implementation activities.

8:50 AM - 9:35 AM **PBCS: Monitoring Programs**

Speaker: Theresa Brewer, *ICAO PBCS Project Team Lead, NextGen, U.S. Federal Aviation Administration*

- Ms Theresa Brewer provided an overview of the ICAO requirements and guidance for PBCS monitoring programs, information and resources to support implementation of a PBCS monitoring program, and significant lessons learned from existing PBCS monitoring programs. She also discussed:
  - actual service performance (ASP);
  - actual communication performance;
  - reporting airspace performance;
  - regional reporting of aircraft performance;
  - global coordination for aircraft non-compliance; and
  - problem reporting, investigation and resolution.
- In concluding, Ms Brewer encouraged participants to utilize the resources provided to support PBCS implementation activities.

9:35 AM – 9:50 AM **PBCS: An Air Navigation Service Provider Regulator's Perspective**

Speaker: Jennifer Kileo, *Aviation Safety, U.S. Federal Aviation Administration*

- Ms Jennifer Kileo briefed the ICAO PBCS Air Navigation Service (ANS) Safety Oversight Standards, discussed ANSP PBCS compliance, and PBCS ANS safety oversight concepts. Ms Kileo emphasized that ANS Regulators should ensure the ANSP:
  - establish means to assess the actual performance of communication and surveillance services in a particular airspace;
  - perform ATM operations predicated on RCP/RSP;
  - establish a means to notify the operator when the actual performance of the operator's fleet does not comply with an RCP/RSP specification; and
  - establish a means to assess the risk of any non-compliance.
- Ms Kileo concluded by encouraging ANS Regulators to establish a formal internal policy or process to ensure compliance that would determine roles and responsibilities, effective data management and analysis, and a surveillance and audit process.

9:50 AM – 10:20 AM **Recap of PBCS: Putting it All Together**

Speaker: Theresa Brewer, *ICAO PBCS Project Team Lead, NextGen, U.S. Federal Aviation Administration*

- Ms Theresa Brewer provided a recap of key points for ANSPs, including:
  - Guidance materials and aids are available to assist an ANSP with PBCS implementation, and implementation examples are available demonstrating ANSP implementation;
  - Participants are encouraged to make sure of the guidance materials and examples to support their PBCS implementing activities.
- Ms Brewer briefed the following monitoring key points:
  - Monitoring ensures continued compliance of the end-to-end system as well as the individual airspace, aircraft, and networks;
  - Monitoring enables continuous system improvement through the reporting, investigation, and resolution of problems; and
  - information to support implementation of a PBCS monitoring program is provided at www.FANS-CRA.com.
- Ms Brewer reemphasized the following ANSP Regulator key points:
  - Based on ICAO PBCS Safety Oversight Standards, ANS Regulators should ensure the ANSP:
    - establish means to assess the actual performance of communication and surveillance services in a particular airspace;
    - perform ATM operations predicated on RCP/RSP;
    - establish a means to notify the operator when the actual performance of the operator's fleet does not comply with an RCP/RSP specification; and
    - establish a means to assess the risk of any non-compliance.
- Ms Brewer concluded that ANS Regulators should establish a formal internal policy or process to ensure compliance that would determine roles and responsibilities, effective data management and analysis, and a surveillance and audit process. She also indicated that economies may reach out to FAA if an economy is interested in implementing PBCS.

10:20 AM – 10:30 AM Conclusions, Resources, and Distribution of Feedback Survey

Speaker: FLLI Facilitator

- Ms Carol Saboni concluded the 3-day workshop by thanking the participants and informing them that the presentation materials will be posted on the APEC website no later than February 18, 2021. She also provided notification that a feedback email will be sent to the emails of participants following the workshop.

5. Post-Workshop Feedback

Following the conclusion of the three-day workshop series, an email was sent to the participants for an opportunity to provide any feedback the participants may have about the webinar and suggestions for future webinars. The email also indicated that participants may respond back to the email if they are interested in further assistance to help implement PBCS in their economy. Numerous participants responded positively that they appreciated the workshop and that the information was interesting and helpful.

One participant proposed Global Navigation Satellite Systems (GNSS) technology for the virtual workshops. Out of the responses received, no participants expressed interest in receiving further assistance to help implement PBCS in their economy. The overall responses received were positive and indicated that the workshop provided valuable information that gave a better understanding of the PBCS concept and its application to flight operations.

6. Recommendation/Conclusion

PBCS optimizes airspace use, provides performance level assurance to support the underlying PBCS-predicated separation standards, and mitigates safety risks. It promotes efficiency – safely reducing aircraft spacing and offering direct routes, which supports harmonization and connectivity. If economies do not implement PBCS, they may i) restrict their aircraft operators' ability to operate in parts of the global aviation network that require PBCS, negatively affecting connectivity, and/or ii) restrict their ANSP's ability to reduce aircraft spacing.

PBCS, which is not widely implemented in the region, provides an innovative approach to enhance airspace capacity safely. Only three APEC economies have published PBCS implementation plans. The workshop encouraged other APEC economies to implement PBCS with the aim to enhance the APEC region's capability to safely implement this technology and the air traffic process that helps expand airspace capacity.

With the target audience of regulators of aircraft operators, regulators of ANSPs, ANSPs, and aircraft operators, the workshop provided an overview of PBCS framework to deliver capacity building in PBCS implementation. The PBCS framework promotes efficiency of air traffic operations by supporting the safe application of ATM initiatives that reduce aircraft spacing and streamline communication. The workshop's purpose was to increase PBCS awareness, explain how regulators can establish PBCS policies for the aircraft operators and ANSPs, and highlight how ANSPs can provide PBCS-compliant services and monitor the performance of the operations enabled by PBCS in their airspace.

During the workshop, the FAA asked APEC economies reach out to the FAA if an economy is interested in implementing PBCS. No participants expressed such interest while the workshop was in progress. Following the workshop's conclusion, the FAA sent out a suggestion/feedback email to participants, asking participants to respond back to the email if they are interested in further assistance to help implement PBCS in their economy; however, out of the responses received no one expressed such interest at that time. The overall responses received were positive and indicated that the workshop provided valuable information that gave a better understanding of the PBCS concept and its application to flight operations. The FAA remains ready to help if any economy asks for further assistance.

APPENDICES

Asia-Pacific Economic Cooperation

Advancing Free Trade for Asia-Pacific Prosperity

What is Performance-Based Communications and Surveillance (PBCS)? ICAO Perspective and Provisions

Day 1 – APEC PBCS Webinar

Presented by

Shane Sumner
International Civil Aviation Organization (ICAO)
Asia/Pacific Regional Office
ssumner@icao.int

Outline

Asia-Pacific Economic Cooperation

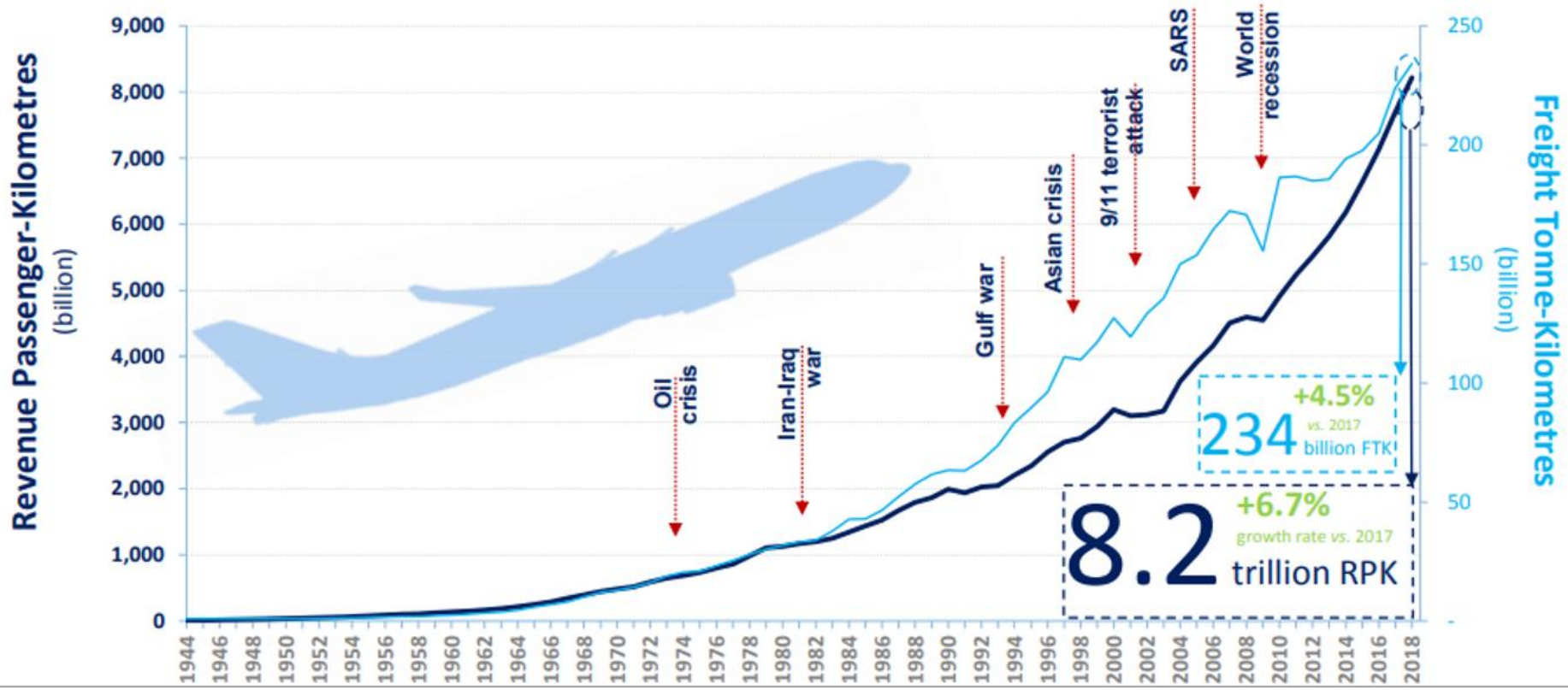
- **Performance-Based Separation and PBCS**
- **What is PBCS?**
- **ICAO Provisions for PBCS**
- **PBCS Implementation Monitoring**

Asia-Pacific Economic Cooperation

PERFORMANCE-BASED SEPARATION AND PBCS

Growth of Air Transport

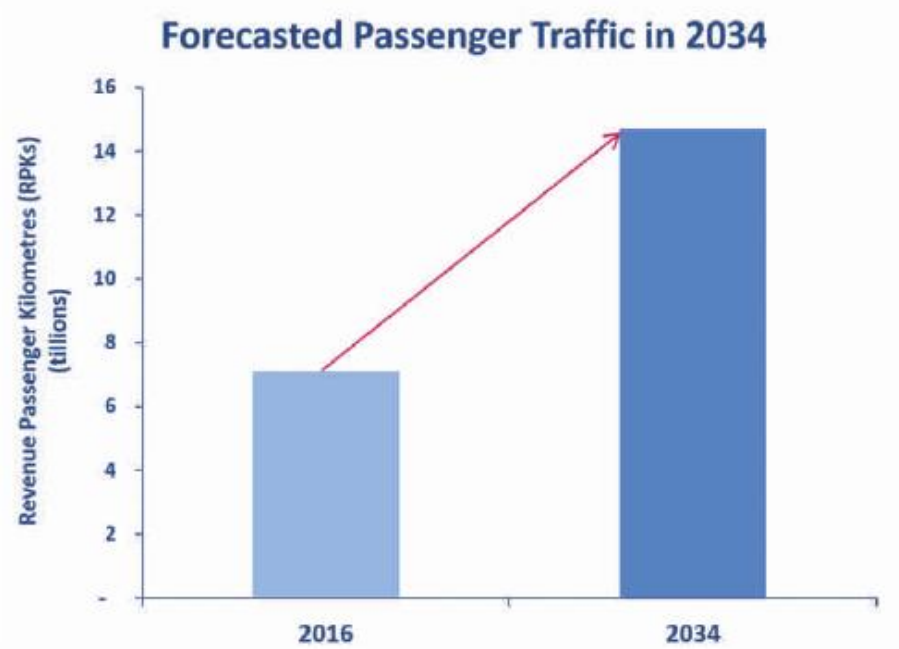
Asia-Pacific Economic Cooperation



Source: ICAO Annual Report of the Council 2019

Growth of Air Transport

Asia-Pacific Economic Cooperation



Growth of Air Transport

Asia-Pacific Economic Cooperation

- Our collective responsibility is to allow the aviation system to safely realize this air transport growth and optimize the use of available airspace
  - Reduced Separation
  - Dynamic Airborne Reroute Procedure (DARP)
  - 4D Trajectory Based Operations (TBO)
- **Required safety and performance assurance** for communications, navigation and surveillance

Why PBCS?

Asia-Pacific Economic Cooperation

- Previously:

  performance-based separation

  supported by

- ***Performance-based navigation*** (PBN) specification (RNAV/RNP)

  Non-RADAR Airspace *No Voice DCPC*

Why PBCS?

Performance-Based Navigation (PBN)

Area navigation based on performance requirements for aircraft operating along an Air Traffic Services (ATS) route, on an instrument approach procedure or in a designated airspace.

*Note.— Performance requirements are expressed in navigation specifications in terms of **accuracy**, **integrity**, **continuity** and functionality needed for the proposed operation in the context of a particular airspace concept.*

ICAO Doc 9613 – PBN Manual

Why PBCS?

Asia-Pacific Economic Cooperation

Area Navigation (RNAV) Specification

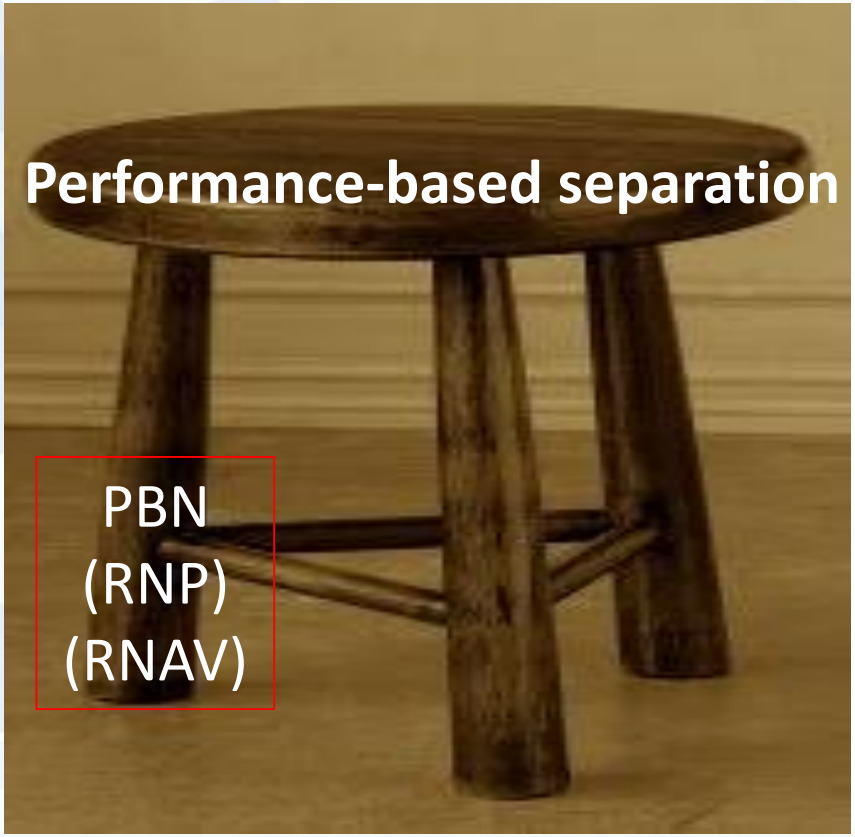
A navigation specification based on area navigation that does not include the requirement for on-board performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1.

Required Navigation Performance (RNP) Specification

A navigation specification based on area navigation that includes the requirement for on-board performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH.

ICAO Doc 9613 – PBN Manual

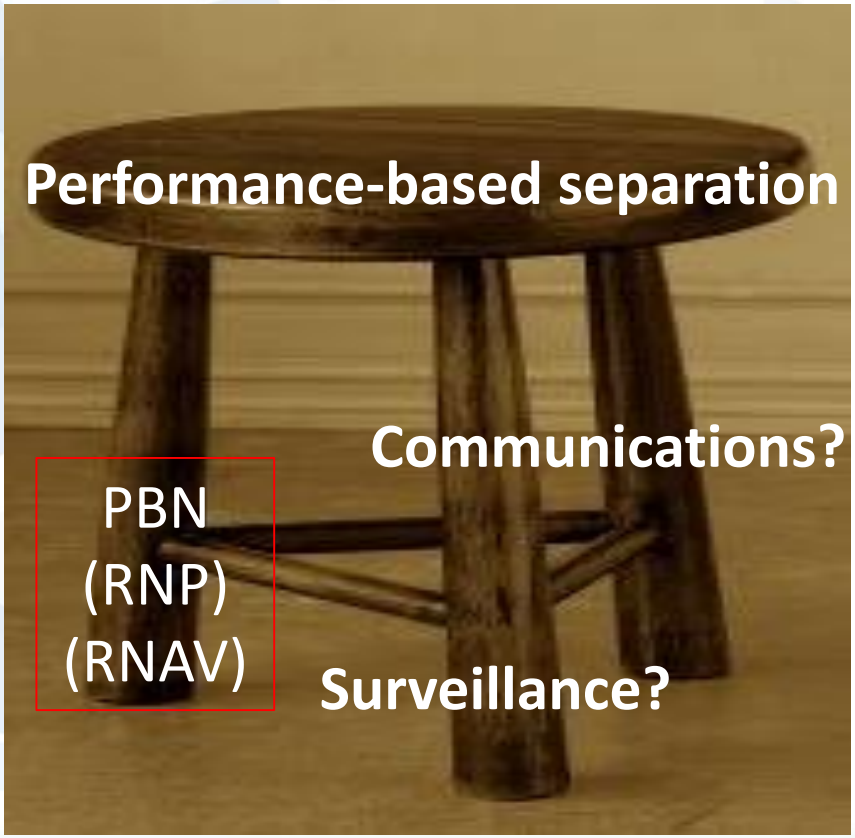
Why PBCS?



- Example: **Longitudinal separation** – *Required Navigation Performance* (RNP) specification

Separation minima	*RNP type*
93 km (50 NM)	10
	4
55.5 km (30 NM)	4

Why PBCS?

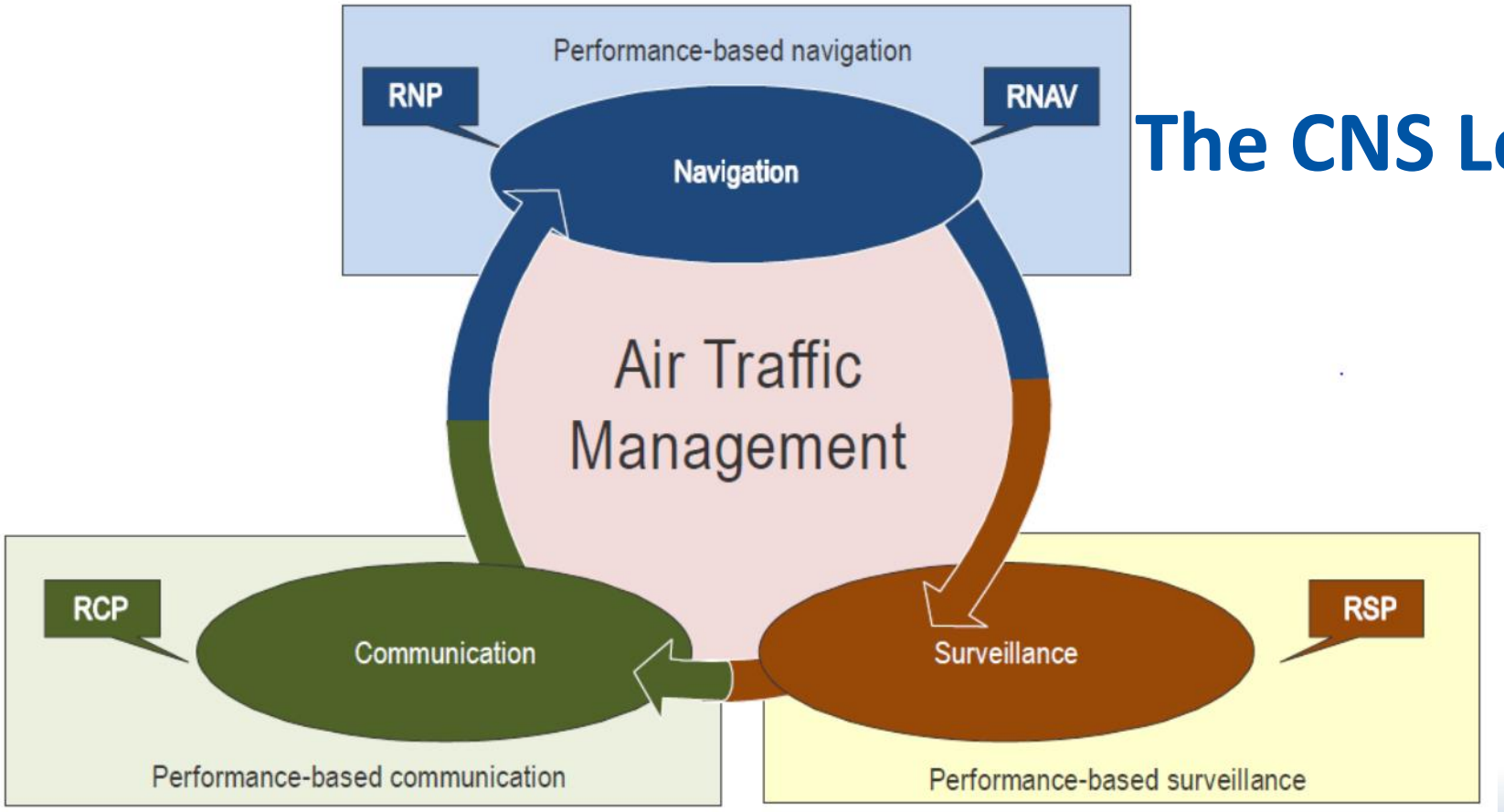


- Example: **Longitudinal separation** – *Required Navigation Performance* (RNP) specification

Separation minima	*RNP type*
93 km (50 NM)	10
	4
55.5 km (30 NM)	4

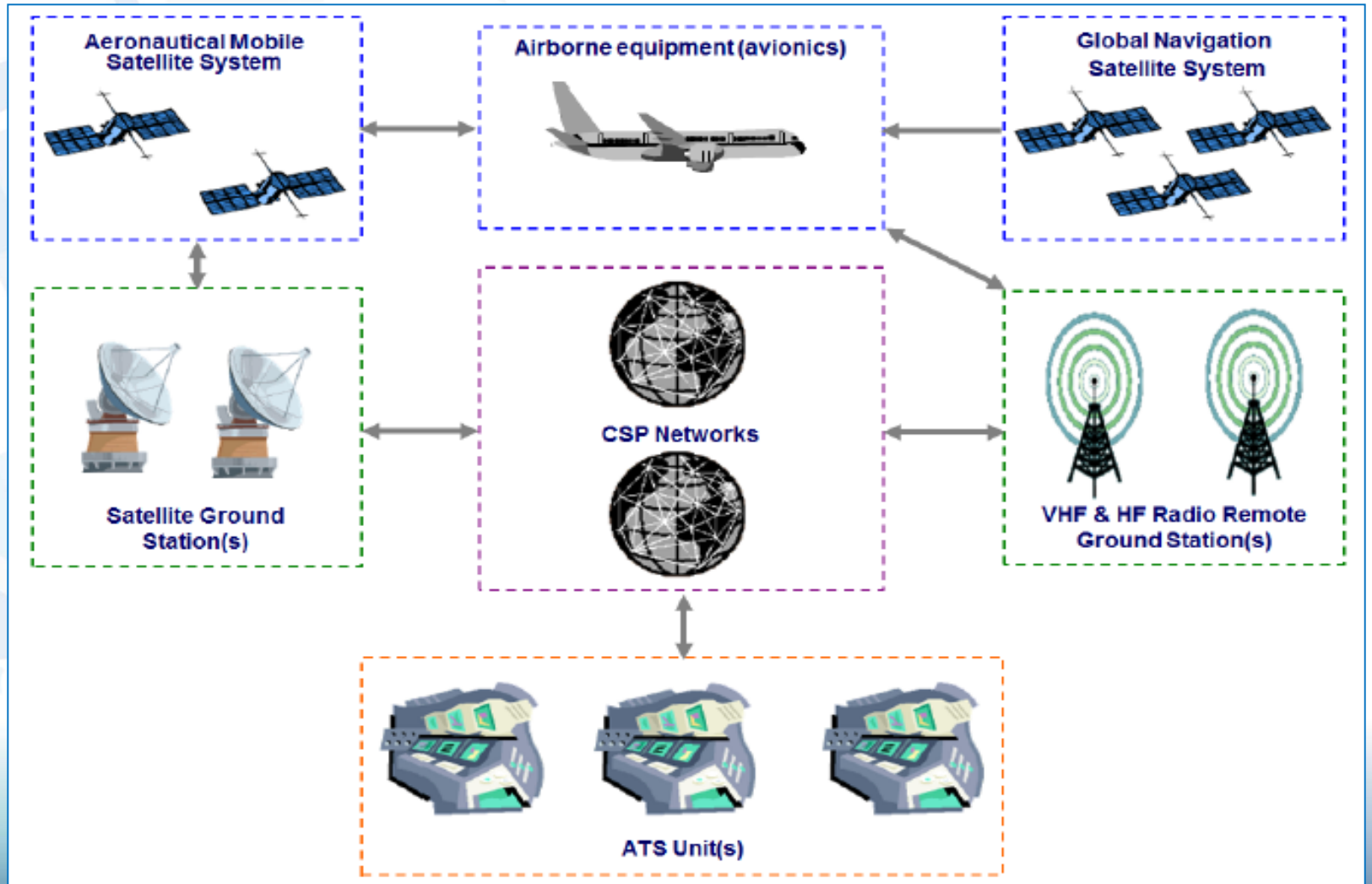
Why PBCS?

Asia-Pacific Economic Cooperation



The CNS Loop

Why PBCS?


Aeronautical Mobile Satellite System
Airborne equipment (avionics)
Global Navigation Satellite System
Satellite Ground Station(s)
CSP Networks
VHF & HF Radio Remote Ground Station(s)
ATS Unit(s)

Asia-Pacific
Economic Cooperation

WHAT IS PBCS?

What is PBCS

Asia-Pacific Economic Cooperation

Performance-Based <u>Communication</u>

Communication based on performance specifications applied to the provision of air traffic services.

Includes communication performance requirements allocated to system components:

- *communication to be provided*
- *associated transaction time*
- *continuity, availability, integrity, safety and functionality*

ICAO Doc 9869 – PBCS Manual

What is PBCS?

Performance-Based Surveillance

Surveillance based on performance specifications applied to the provision of air traffic services.

Includes surveillance performance requirements allocated to system components:

- *surveillance to be provided;*
- *associated data delivery time*
- *continuity, availability, integrity, accuracy, safety and functionality*

ICAO Doc 9869 – PBCS Manual

What is PBCS?

Required Communication Performance (RCP) Specification

A set of requirements for air traffic services provision and associated ground equipment, aircraft capability, and operations needed to support performance-based communication.

Required Surveillance Performance (RSP) Specification

A set of requirements for air traffic services provision and associated ground equipment, aircraft capability, and operations needed to support performance-based surveillance.

ICAO Doc 9869 – PBCS Manual

ICAO PROVISIONS FOR PBCS

ICAO Provisions

Asia-Pacific Economic Cooperation

Chicago Convention

Annexes to the Convention

Procedures for Air Navigation Services (PANS)

Manuals and other Guidance Material

ICAO Provisions

- **Address the need for appropriate means** to quantify, measure and improve system performance

- **Provide a framework** that assures that the required level of communication and surveillance performance is managed in accordance with globally accepted specifications (RCP/RSP)

- **Mitigate safety risks** - misapplying current evolving ATM operations to inappropriate aircraft pairs

PBCS Provisions

Asia-Pacific Economic Cooperation

- **PBCS, RCP and RSP**
  - *PBCS Framework (Prescription, Approval and Monitoring)*
  - *Continuity, Integrity, Availability and Safety Requirements*
- **Application (services and messages)**
  - *Functionality, Content, and Procedures*
- Medium and Network
  - *Various media and the network supporting them*

PBCS Framework

- *Prescription of RCP and RSP* for air traffic services that are predicated on communication and surveillance performance ***(Annex11)***
- *Approval of aircraft and operators* for a communication and/or surveillance capability including aircraft equipage for operations where RCP and/or RSP specifications have been prescribed ***(Annex 6)***
- *Indication of an aircraft's communication and surveillance capability and performance* in the form of RCP/RSP specifications in the flight plan ***(PANS-ATM)***
- *Monitoring programmes to assess actual communication and surveillance performance* against RCP and RSP specifications ***(Annexes 6 and 11)***
- *Corrective actions,* as applicable, for the appropriate entity ***(Annexes 6 and 11)***.

Performance-Based Separation

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10 November 2016

Lateral Separation Minimum (LatSM)

	COM	NAV	SUR
30 NM	-	RNP4	-
50 NM	-	RNP4 or 10	-

	COM	NAV	SUR
23NM	RCP240	RNP4	RSP180
50 NM	-	RNP4 or 10	-

Longitudinal Separation Minimum (LongSM)

	COM	NAV	SUR
10 Min	See Note 1	See Note 2	Procedural Position Report
50 NM	**Direct pilot-controller communications** (DCPC: Voice or CPDLC)	RNP10	
30 NM	CPDLC	RNP4	ADS-C
50 NM	CPDLC	RNP4 or 10	ADS-C

	COM	NAV	SUR
10 Min	See Note 1	See Note 2	Procedural Position Report
50 NM	**Direct pilot-controller communications** (DCPC: Voice or CPDLC)	RNP10	
5 Min	RCP240	RNP4	RSP180
30 NM	RCP240	RNP4	RSP180
50 NM	RCP240	RNP4 or 10	RSP180

Note1. Suitable to comply with the requirements for position reporting contained in 4.11 of Doc 4444.
Note2. Navigation aids permitting frequent determination of position and speed.

Separation minimum applicable only to PBCS capable aircraft

PBN Provisions

Asia-Pacific Economic Cooperation

Annex 10
Annex 11

- Standards and Recommended Practices (SARPS) for Performance-based Navigation Systems
- SARPS for application of PBN in ATM

PANS-OPS (Doc 8168)
PANS-ATM (Doc 4444)

- Procedures for the application of RNAV and RNP specifications to aircraft operations and ATM services

PBN Manual (Doc 9613)

- PBN concept and implementation guidance for Aeronautical Regulatory Authorities, ANSPs, Aircraft Operators

PBCS Provisions

Asia-Pacific Economic Cooperation

Annex 6
Annex 11

- Prescription of RCP and/or RSP for the provision of ATS
- Approval for aircraft and operators
- PBCS monitoring and information/data exchange

PANS-ATM (Doc 4444)

- ATM services requiring RCP/RSP (e.g. performance-based separation minima)
- Flight planning requirements

PBCS Manual (Doc 9869)

- Development of new specifications
- PBCS framework implementation guidance for Aeronautical Regulatory Authorities, ANSPs, CSPs, Operators, Monitoring agencies
- Content of RCP and RSP specifications

Data Link Application Provisions

Asia-Pacific Economic Cooperation

Annex 10 Vol II

- Functional requirements of ATS data link
- Operational procedures on the use of ATS data link

PANS-ATM (Doc 4444)

- Communication requirements for ATS services Operational procedures on the use of ATS data link
- Data link phraseology (i.e. CPDLC Message Set)

GOLD Manual (Doc 10037)

- Overview of ATS data link applications
- Guidance for State, ATSP, CSP and Operators for planning and implementation of data link
- Controller/pilot procedures and recommended use of associated CPDLC messages

Operational Authorization

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Aircraft Operator

7.1.3 For operations where communication equipment is required to meet an RCP specification for performance-based communication (PBC) , an aeroplane shall, in addition to the requirements specified in 7.1.1:

a) be provided with communication equipment which will enable it to operate in accordance with the prescribed RCP specification(s);

b) have information relevant to the aeroplane RCP specification capabilities listed in the flight manual or other aeroplane documentation approved by the State of Design or State of Registry; and

c) have information relevant to the aeroplane RCP specification capabilities included in the MEL.

Note.— Information on the performance-based communication and surveillance (PBCS) concept and guidance material on its implementation are contained in the Performance-based Communication and Surveillance (PBCS) Manual *(Doc 9869).*

Civil Aviation Authority

7.1.4 The State of the Operator shall, for operations where an RCP specification for PBC has been prescribed, ensure that the operator has established and documented:

a) normal and abnormal procedures, including contingency procedures;

b) flight crew qualification and proficiency requirements, in accordance with appropriate RCP specifications;

c) a training programme for relevant personnel consistent with the intended operations; and

d) appropriate maintenance procedures to ensure continued airworthiness, in accordance with appropriate RCP specifications.

Operational Authorization

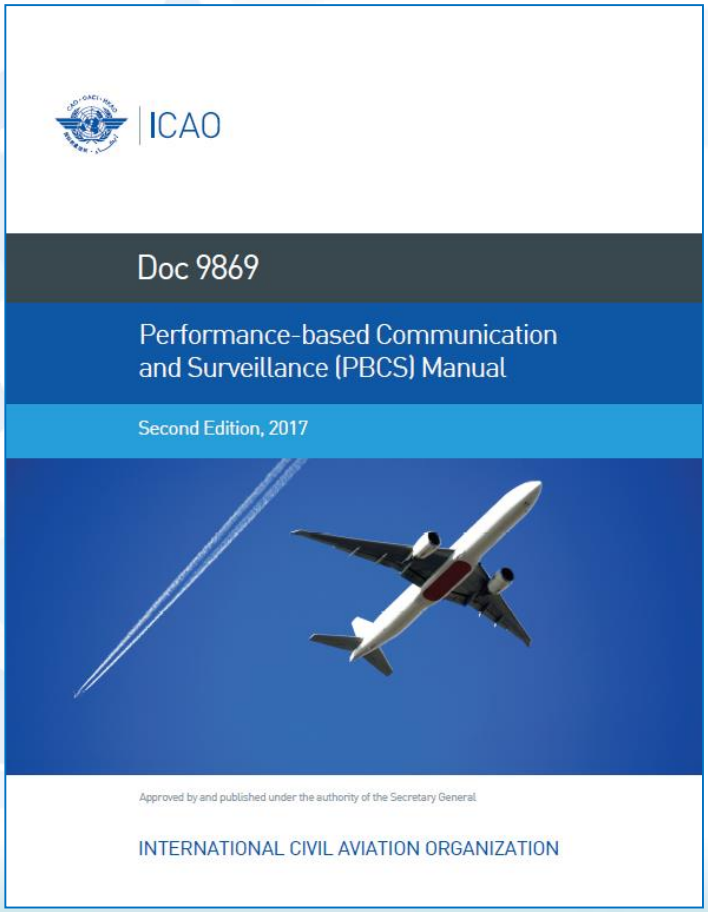
Civil Aviation Authority

7.1.5 The State of the Operator shall ensure that, in respect of those aeroplanes mentioned in 7.1.3, adequate provisions exist for:

a) receiving the reports of observed communication performance issued by monitoring programmes established in accordance with Annex 11, Chapter 3, 3.3.5.2; and

b) taking immediate corrective action for individual aircraft, aircraft types or operators, identified in such reports as not complying with the RCP specification(s).

Operational Authorization



- **Chapter 4. Complying with RCP/RSP specifications**
  - Guidance for CAAs
  - Initial compliance determination and related approvals
  - Flight plan requirements
  - Continued operational compliance

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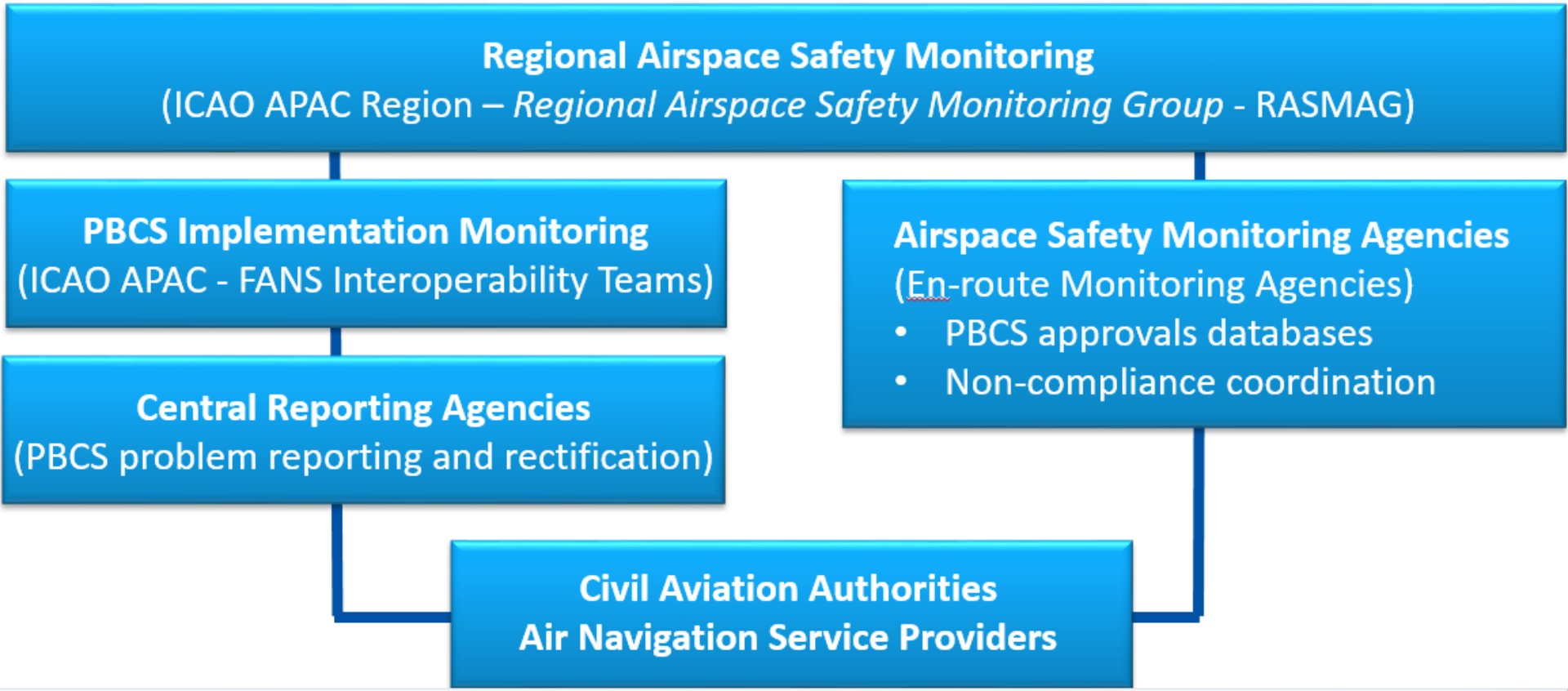
PBCS IMPLEMENTATION MONITORING

Monitoring Programmes

Asia-Pacific Economic Cooperation



ICAO Asia/Pacific PBCS Implementation

Asia-Pacific Economic Cooperation

FIT-Asia PBCS Planning Chart (Administrations with FIR/s)

	Task Group	Task ID	TASK descriptor			State	Afghanistan	Bangladesh	Cambodia	China	Hong Kong China	India	Indonesia	DPR Korea	Republic of Korea	Lao PDR	Malaysia	Myanmar	Maldives	Mongolia	Nepal	Pakistan	Philippines	Sri Lanka	Singapore	Thailand	Viet Nam
PBCS Implementation Task List	Group A	A-1	AIP (Prescription of an RCP/RSP specification)							X			X										X		X		
		A-2	ANSP (PBCS policies, objectives supporting safety oversight)							X													X		X		
		A-3	Operator and aircraft System- PBCS policies, objectives supporting safety oversight							X													X		X		
		A-4	Regional Supplementary Procedures (Doc. 7030) for PBCS operations , if applicable							X							X								X		X
	Group B	B-1	PBCS Implementaion Plan							X			X										X		X		
		B-2	Target dates for PBCS and relevant ATM operations							X			X										X	X	X		X
		B-3	RCP/RSP specifications							X			X										X	X	X		X
		B-4	PBCS awareness							X			X										X	X	X		X
	Group C	C-1	Operational concepts and procedures for PBCS operations							X			X										X		X		X
		C-2	ATC automation changes to use flight plan RCP/RSP indicators							X			X		X								X		X		X
		C-3	ATC automation changes for PBCS monitoring										X										X		X		
		C-4	Confirm initial ANSP compliance with RCP/RSP specifications							X			X										X		X		X
	Group D	D-1	Aircraft operator readiness																				X		X	X	X
		D-2	Confirm initial operator and/or aircraft type/system compliance with RCP/RSP																				X		X	X	X
	Group E	E-1	PBCS monitoring - post implmentation							X			X										X		X		
Does your State submit data link problem reports to a recognized Central Reporting Agency (CRA)										X						X							X		X		X
Cmmunication Specifications & Interoperatability Standards	Normal	RCP240	FANS1/A CPDLC							X			X										X		X		X
	Alternate	RCP400	SATVOICE													X											
		RCP400	HF										X			X											
Surveillance Specifications & Interoperatability Standards	Normal	RSP180	FANS1/A ADS-C							X			X										X		X		X
	Alternate	RSP400	SATVOICE													X											
		RSP400	HF										X			X											
			ADS-B																						X		
Navigation Specifications & Applicable ATM Operations	RNAV/RNP	RNAV/RNP 10	50 NM Lateral Separation								X		X			X				X		X	X	X	X		X
			50 NM Longitudinal Separation								X		X							X		X	X		X		X
		RNP 4	30 NM Longitudinal Separation																								X
			30 NM Lateral Separation (pre-existing std)																								X
			23 NM Lateral Separation (new std)																								X
		RNP2	30NM Climb-Descend Through																								
			20NM Lateral Climb-Descend Through	NOT YET SURVEYED																							
			07 - 15 NM VHF Lateral Separation	NOT YET SURVEYED																							
			8NM VHF Climb-Descend Through	NOT YET SURVEYED																							

ICAO Asia/Pacific PBCS Implementation

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PBCS Planning Chart (Non-FIT-Asia Administrations)

	Task Group	Task ID	TASK descriptor	Applicable Airspace: Australia	Fiji	French Polynesia	Japan	Nauru	New Caledonia	New Zealand	Papua New Guinea	Solomon Islands	United States	
PBCS Implementation Task List		A-1	AIP (Prescription of an RCP/RSP specification)										X	
	Group A	A-2	ANSP (PBCS policies, objectives supporting safety oversight)		X					X			X	
		A-3	Operatpr and aircraft System- PBCS policies, objectives supporting safety oversight		X					X			X	
		A-4	Regional Supplementary Procedures (Doc. 7030) for PBCS operations , if applicable	X			X			X			X	
	Group B	B-1	PBCS Implementaion Plan		X		X			X			X	
		B-2	Target dates for PBCS and relevant ATM operations		X		X			X			X	
		B-3	RCP/RSP specifications	X	X		X			X			X	
		B-4	PBCS awareness		X		X			X			X	
	Group C	C-1	Operational concepts and procedures for PBCS operations		X		X			X			X	
		C-2	ATC automation changes to use flight plan RCP/RSP indicators							X			X	
		C-3	ATC automation changes for PBCS monitoring	X			X			X			X	
		C-4	Confirm initial ANSP compliance with RCP/RSP specifications		X					X			X	
	Group D	D-1	Aircraft operator readiness	X						x			X	
		D-2	Confirm initial operator and/or aircraft type/system compliance with RCP/RSP	X									X	
	Group E	E-1	PBCS monitoring - post implmentation							x			X	
Does your State submit data link problem reports to a recognized Central Reporting Agency (CRA)				X			X			X			X	
Cmmunication Specifications & Interoperatability Standards	Normal	RCP240	FANS1/A CPDLC	X			X			X			X	
	Alternate	RCP400	SATVOICE							X			X	
		RCP400	HF	X						X			X	
Surveillance Specifications & Interoperatability Standards	Normal	RSP180	FANS1/A ADS-C	X			X			X			X	
	Alternate	RSP400	SATVOICE							X			X	
		RSP400	HF	X						X			X	
	ADS-B													
Navigation Specifications & Applicable ATM Operations	RNAV/RNP	RNAV/RNP 10	50 NM Lateral Separation	X			X			X			X	
			50 NM Longitudinal Separation	X			X			X			X	
		RNP 4	30 NM Longitudinal Separation	X			X			X			X	
			30 NM Lateral Separation (pre-existing std)	X			X			X			X	
			23 NM Lateral Separation (new std)	X										
		RNP2	30NM Climb-Descend Through										X	
			20NM Lateral Climb-Descend Through	NOT YET SURVEYED										
			07 - 15 NM VHF Lateral Separation	NOT YET SURVEYED										

PBCS Charter

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FANS-CRA.COM

De-identified | Report | Performance | PBCS Charter | Contact Us | ICAO APAC

- Raise problem reports against the FANS1/A System
- View problem reports
  - Raised by or assigned to the stakeholder; or
  - De-identified problem reports
- View information on system performance
- **Sign up to the PBCS Charter**

PBCS Charter

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Charter Stakeholders

- Aircraft Manufacturers and Aircraft Equipment Suppliers
- Communication Service Providers and Satellite Service Providers
- ANSP and CAA
- Aircraft Operators

ICAO Asia/Pacific Region CAAs/ANSPs

ANSP and CAA

- Airways New Zealand
- NAV Portugal
- Japan Air Navigation Service
- Airports Fiji Limited
- DECEA Brazil
- DGAC-Chile
- CAA Philippines
- FAA (United States)
- ISAVIA ANS (Iceland)
- ATMB of CAAC (China ANSP)
- NATS (United Kingdom)
- NAV CANADA
- AirNav Indonesia

Summary

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- Performance-Based Separation
  - Traffic Growth
  - Performance-based standards, procedures and specifications to support overall system safety and efficiency
  - the CNS Loop
- What is PBCS?
- ICAO Provisions for PBCS
  - Annexes, PANS, Guidance Material, USOAP
- PBCS Implementation Monitoring
  - ICAO Asia/Pacific Region Implementation
- PBCS Charter

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Advancing Free Trade for Asia-Pacific Prosperity

What are the Benefits of PBCS?

TPTWG Workshop

Presented by
Michael Watkins, FAA Senior Air Traffic Representative – Asia Pacific

Topics

Air Mass and Jet Streams

Air Route Structure

Routing Options - ASPIRE

Benefits

Airspace

Actions

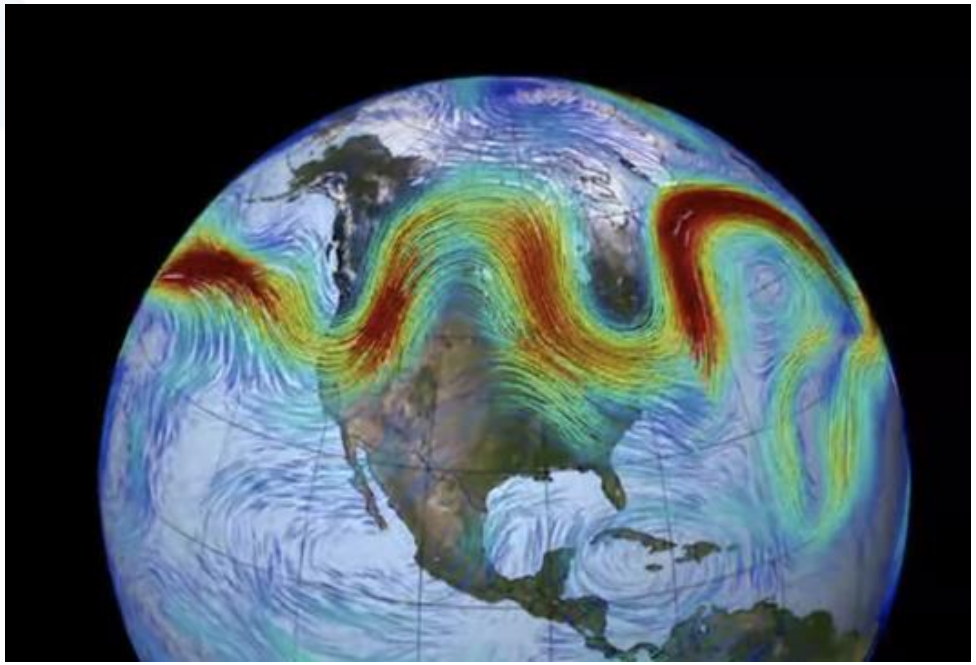
Air Mass

Asia-Pacific Economic Cooperation

Aircraft move with the air around them

Enroute
- Tailwinds - good
- Headwinds - bad

Takeoff and Landing
- Headwinds - good
- Tailwinds - bad



Jet Stream

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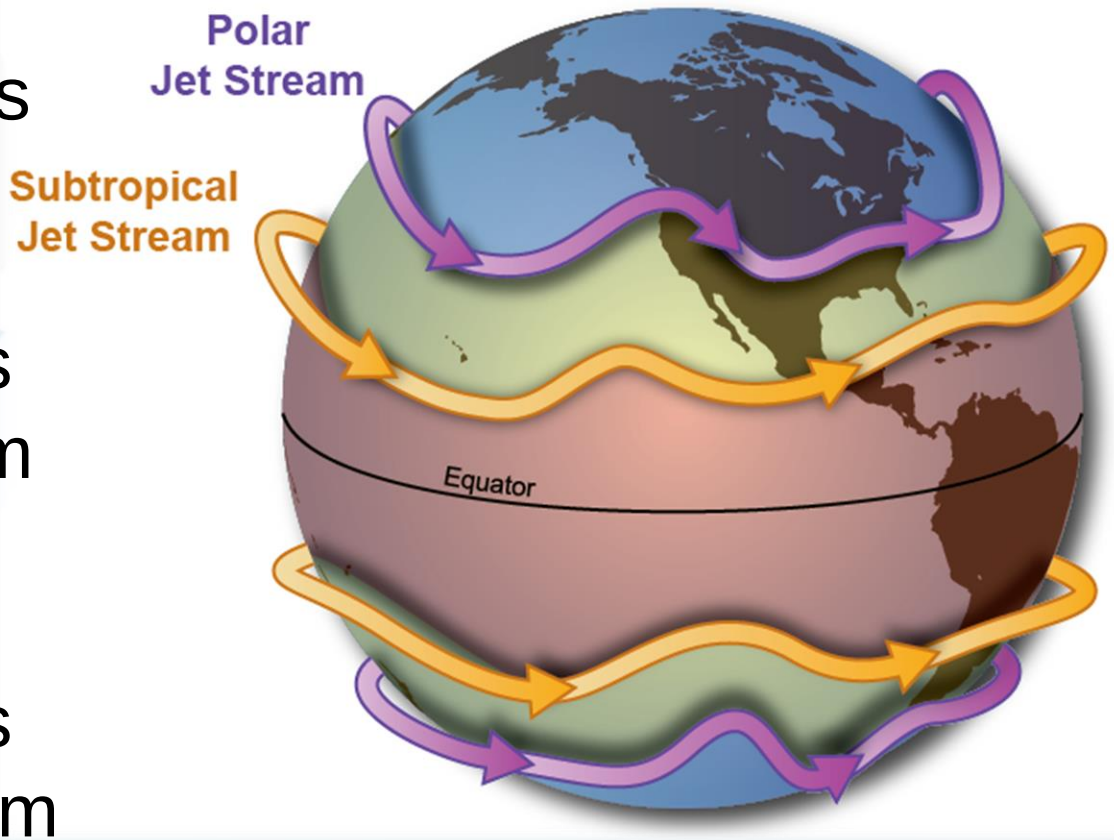
Jet Streams are predictable currents of fast moving air

West to East flights fly in the Jet Stream when possible

East to West flights avoid the Jet Stream



Jet Stream

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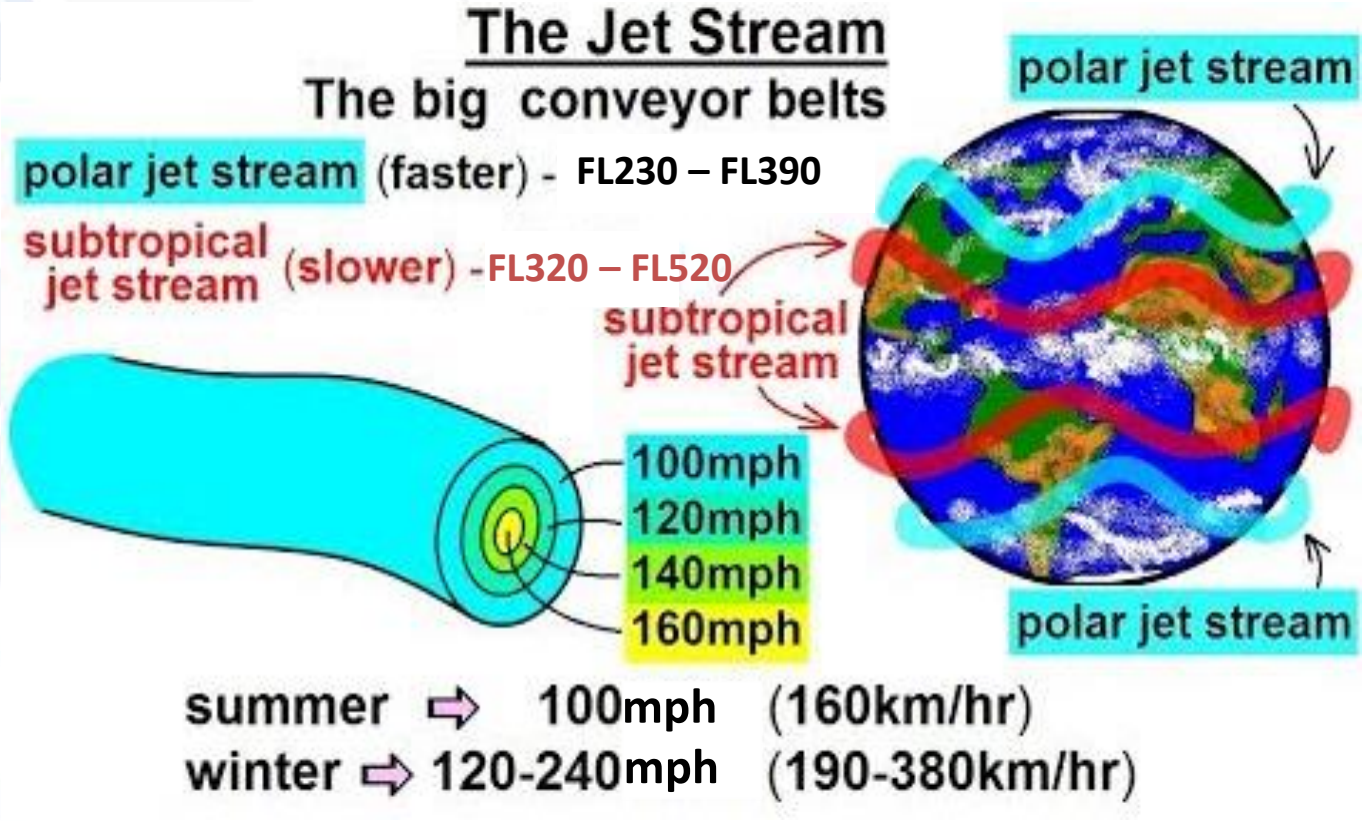


Effective Jet Stream use can reduce flight time of a long haul flight by an hour or more!

Air Route Structure

Air routes designed to minimize distance

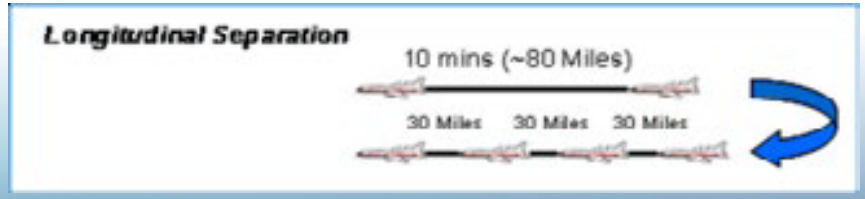
A few are adjusted daily for winds

Operators flight plan to minimize time and cost

Routing Options - ASPIRE

A 2008 partnership between the FAA, Airways New Zealand , Air Services Australia, AEROTHAI, CAAS, JANS and airlines to reduce aviation's impact on the environment
Disbanded in 2018 after implementing many safety and efficiency improvements including:

- User-Preferred Routes (UPRs)
- Dynamic Airborne Reroute Procedure (DARP)
- Reduced Oceanic Separation



Real PBCS Benefits

Aircraft flying with PBCS approvals and lower RSP and RCP values can fly closer together

More aircraft can optimize flight paths for winds, routing, flight levels, and weather avoidance

Improves airspace efficiency, capacity, and safety

Reduces aircraft fuel burn and carbon emissions

Reduces system delay and improves schedule performance

Real PBCS Benefits

Asia-Pacific Economic Cooperation

PBCS reduces verbal transmissions and improves situational awareness

Reduces verbal miscommunication, particularly for non-native English speakers

Improves remote airspace situational awareness

Allows earlier conflict detection and resolution

Simplifies Quality Assurance Assessments

PBCS Airspace

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Currently the only PBCS exclusive airspace is the North Atlantic High Level Airspace (NAT HLA)

Air Traffic Services working with airlines to develop PBCS required routes

Non-PBCS aircraft operators may receive sub optimal routing or flight levels in the future

Why Now?

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- ICAO implementation date has past
- Most aircraft are equipped
- Airspace is ready
- Some routes developing for PBCS only
- Soon non-approved aircraft given reroutes, delays, or sub-optimal flight levels
- Less efficient flights are less competitive
- Allows the development of future ASPIRE type measures

This workshop provides head start for Regulators, Aircraft Operators, and Air Traffic Services

Action Required

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Action required if your registered aircraft will fly in PBCS airspace

PBCS supports new procedures which improve efficiency, safety and reduce environmental impact

In accordance with the ICAO PBCS Provisions	In accordance with domestic regulations	
CIVIL AVIATION AUTHORITY RESPONSIBILITY	**ANSP RESPONSIBILTY**	**OPERATOR RESPONSIBILTY**
❑ Establishes PBCS policies for ANSP, operator, airworthiness, etc. ❑ Prescribes RCP/RSP specifications in the applicable airspace for the relevant operations ❑ Publishes PBCS requirements in aeronautical information publication (AIP)	❑ Provides RCP/RSP-compliant services ❑ Recognizes RCP/RSP capabilities in air traffic control (ATC) automation ❑ Establishes PBCS monitoring program	❑ Files RCP/RSP capabilities in flight plan in accordance with State PBCS policy ❑ Participates in ANSP PBCS monitoring programs

Inaction places your airlines at a competitive disadvantage!

For Aircraft Operators

Asia-Pacific Economic Cooperation

The performance-based communication and surveillance (PBCS) framework allows for higher safety standards and more efficient airspace use

Equipped aircraft also require regulatory approval.

When all aircraft in an airspace have a lower RSP value and a lower RCP value, ANSPs can optimize routing

Saves time and money while enhancing safety and reducing carbon emissions

Conclusion

- PBCS Implementation improves Safety and Efficiency
- Actions are required, even if you are not managing PBCS airspace
- PBCS supports future airspace developments
- Failure to act will result in less efficient routes for your aircraft operators

Ask questions during the rest of the workshop!

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Advancing Free Trade for Asia-Pacific Prosperity

Day 1 Recap of PBCS: Putting it All Together

Presented by

Shane Sumner, Regional Officer, Air Traffic Management, ICAO
Michael Watkins, FAA's Senior Representative for ATO in Asia Pacific

Day 1 Wrap-up

Asia-Pacific Economic Cooperation

PBCS Framework:

- **Addresses the need for appropriate means** to quantify, measure and improve system performance

- **Provides a framework** that assures that the required level of communication and surveillance performance is managed in accordance with globally accepted specifications (RCP/RSP)

- **Mitigates safety risks** - misapplying current evolving ATM operations to inappropriate aircraft pairs

Day 1 Wrap-up

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PBCS Benefits

- Aircraft flying with PBCS approvals and lower RSP and RCP values can fly closer together.
- More aircraft can optimize flight paths for winds, routing, flight levels, and weather avoidance
- Improves airspace efficiency, capacity, and safety
- Reduces aircraft fuel burn and carbon emissions
- Reduces system delay and improves schedule performance

Or…

Enhances safety, Saves Money and Time and Helps Preserve the Global Environment

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Advancing Free Trade for Asia-Pacific Prosperity

PBCS: An Implementation Outline

Day 2

Presented by
Theresa Brewer, United States, ICAO PBCS Project Team lead

Objective

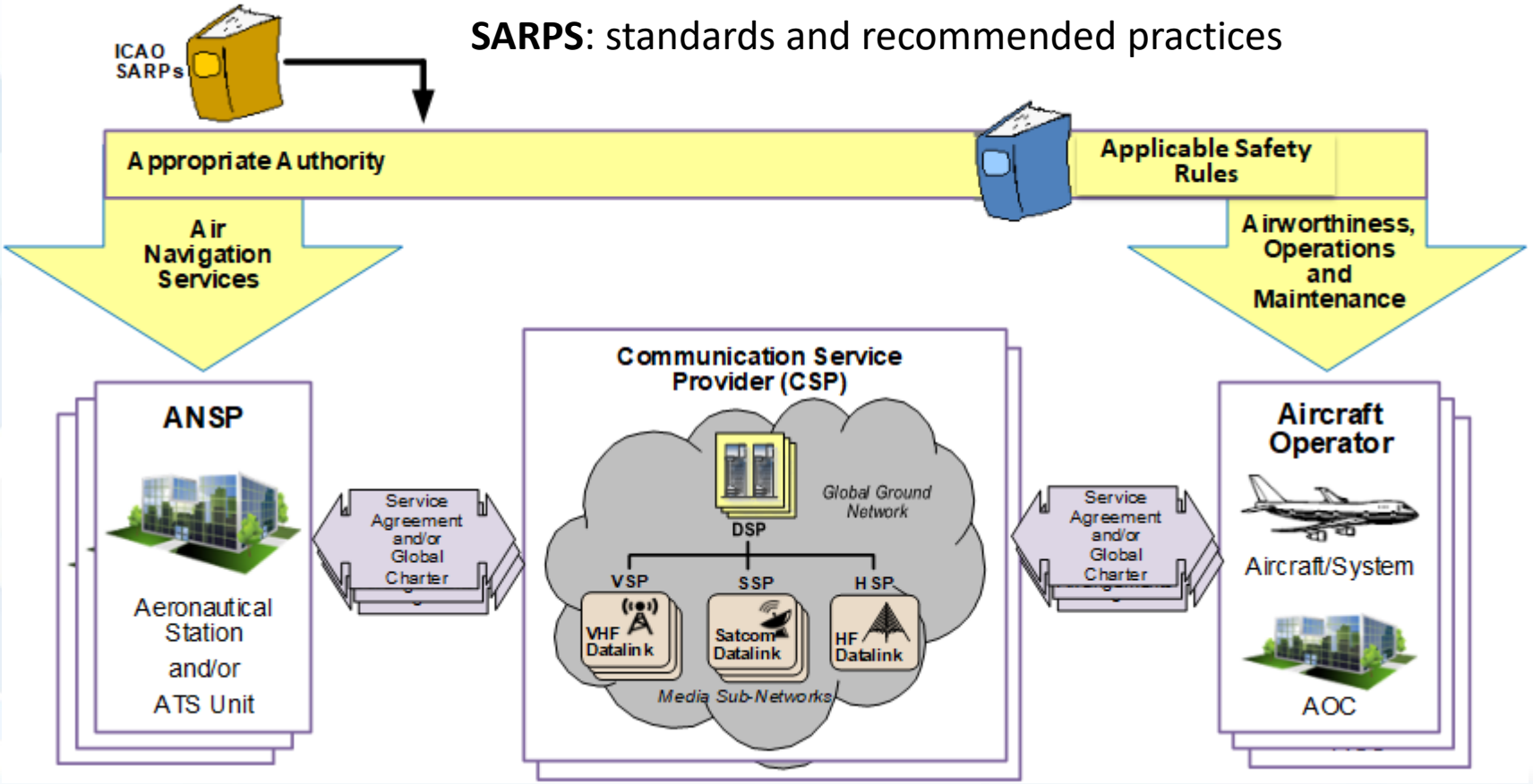
This presentation will provide:

- an overview of the PBCS framework
- an outline of the implementation tasks by stakeholder type
  - civil aviation authority (CAA)
  - air navigation service provider (ANSP)
  - aircraft operator
- information to help each stakeholder determine their PBCS responsibilities
- a brief introduction to the importance of monitoring
- information on how the communication service provider (CSP) is addressed in the PBCS framework

The PBCS Framework

Asia-Pacific Economic Cooperation

SARPS: standards and recommended practices



ANSP: air navigation service provider
ATS: air traffic services

DSP: datalink service provider
VSP: VHF subnetwork provider
HSP: HF subnetwork provider
SSP: Satellite service provider

AOC: aeronautical operational control

Implementation Tasks

Group A tasks — CAA/region preparation;

Group B tasks — air navigation services provider (ANSP) general project development and management;

Group C tasks — ANSP implementation activities – air traffic services (ATS) provision;

Group D tasks — Aircraft operator, aircraft type/system (airworthiness) eligibility; and

Group E tasks — All stakeholders – post-implementation monitoring.

ICAO Document 9869, Edition 2, PBCS Manual, Appendix A

Group A Tasks – CAA

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What responsibilities does your CAA have for PBCS?

1. Does your **ANSP** provide or plan to provide an ATM operation that has an associated required communication performance (RCP) and/or required surveillance performance (RSP)?
   - **see Annex 11** (paragraphs 2.8.1-2.8.2, 2.9.1-2.9.3, 3.3.5.2-3.3.5.3, 6.1.1.2)
   - **see ICAO Document 4444** (paragraphs 5.4.1.2.1.6, 5.4.2.9.2)

   YES – you will need to work with your ANSP to develop PBCS policy/plan for safety oversight of the relevant ATM operation and ensure the applicable RCP and/or RSP is identified in the Aeronautical Information Publication (AIP) or equivalent; move to question 2

   NO – you have no ANSP oversight responsibilities, move to question 2 (next slide)

Group A Tasks – CAA

What responsibilities does your CAA have for PBCS?

2. Do your **Operators** fly in any airspace where one or more ATM operations that have an associated RCP and/or RSP are provided?
   - **see Annex 6** (Part I, paragraphs 7.1.3-7.1.5, 7.3.2-7.3.4; Part II, paragraphs 2.5.1.6-2.5.1.9, 2.5.3.2-2.5.3.5)

YES – you will need to develop PBCS policy for operational approval of your operators and issue authorizations to operators/aircraft, where the requirements are met

NO – this is an unlikely response

Group B/C Tasks – ANSP

What responsibilities does your ANSP have for PBCS?

1. Do you provide an ATM operation that has an associated RCP and/or RSP?
   - **see Annex 11** (paragraphs 2.8.1-2.8.2, 2.9.1-2.9.3, 3.3.5.2-3.3.5.3, 6.1.1.2)
   - **see Doc 4444** (PANS-ATM) (paragraphs 5.4.1.2.1.6, 5.4.2.9.2)

   YES – you will need to develop PBCS policy and implementation plan and ensure the applicable RCP and/or RSP is identified in the Aeronautical Information Publication (AIP) or equivalent

   NO – determine whether your operation may still benefit from a monitoring program

Group B/C Tasks – ANSP

What responsibilities does your ANSP have for PBCS?

2. Do your current or future plans for ATM operations include the use of data link or SATVOICE?

   YES – consider whether a monitoring program would provide benefit for identifying performance or safety issues, and stay tuned for developments of RCP for ATM operations enabled by voice technologies such as SATVOICE

   NO – PBCS may not be of interest to you at the current time

Group D Tasks – Operator/Aircraft

What responsibilities does your company have for PBCS?

1. Do you operate in airspace where an ATM operation that has an associated RCP and/or RSP is provided and would your operations benefit from utilizing them?
   - **Review relevant AIPs**

   YES – you will need to consult your CAA to determine the policy for obtaining necessary authorization, and if there is no policy in place, work with them to develop one

   NO – PBCS may not be of interest to you at the current time

Group E Tasks – Monitoring

Asia-Pacific Economic Cooperation

Who has responsibilities related to PBCS monitoring?

- Every **CAA** with ANSP providing ATM operations enabled by PBCS
- Every **CAA** with one or more Operators flying in airspace providing ATM operations enabled by PBCS
- Every **ANSP** providing ATM operations enabled by PBCS (all ANSPs using data link would benefit from a monitoring program)
- Every **operator** with authorization or seeking authorization to participate in ATM operations enabled by PBCS
- Every **communication service provider (CSP)** providing service in airspace where ATM operations enabled by PBCS are offered
- Every **aircraft/avionics manufacturer** with aircraft eligible or authorized for an RCP/RSP

Group E Tasks – Monitoring

Asia-Pacific Economic Cooperation

What is the purpose of the monitoring?

- ✓ Ensure continued compliance of the airspace
- ✓ Ensure continued compliance of each aircraft
- ✓ Ensure continued compliance of each CSP and subnetwork
- ✓ Report, investigate, resolve problems
  - Correction of inefficient/incorrect settings at aircraft, CSP, ANSP level
  - Development of aircraft software fixes
  - Development of ground and network automation fixes/improvements
  - Development of improvements to technical and interoperability standards
  - Development of improved procedures and training

What about the CSP?

- Compliance of CSP performance is crucial to end-to-end performance and is assured through ANSP and operator because no direct safety oversight requirements exist under current Annex provisions
  - **ATS provision and aircraft operation are subject to the certification and/or safety management system (SMS) requirements under Annexes 6, 11 and 19**
- PBCS framework initially intended to ensure compliance via contractual arrangements but challenges include:
  - Significant cost/effort to re-negotiate individual contracts currently in place between CSPs and each operator/ANSP
  - No ability to clearly isolate contribution by CSP from that of aircraft and certain ground implementations, as well as by subnetworks (i.e. Satellite, VHF data link, HF data link)

PBCS Global Charter

- Developed as an **alternate** means of compliance for CSP "contract/agreement" needed for operator and ANSP approval
- Facilitates cooperation among all PBCS stakeholders to achieve PBCS objectives
- Hosted on the www.FANS-CRA.com website where stakeholders will go to sign and obtain proof of respective CSP signature, as required by approval process

❖ A change of charter membership by any stakeholder may affect status of authorization/eligibility of other stakeholders

Charter Stakeholders

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Aircraft Manufacturers and Aircraft Equipment Suppliers

- Boeing
- Gulfstream
- Collins Aerospace (Flight Test)
- Bombardier / Learjet
- Airbus

Communication Service Providers and Satellite Service Providers

- Inmarsat
- Iridium
- GoDirect
- SITAONAIR
- ADCC
- AVICOM JAPAN CO., LTD.
- ARINCDirect
- Collins IMS (ARINC)

ANSP and CAA

- Airways New Zealand
- NAV Portugal
- Japan Air Navigation Service
- Airports Fiji Limited
- DECEA Brazil
- DGAC-Chile
- CAA Philippines
- ISAVIA ANS (Iceland)
- ATMB of CAAC (China ANSP)
- FAA (United States)
- NAV CANADA
- NATS (United Kingdom)
- AirNav Indonesia

Aircraft Operators

https://www.fans-cra.com/charter/stakeholders/

Key Points

- Stakeholders should carefully assess their PBCS responsibilities and identify applicable group(s) of PBCS implementation tasks
  - More details on specific tasks will be provided in following presentations
- The monitoring is an integral component of the overall PBCS framework
- The PBCS Global Charter is an important tool in achieving initial compliance for CSP oversight, and ensuring continued compliance of end-to-end system performance
  - All major data link CSPs, aircraft manufacturers and aircraft equipment suppliers are signatories
  - All ANSPs providing performance-based ATM operations are signatories

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Advancing Free Trade for Asia-Pacific Prosperity

PBCS: An Operator's Perspective

Day 2

Presented by
Blair Cowles, Regional Director
Safety and Flight Operations - ASPAC

Enhancing Aviation Efficiency and Safety

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Every dollar/mile/kg counts

"If you want to be a millionaire,
start with a billion dollars and launch a new airline"

Richard Branson

2020 Overview

Asia-Pacific Economic Cooperation

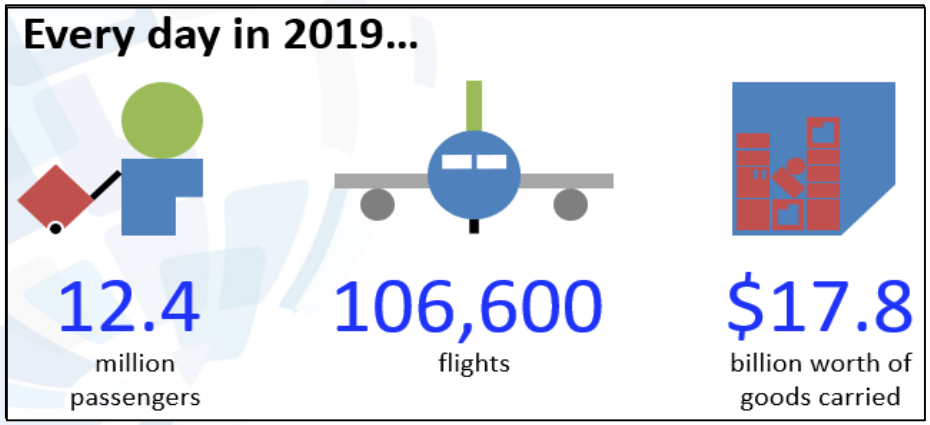
AN INDUSTRY IN CRISIS

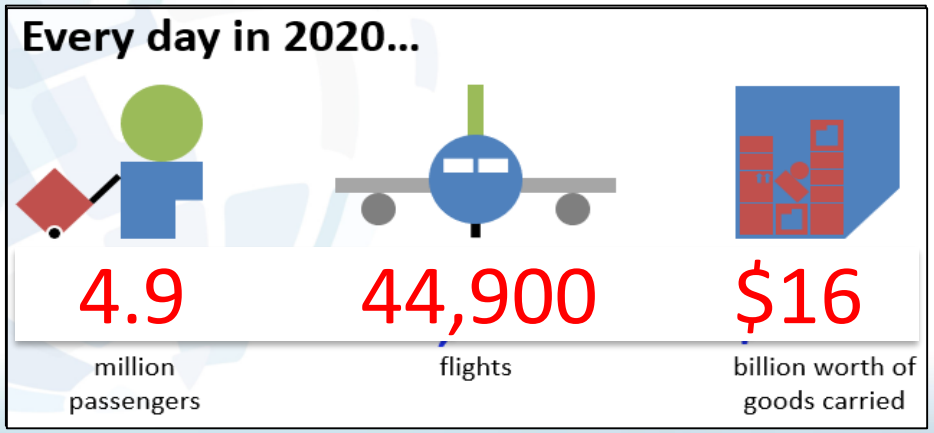
TOTAL LOSSES IN 2020: $118 BILLION

DEMAND: DOWN 61% vs 2019

2020 Overview

Asia-Pacific Economic Cooperation

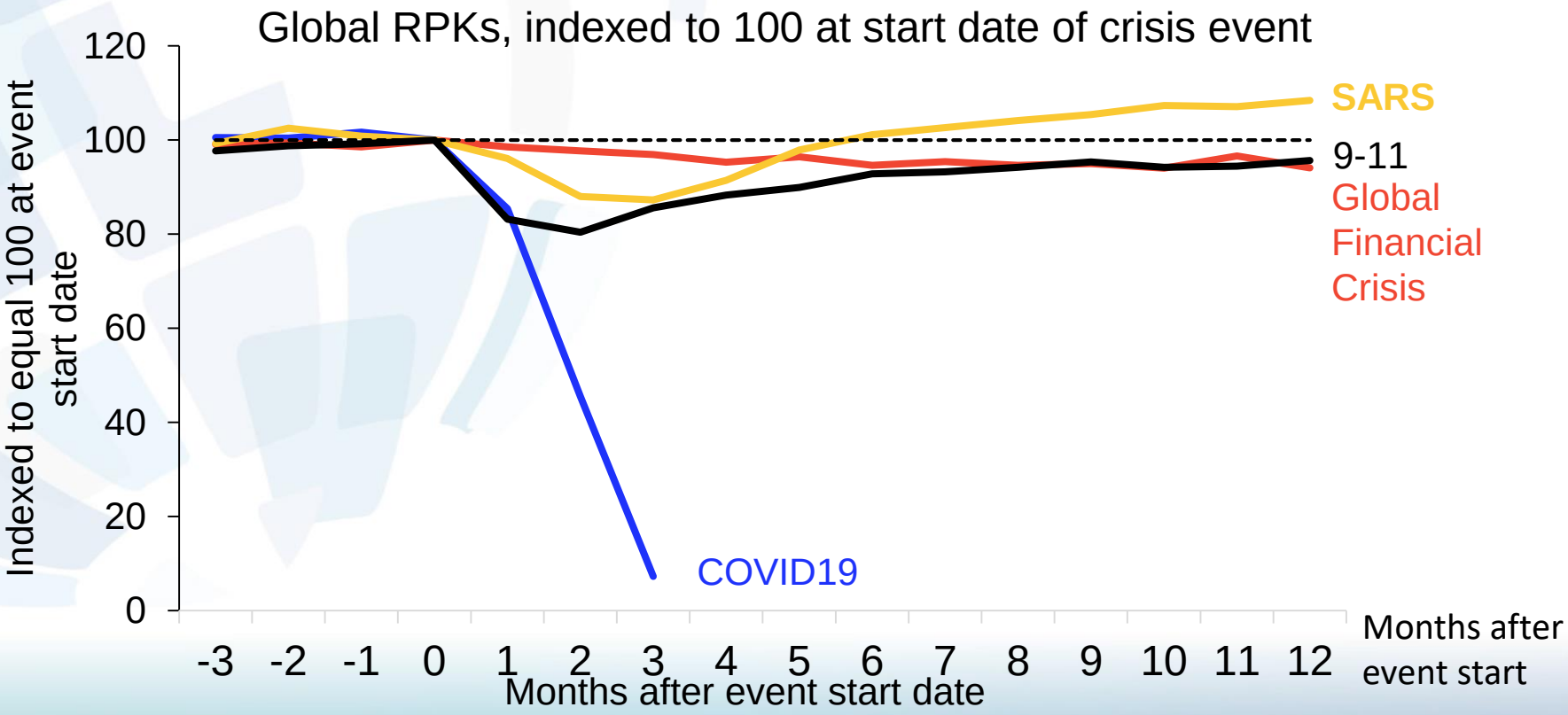




COVID19 Impact - RPKs

Asia-Pacific Economic Cooperation

RPKs fell 20% after 9-11, 12% after SARS, 95% in April 2020



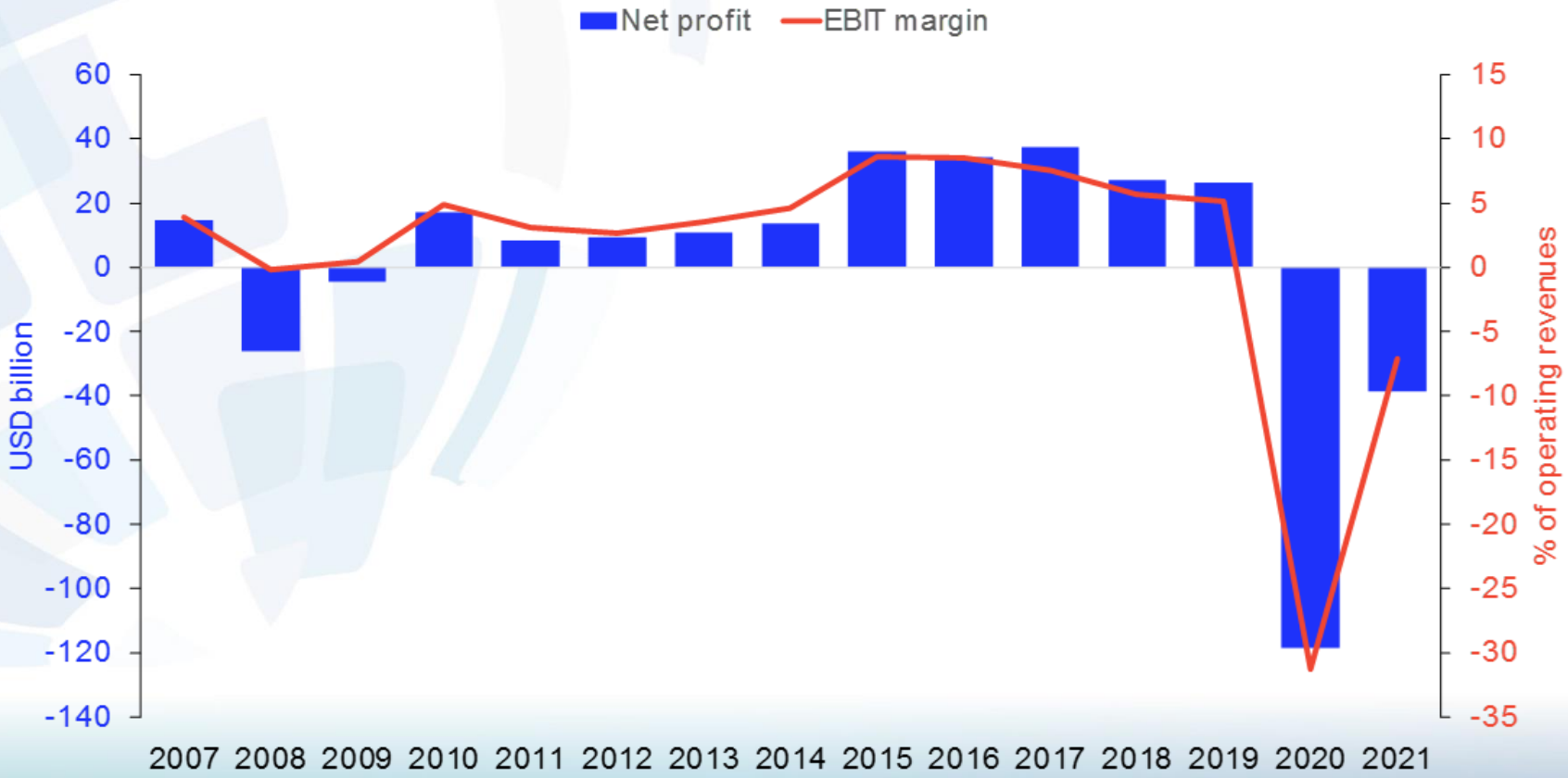
RPK: Revenue Passenger Kilometers

Source: IATA Economics using data from IATA Statistics

COVID19 Impact - Revenues

Asia-Pacific Economic Cooperation

After $118 billion net loss in 2020 we forecast further losses of $38 billion in 2021



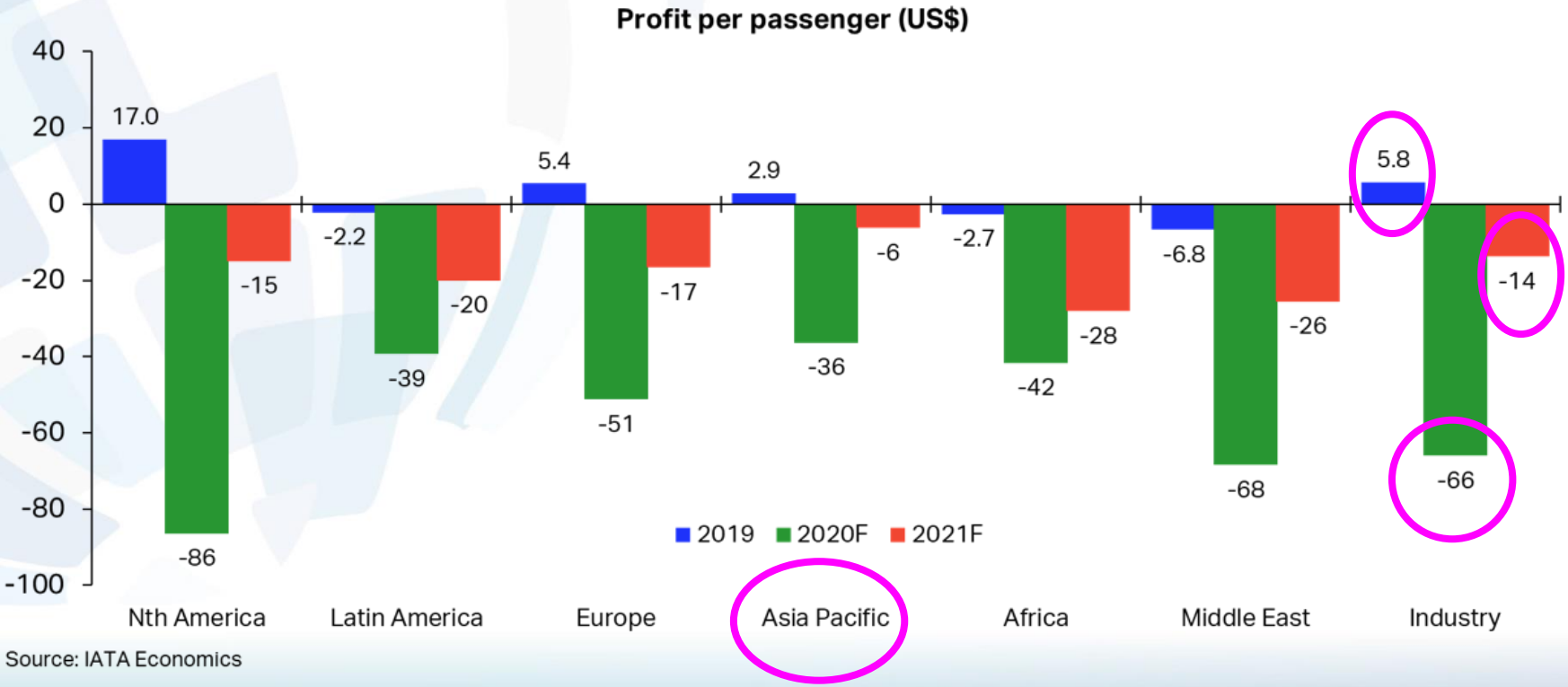
EBIT: Earnings Before Interest and Taxes

Source: IATA Economics 12 January 2021 update

COVID19 Impact - Profits

Asia-Pacific Economic Cooperation

Per passenger (net) losses show regional variation

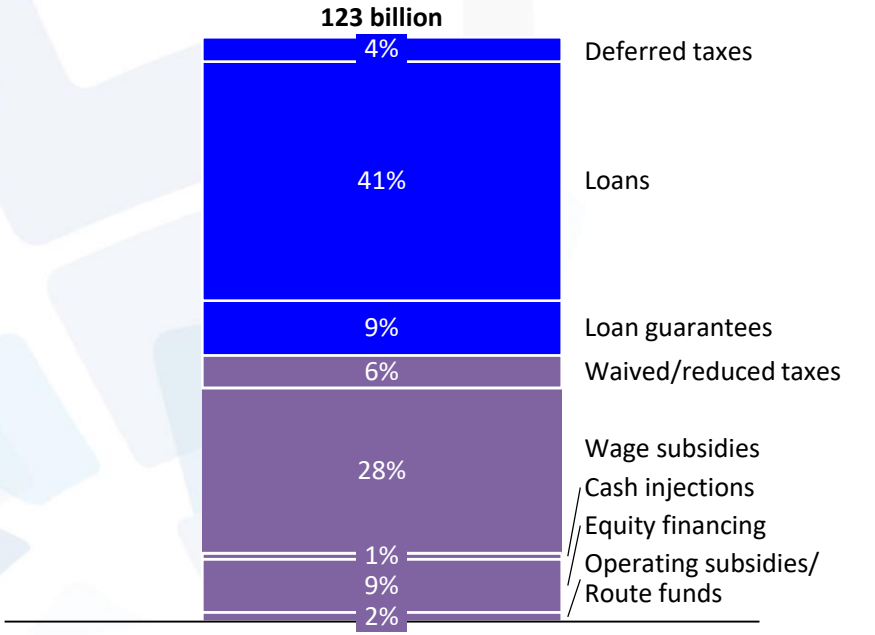


Source: IATA Economics

COVID19 Impact – Government Aid by Type

Asia-Pacific Economic Cooperation

Majority of aid will leave airlines with more debt



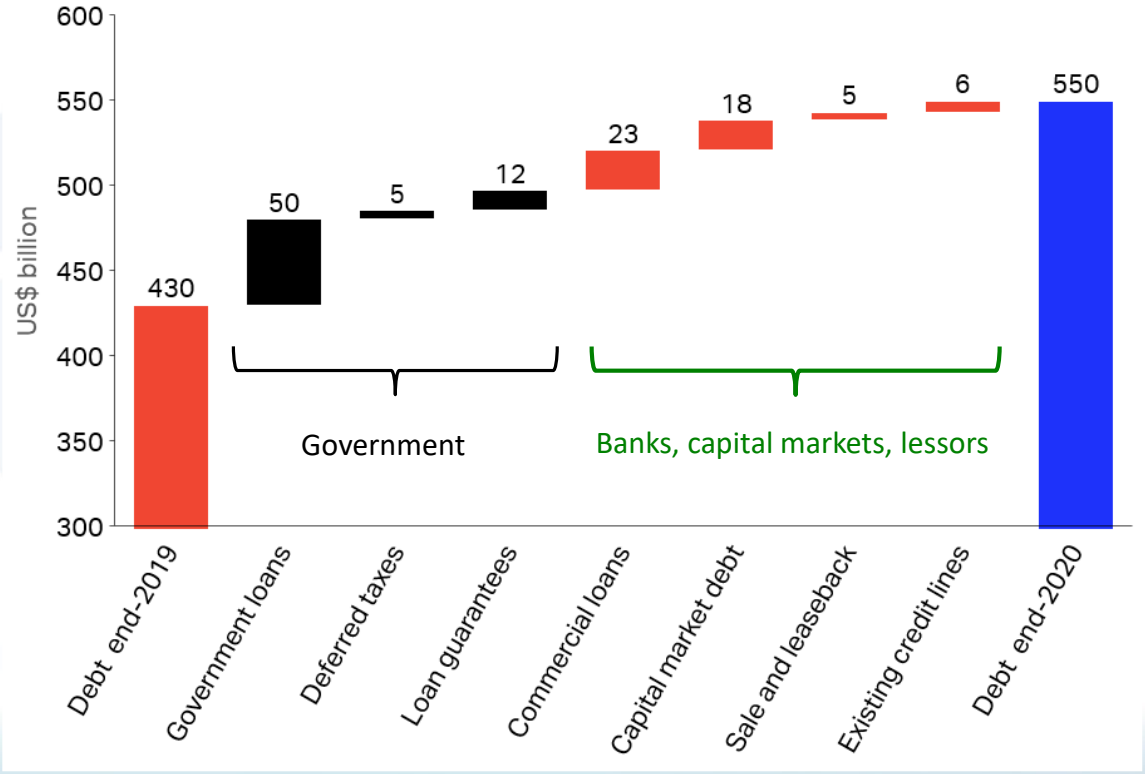
USD 67 billion of aid creates new liabilities

$67bn or 55% of Government aid creates debt – only $11bn of equity

COVID19 Impact – Net Debt Build Up 2020

Asia-Pacific Economic Cooperation

Airlines will enter 'restart' with very high levels of debt

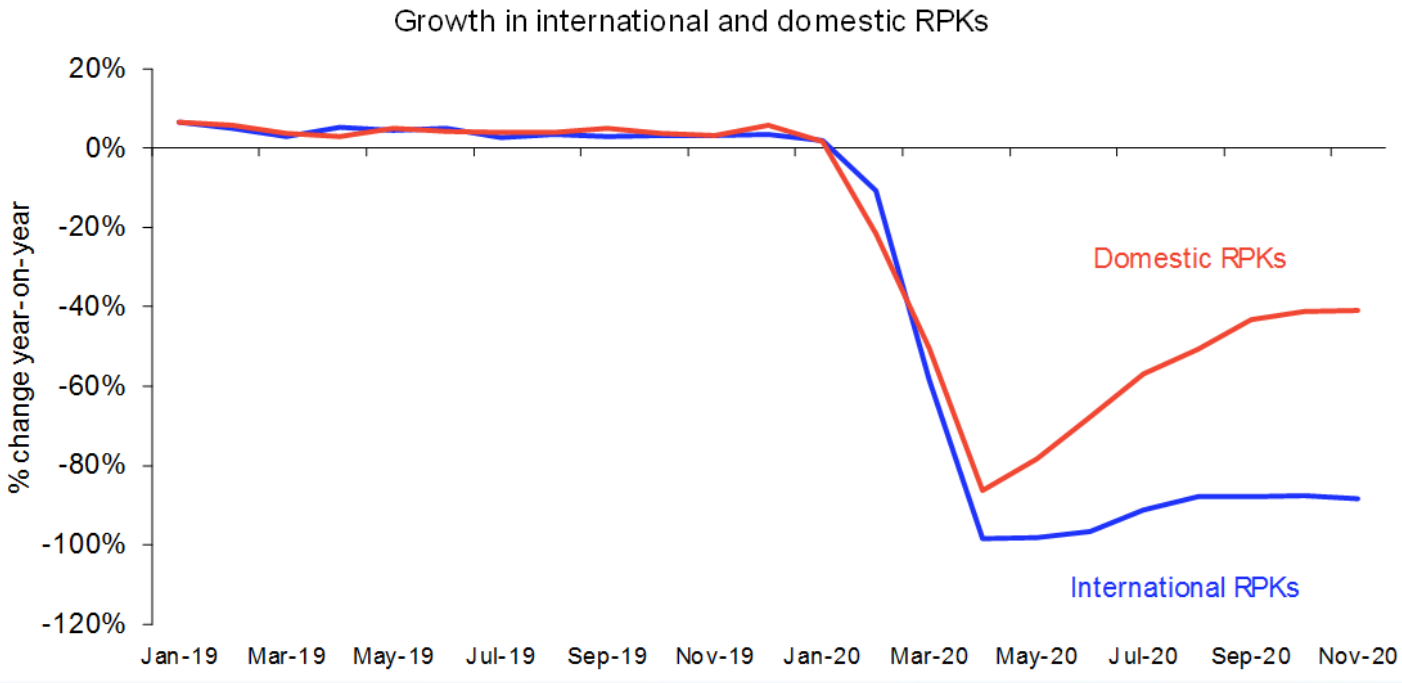


US$120bn rise in debt but <$30bn new equity ($11bn from Govt)

COVID19 Impact - Travel

Asia-Pacific Economic Cooperation

November: international traffic down 88%, while the domestic recovery halted at -41% year-on-year



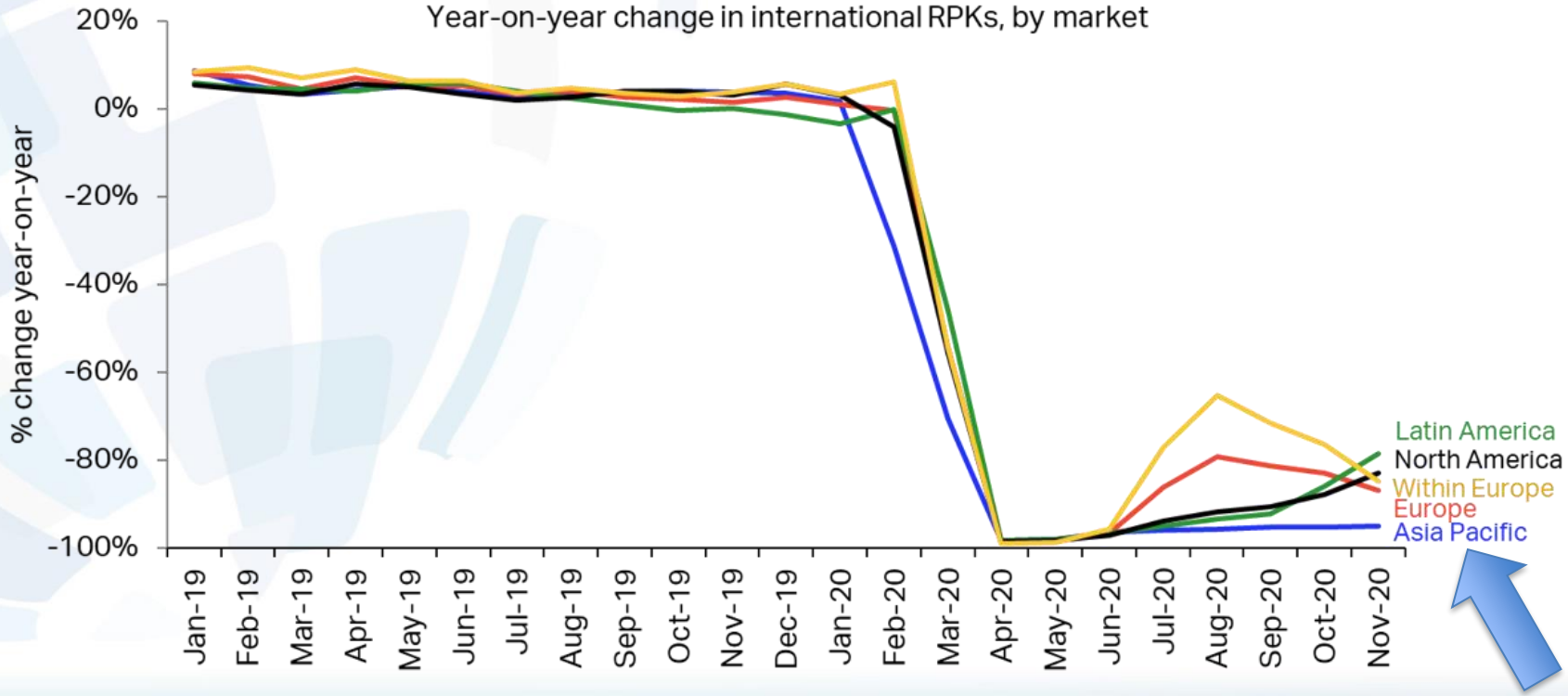
Rising COVID-19 cases stopped further progress

Source: IATA Economics using date from IATA statistics

COVID19 Impact - Travel

Asia-Pacific Economic Cooperation

International traffic in Asia Pacific worst performing



Rising COVID-19 cases stopped further progress

RPK: Revenue Passenger Kilometers

Source: IATA Economics

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Why is all this so important?

Global Air Transport Industry

Asia-Pacific Economic Cooperation

87.7 million

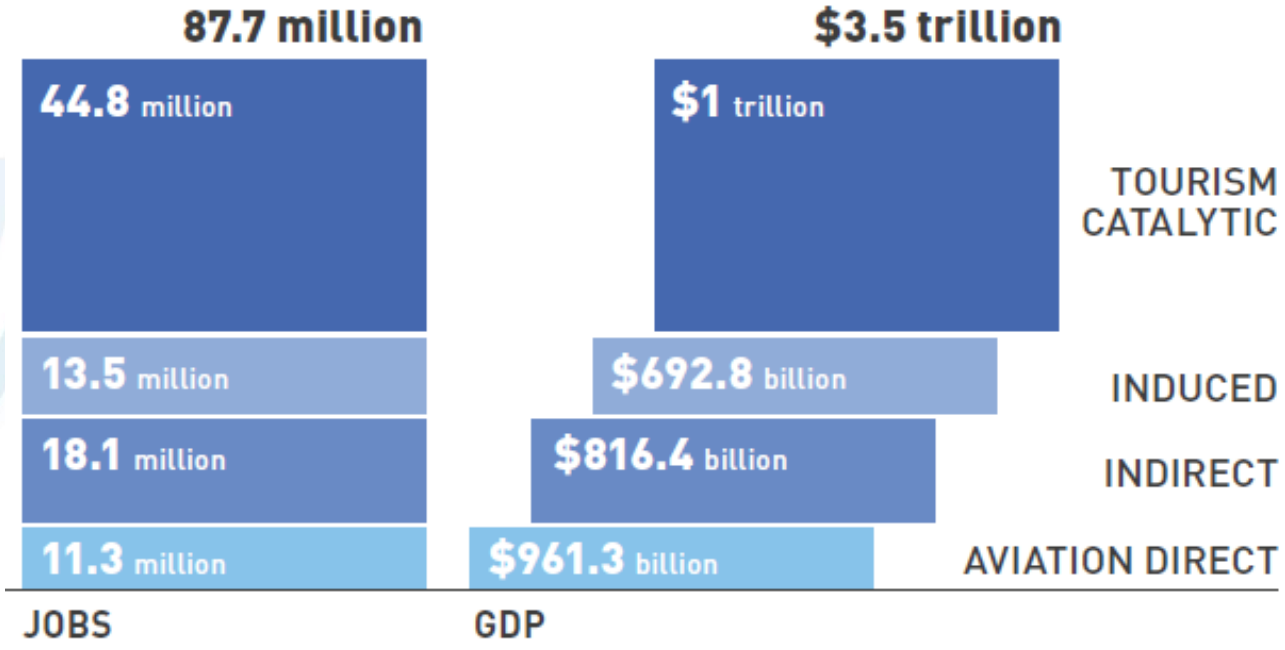
Jobs supported by aviation worldwide

$3.5 trillion

Aviation's global economic impact (including direct, indirect, induced and tourism catalytic)

4.1%

Global GDP supported by aviation



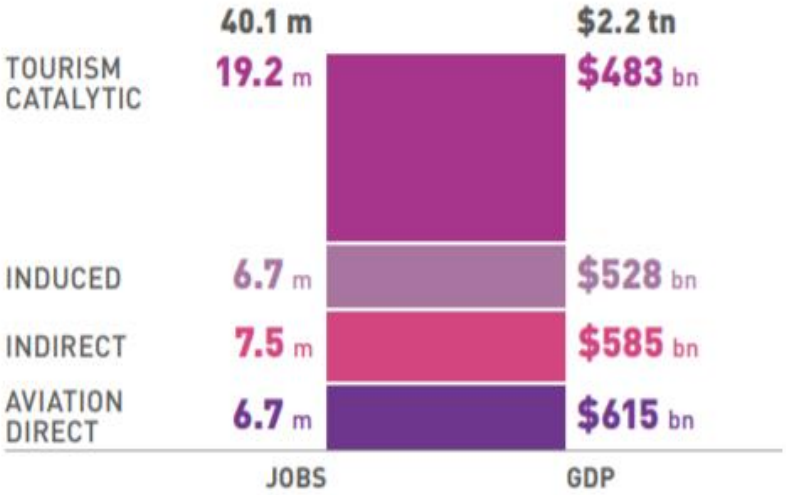
Source: IATA

COVID19 Impact - APEC

Asia-Pacific Economic Cooperation

Air transport across the APEC economies

Total jobs and GDP generated by air transport in the APEC economies, 2018.



2.7 billion passengers[213]

59% share of global passenger traffic

473 airlines

1,924 airports

19,085 aircraft in service

Enhancing Aviation Efficiency and Safety

Asia-Pacific Economic Cooperation

Every dollar/mile/kg counts

- Airlines are in extremely perilous financial position
- ANSPs and regulators to do everything they possibly can to help airlines save costs and stay in business
- PBCS is a key efficiency enabler that helps airlines to fly as cost effectively as possible

Enhancing Aviation Efficiency and Safety

Asia-Pacific Economic Cooperation

- The absence of a PBCS regulatory framework may put an economy's airlines at a competitive disadvantage
- And potentially impact the system as a whole if PBCS generated efficiencies cannot be fully utilized by other airlines
- We need the region's economies to be doing ***everything possible*** to create an aviation ecosystem that allows operators to save every dollar/mile/kg they can

Thank you

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Advancing Free Trade for Asia-Pacific Prosperity

PBCS: A Flight Operations Regulator's Perspective

Day 2

Presented by
Scott Bender (FAA Aviation Safety)
Shawn Silverman (FAA Aviation Safety Contractor)

Purpose/Overview

Asia-Pacific Economic Cooperation

Provide an understanding of the PBCS requirements as it pertains to the authorization

We will discuss...

- **Requirements**
- **Authorization**
- **Aircraft**
- **Operator**

Requirements

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International Civil Aviation Organization (ICAO)

Document ID	Description
Annex 6	Operation of Aircraft
Part I	Commercial Air Transport
Part II	General Aviation - Aeroplanes
Part III	Operations - Helicopters
Annex 11	Air Traffic Services
Annex 15	Aeronautical Information Services
Doc 4444	PANS – Air Traffic Management
Doc 8400	PANS – Abbreviations and Codes

Supporting Documents

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International Civil Aviation Organization

Document ID	Description
Doc 9869	Performance-based Communications and Surveillance (PBCS) manual, Edition 2
Doc 10037	Global Operational Data Link (GOLD) Manual, Edition 1
Doc 10063	Manual on Monitoring the Application of Performance-based Horizontal Separation Minima, Edition 1

ICAO Operational Authorization Guide - PBCS

https://www.icao.int/airnavigation/pbcs/PublishingImages/Pages/Operatinal-authorization/PBCS%20Operational%20Authorization%20Guide_V1.0_Final.pdf

How the FAA Meets the Requirements

- FAA AC 90-117 Datalink Communications
- FAA AC 20-140C Guidelines for Design Approval of Aircraft Data Link Communication Systems Supporting Air Traffic Services (ATS)
- Datalink Communications Compliance Guide
- Other documents applicable to Data Link Authorizations
  - ICAO Global Operational Data Link Document (GOLD)
  - ICAO Doc 9869 (Manual on Required Communication Performance)
  - ICAO Oceanic Errors Safety Bulletin
  - FAA Orders
  - FAA Inspector Guidance (e.g. Notices)

Authorization

Operational authorization should be a specific approval obtained from an assessment of the following:

- Aircraft eligibility and airworthiness
- Maintenance and operations procedures for data link systems
- Means of ensuring compliance of contracted services
- Procedures for participation in PBCS monitoring and problem reporting (PBCS Global Charter - http://www.fans-cra.com/)
- Procedures to control of configuration of aircraft systems, software, and communications subnetworks
- Training of flight crew, dispatchers, and maintenance

Authorization Example

Asia-Pacific Economic Cooperation

U.S. Department of Transportation
Federal Aviation Administration

14 CFR Part 91 Operations

Letter of Authorization
Data Link Communications

1. The operator XYZ Aviation is authorized to conduct data link communications in accordance with the limitations and provisions of this Letter of Authorization (LOA).

2. Authorized Aircraft and Equipment for Data Link Communications. The operator is authorized to conduct data link communications using the following aircraft and FAA-certified data link communication systems with the selected performance specified in Table 1:

Table 1 - Authorized Aircraft and Equipment for Data Link Communications

Aircraft M/M/S	Data Link System			Subnetworks	CSP	RCP	RSP	Limitations
	Manufacturer	Model	INTEROP Designator					
BD-700-1A10	Honeywell	IC-810	FANS 1/A (+) with push to load	SATCOM Inmarsat	Rockwell Collins/ARINC	RCP 240	RSP 180	N/A

3. Pilot Training. The operator must provide training for pilots using data link communications. This training is conducted by Computer Training Systems (CTS). Pilots must be knowledgeable of and comply with:

(a) All provisions applicable to the use and operation of the installed data link system; and

(b) Flight planning designators and requirements.

PBCS Global Charter

- Under ICAO guidance, Air Navigation Service Providers (ANSP), Operators and Communications Service Providers (CSP) are required to ensure adequate performance via a contract.
- Charter membership serves as a means of compliance for operator/CSP contract and/or service agreements
- Developed in response to CSP concerns:
  - Significant cost/effort to re-negotiate current individual contracts between operator/CSP as well as each ANSP
  - Many contributors affecting performance are outside of the CSP domain/control
- Facilitates cooperation among all PBCS stakeholders to achieve PBCS objectives
- Operators must remain as Charter members or notify their authorizing agency of change of status

→ A change of charter membership status affects operational authorization

Aircraft

- Aircraft manufacturer or equipment supplier should demonstrate that aircraft system meets the required communication performance (RCP)/required surveillance performance (RSP) specifications allocated to the aircraft system as contained in the PBCS Manual (Doc 9869)

- Demonstration of compliance with the RCP and RSP specifications should be specific to each individual airframe or the combination of the aircraft type and configuration

Aircraft Statement of Compliance

Asia-Pacific Economic Cooperation

AIRBUS

A321
AIRPLANE FLIGHT MANUAL

LIMITATIONS

INFORMATION SYSTEMS

Network	ICAO designator of aircraft datalink system	Applications	Subnetwork used	ATC datalink performance
ACARS	FANS 1/A +	CPDLC	- VDL Mode A - SATCOM - If installed : VDL Mode 2(1)	RCP 240
			If installed : HFDL	No RCP demonstrated (2)
		ADS-C	- VDL Mode A - SATCOM - If installed : VDL Mode 2(1)	RSP 180
			If installed : HFDL	No RSP demonstrated (2)

(1) *The VDL Mode 2 supports the multiple frequency capability.*

(2) *HFDL is used as a supplementary communication means in addition to VHF and SATCOM datalink means.*

Aircraft systems involved in ATC datalink performance as mentioned in the above table, are compliant with RCP 240 and RSP 180 requirements allocated to aircraft as specified in the ED-122/DO-306 and as prescribed in the Performance-Based Communication and Surveillance (PBCS) Manual (ICAO Doc 9869). Nevertheless, some ANSPs may decide to exclude subnetwork as acceptable means for a given RCP/RSP specification.

Compliance with the above does not constitute an operational approval. Such authorization must be obtained by the operator from the appropriate authorities.

Operator

Operator eligibility should be determined by:

- Operational Procedures
  - Establish procedures for normal and non-normal data link system use and problem reporting
- Training
  - Flight crew and other personnel (dispatch and maintenance) are proficient with PBCS operations
- CSP Compliance
  - Ensure that contracted CSPs comply with the RCP/RSP specification allocations as well as monitoring, recording and notification (PBCS Charter)

Operator *(continued)*

Asia-Pacific Economic Cooperation

Operator eligibility should be determined by:

- Participation in PBCS Monitoring
  - Establish a process to participate in local and/or regional PBCS monitoring
- Flight Planning
  - Ensure that the planned use of communication and surveillance capabilities for the flight are in accordance with regulations, policies and procedures in control areas for the flight as published guidance
  - Ensure that the proper information indicating PBCS operational authorization for RCP/RSP capabilities is included in the ICAO flight plan

Key Points

- Civil Aviation Authorities should establish guidance for PBCS implementation. ICAO & FAA have examples of comprehensive job aides that should make the process easier

- Original Equipment Manufacturer's (OEM) Statement of Compliance (SOC) is basis for aircraft's capability

- PBCS Global Charter is vital to the success of the PBCS framework for all involved

- Training, procedures and proper flight plan filing/coding are the operators primary responsibilities

- Addressing poor monitoring performance is important to the success and safety of the PBCS process

Contact Info

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Day 2 Recap of PBCS: Putting it All Together

Presented by
Blair Cowles, Regional Director, Safety and Flight Operations, IATA
Scott Bender, Flight Standards, U.S. Federal Aviation Administration
Shawn Silverman, Flight Standards Support, U.S. Federal Aviation Administration

2020 Overview

Asia-Pacific Economic Cooperation

AN INDUSTRY IN CRISIS

TOTAL LOSSES IN 2020: $118 BILLION

DEMAND: DOWN 61% vs 2019

Day 2 Wrap-up

Asia-Pacific Economic Cooperation

The global air transport industry

87.7 million
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Aviation's global economic impact (including direct, indirect, induced and tourism catalytic)

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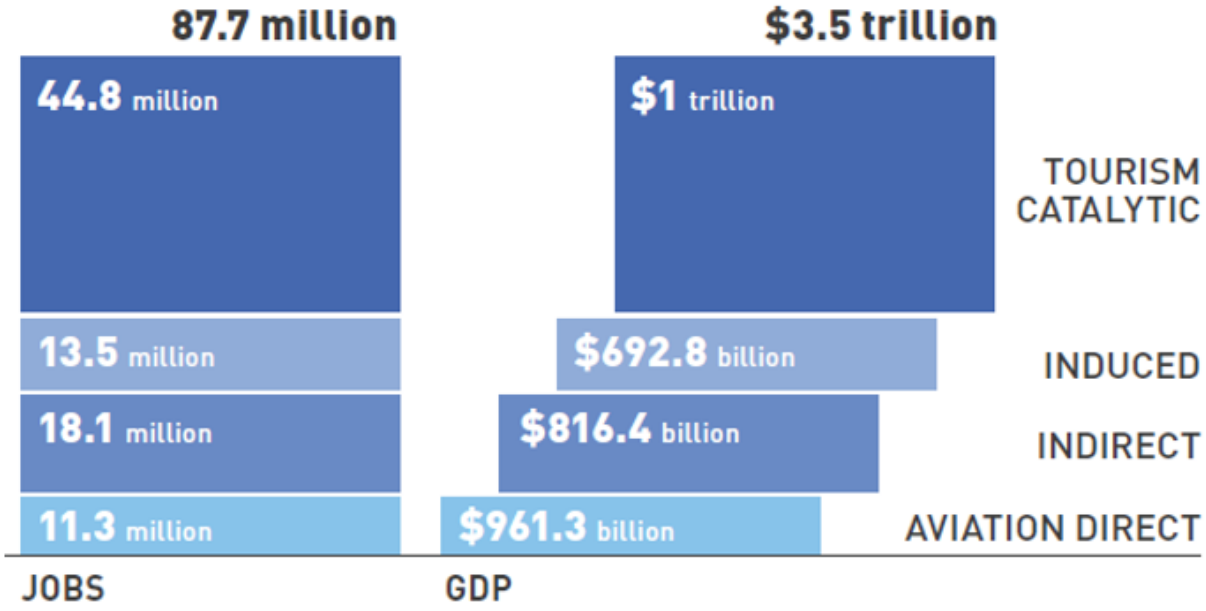
Global GDP supported by aviation



Source: IATA

IATA

Day 2 Wrap-up

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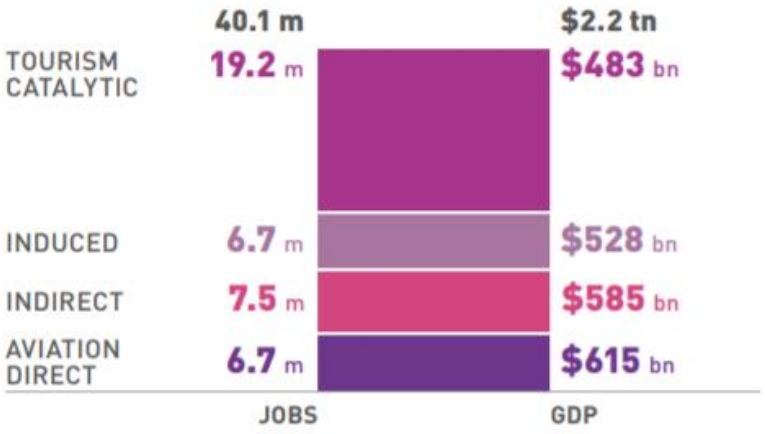
Every dollar, mile, and kg counts!

Total jobs and GDP generated by air transport in the APEC economies, 2018.



2.7 billion passengers[213]

59% share of global passenger traffic

473 airlines

1,924 airports

19,085 aircraft in service

Day 2 Wrap-up

- Civil Aviation Authority should develop a process and publish guidance for operators that desire to obtain a PBCS Operational Authorization
- ICAO & FAA have examples of comprehensive job aides that should make implementing a process easier
- Original Equipment Manufacturer's (OEM) Statement of Compliance (SOC) is basis for aircraft's capability
- PBCS Global Charter is vital to the success of the PBCS framework for all involved
- Training, procedures and proper flight plan filing/coding are the operators primary responsibilities
- Addressing poor monitoring performance is important to the success and safety of the PBCS process

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PBCS: An ANSP Perspective

DAY 3

Presented by
Paul Radford, Airways New Zealand

Objective

Asia-Pacific Economic Cooperation

This presentation will provide:

- A summary of guidance material and aids available to ANSP when implementing PBCS.
- An overview of an ANSP's implementation of PBCS.

Contents

- **Section 1** – Guidance Material and Implementation Aids
  - PBCS implementation plan (Doc 9869 PBCS Manual)
  - ANSP action list (RASMAG)
  - Datalink performance monitoring (RASMAG)
  - CRA website
- **Section 2** – Airways New Zealand PBCS Implementation
  - ATM system modifications
  - Oceanic SPR safety requirements
  - Online PBCS analysis tool
  - Post implementation monitoring and reporting

RASMAG: Regional Airspace Safety Monitoring Advisory Group

SPR: Safety and Performance Requirements

Section 1 – Guidance Material and Implementation Aids

Asia-Pacific Economic Cooperation

This section lists some of the guidance material and aids available to ANSP when implementing PBCS in their airspace.

PBCS Implementation - Guidance

- **PBCS Implementation Plan (Doc 9869 PBCS Manual Appendix A)**
  - Group B tasks – ANSP general project development and management;
  - Group C tasks – ANSP implementation activities – ATS service provision;
  - Group E tasks – All stakeholders – post-implementation monitoring.

- **Regional Airspace Safety Monitoring Advisory Group (RASMAG)**
  - ANSP action list (RASMAG/23 Report – Appendix C)
  - Conclusion RASMAG/24-2: Continuous Data Link Performance Monitoring

Doc 9869 PBCS Implementation Plan

Asia-Pacific Economic Cooperation

Group B tasks – ANSP general project development and management			
B-3	**RCP and RSP specifications**	**Identify and confirm applicable RCP/RSP specifications that will be used for operational implementation of communication and surveillance capabilities supporting specified ATM operation(s).**	**Chapter 3** **Appendix B** **Appendix C**
B-4	**PBCS awareness**	**Establish means to raise awareness on PBCS implementation in a particular region or airspace through workshops and distribution of information. Establish a planning team to work with ICAO and subject matter experts to develop relevant material.**	**Doc 9869** **Doc 10037** **Doc 10038**

Doc 9869 PBCS Implementation Plan

Asia-Pacific Economic Cooperation

Group C tasks – ANSP implementation activities – ATS provision			
C-1	Operational concepts and procedures for PBCS operations	Develop operational concepts for implementation of any ATM operation predicated on an RCP/RSP specification. Consider the following: a) applicable ATM operation(s); b) relevant interoperability requirements for communication and surveillance capabilities; c) provision for PBCS operations and appropriate RCP/RSP specifications; d) operating procedures for PBCS operations; e) operator/flight crew and/or ATS unit/controller contingency procedures when system degrades below that required by RCP/RSP specifications; and f) procedures for resuming specified ATM operation(s) after system is restored to an acceptable level of performance.	Doc 9869 Doc 10037 Doc 10038

Doc 9869 PBCS Implementation Plan

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Group C tasks – ANSP implementation activities – ATS service provision			
C-2	ATC automation changes to use flight plan RCP/RSP indicators	Implement changes to recognize and use flight plan RCP/RSP indicators to apply ATM operation(s) predicated on the RCP/RSP specifications only to eligible operators/aircraft, and/or adapt other system parameters, if applicable (e.g. set timer threshold values), based on different performance levels). This task should be complete prior to operational implementation of ATM operation(s) predicated on RCP/RSP specifications.	Chapter 4 Section 4.4

Doc 9869 PBCS Implementation Plan

Asia-Pacific Economic Cooperation

Group C tasks – ANSP implementation activities – ATS provision			
C-3	ATC automation changes for PBCS monitoring	Implement post-implementation monitoring capability in ATC automation. This task should be completed to obtain a sufficient sample to confirm ACP and ASP comply with RCP/RSP specifications prior to implementation of specified ATM operation(s).	Chapter 4 Section 4.5 Appendix D Appendix E

Doc 9869 PBCS Implementation Plan

Asia-Pacific Economic Cooperation

Group C tasks – ANSP implementation activities – ATS provision			
C-4	Confirm initial ANSP compliance with RCP/RSP specifications	Prior to operational implementation, confirm CPDLC and ADS-C comply with RCP/RSP specifications: a) measure actual performance against RCP/RSP specifications for compliance to support initial approval of ATS provision, including CSP/SSP service agreement, if applicable; b) identify any aspect of service performance that is not compliant with the RCP/RSP specifications; and c) take appropriate action to mitigate.	Chapter 4 Section 4.2.2 Section 4.3.1 Section 4.3.2 Appendix D Appendix E

Doc 9869 PBCS Implementation Plan

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Group E tasks – All stakeholders – post-implementation monitoring			
C-4	Confirm initial ANSP compliance with RCP/RSP specifications	On-going post-implementation data collection, monitoring, problem reporting and tracking, analysis and corrective action. When performance falls below specified levels, or problems are reported, operational judgment may be a consideration in determining appropriate actions.	Chapter 4 Section 4.5 Appendix D Appendix E Doc 9937 Doc 10063

RASMAG – ANSP PBCS Implementation Action Items

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1.1 Register on CRA website at www.fans-cra.com.

1.2 Establish means to extract FANS1A analysis data for CPDLC and ADS-C using guidance provided in ICAO Doc 9869 PBCS Manual Appendix D.

1.3 Filter extracted data FANS1A analysis data for CPDLC and ADS-C using guidance in PBCS Manual Appendix D.

1.4 Establish means to perform analysis of CPDLC RCP and ADS-C RSP at a suitable interval (usually monthly, but specific interval will be determined by local factors such as volume of data).

1.5 Investigate any performance degradation identified during monthly analysis.

1.6 Report non-compliance with RCP/RSP specifications to CRA.

1.7 Support CRA non-compliance investigations.

RASMAG – ANSP PBCS Implementation Action Items

Asia-Pacific Economic Cooperation

1.8 Report any aircraft that are filing as PBCS qualified but showing non-compliance with RCP and RSP 95% normal operating criteria to your CAA and RMA.

1.9 Withdraw the use of performance-based separation minima requiring PBCS where aircraft data link performance is not compliant with RCP and RSP 95% operating criteria.

1.10 Implement an analysis of service availability to determine the impact of reported unplanned outages in your airspace (usually annually).

1.11 Implement local procedures and training to ensure operational staff log FANS1/A problems identified during operations to enable subsequent investigation.

1.12 Implement local investigation process for reported FANS1/A problems.

1.13 Implement CRA website reporting of confirmed FANS1/A problems.

1.14 If implementing PBCS, sign up to Global PBCS Charter on CRA website.

Conclusion RASMAG/24-2

Conclusion RASMAG/24-2: Continuous Data Link Performance Monitoring

That, ANSP providing ADS-C and CPDLC services are urged to undertake the following actions, in accordance with ICAO Doc 9689 - PBCS Manual and Doc 10037 - GOLD Manual, and the Asia/Pacific PBCS Action List for ANSPs:

1. **Continuously monitor data link performance;**

2. **Conduct monthly data link performance analyses on a rolling three-month basis, and report problems and significantly poor performance to the CRA and RMA in accordance with the Asia/Pacific PBCS Action List for ANSPs;**

3. **Take steps to identify any local cause of poor performance identified in each monthly analysis;**

ICAO Letter Ref. T 3/ 10.1.17 - APl00/19 (ATM) 17 September 2019

Conclusion RASMAG/24-2

Conclusion RASMAG/24-2: Continuous Data Link Performance Monitoring (continued)

4. **Compile monthly performance report data in reporting periods from January to June and July to December each year;**

5. **Provide the compiled performance report data to the ANSP responsible for the compilation and analysis of Regional aggregated data,·**

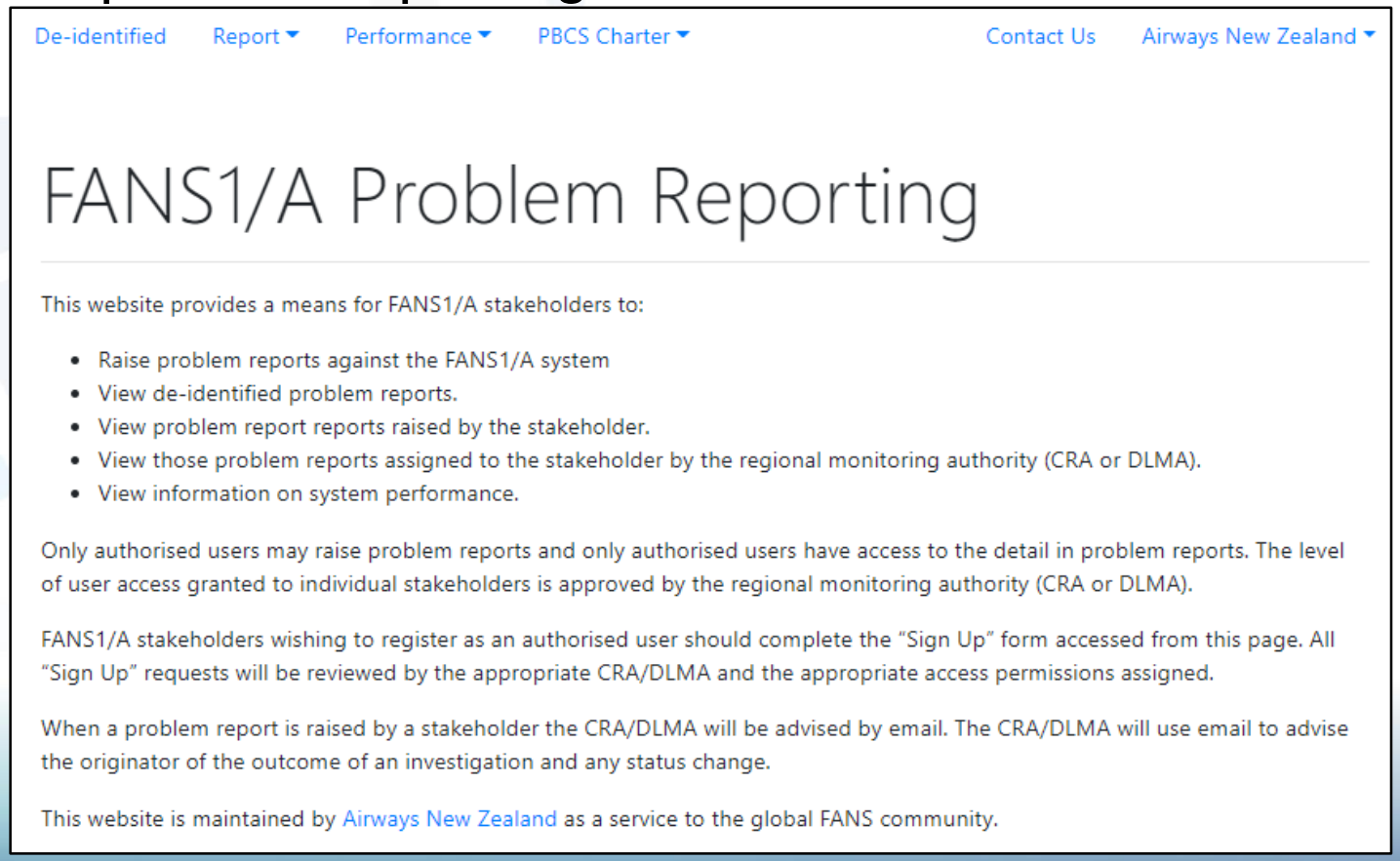
6. **Include narrative information on efforts made to determine the causes of poor performance, action taken to rectify poor performance, and the results of that action, in annual performance monitoring analysis reports to FIT-Asia;**

7. **Make airframe and fleet performance data available on request to all Administrations for regulatory oversight purposes.**

ICAO Letter Ref. T 3/ 10.1.17 - APl00/19 (ATM) 17 September 2019

CRA Website

- The FANS1/A CRA website at https://www.fans-cra.com facilitates problem reporting for stakeholders.



CRA Website

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De-identified | Report | Performance | PBCS Charter | Contact Us

ALL REGIONS

PAC PBCS Monitoring Results - Jan-Jun 2020

(Uploaded by Airways New Zealand at 14 Dec 2020)

Monitoring results by fleet and by individual airframe for ADS-C ASP and CPDLC RCP in Anchorage, Auckland, Fukuoka, Oakland, Nadi and Tahiti FIRs during Jan-Dec 2020. Observed filing of P2/RSP180 has been included where available. Any questions or concerns please reach out to the respective points of contact.

PAC PBCS Monitoring Report Jan-Jun 2020 all results_rev.xlsx

FANS1/A Problem Solution Tracker

(Uploaded by Airways New Zealand at 06 Oct 2020)

The Problem Solution Tracker provides a consolidated list of FANS1/A problems, recommended aircraft software versions , and performance improvement options.

This version updated by NAT TIG October 2020

FANS-Problem-Solution-Tracker_Oct_2020.xlsx

NAT PBCS Monitoring Results - Jan-Jun 2020

(Uploaded by FAA (United States) at 21 Sep 2020)

CRA Website

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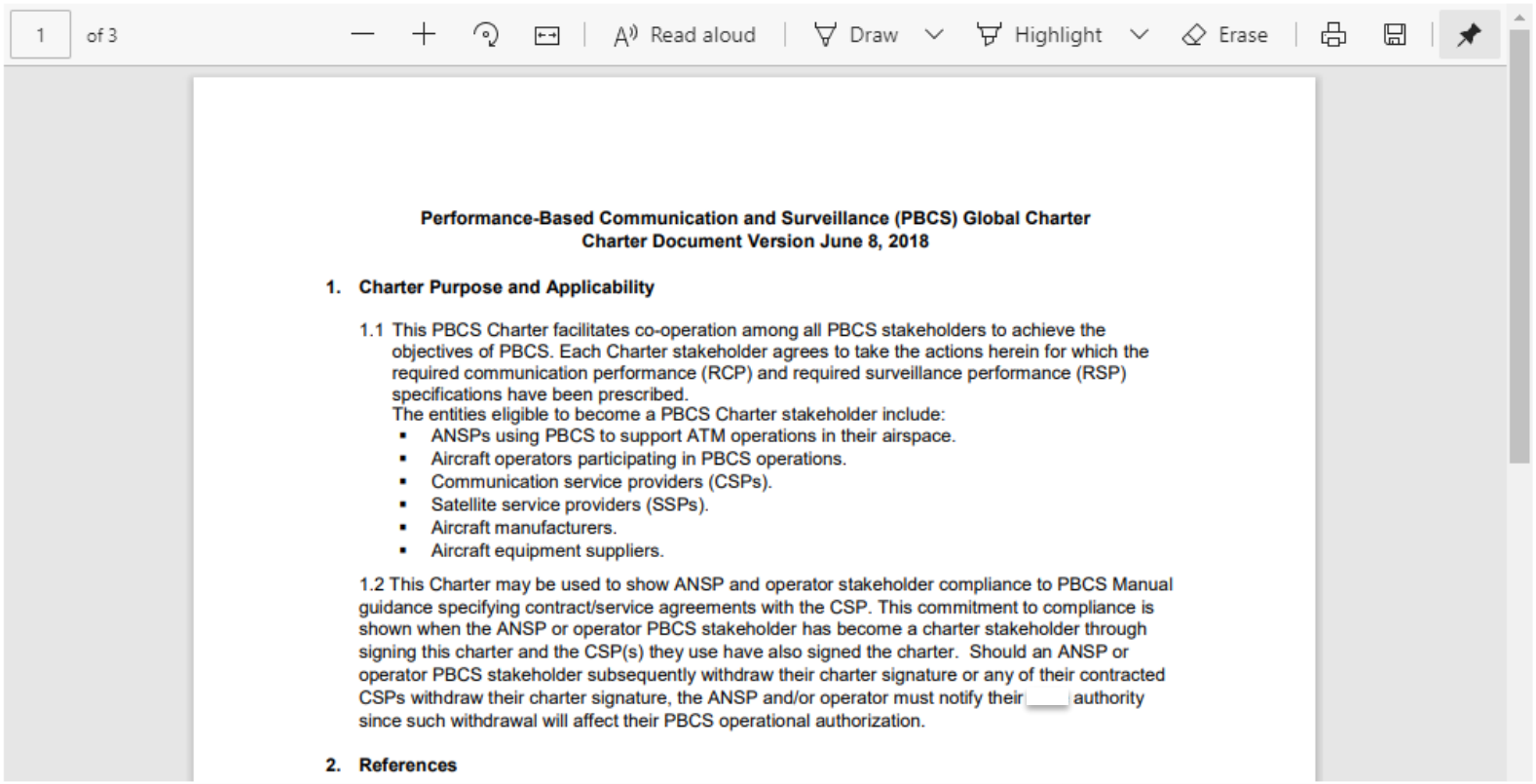

Performance-Based Communication and Surveillance (PBCS) Global Charter
Charter Document Version June 8, 2018

1. Charter Purpose and Applicability

1.1 This PBCS Charter facilitates co-operation among all PBCS stakeholders to achieve the objectives of PBCS. Each Charter stakeholder agrees to take the actions herein for which the required communication performance (RCP) and required surveillance performance (RSP) specifications have been prescribed.
The entities eligible to become a PBCS Charter stakeholder include:

- ANSPs using PBCS to support ATM operations in their airspace.
- Aircraft operators participating in PBCS operations.
- Communication service providers (CSPs).
- Satellite service providers (SSPs).
- Aircraft manufacturers.
- Aircraft equipment suppliers.

1.2 This Charter may be used to show ANSP and operator stakeholder compliance to PBCS Manual guidance specifying contract/service agreements with the CSP. This commitment to compliance is shown when the ANSP or operator PBCS stakeholder has become a charter stakeholder through signing this charter and the CSP(s) they use have also signed the charter. Should an ANSP or operator PBCS stakeholder subsequently withdraw their charter signature or any of their contracted CSPs withdraw their charter signature, the ANSP and/or operator must notify their ____ authority since such withdrawal will affect their PBCS operational authorization.

2. References

Section 2 – Airways PBCS Implementation

Asia-Pacific Economic Cooperation

This section contains some implementation examples specific to the Airways New Zealand PBCS implementation.

ATM System Modifications for PBCS

- The Conflict Prediction algorithms for the application of performance based separation standards verify from the filed FPL that the aircraft meets RCP240 and RSP180 before application of the separation is allowed.

- A ‘degraded PBCS’ button allows the controller to prevent the application of the performance based separation standards on an aircraft if they are advised or consider that either RCP/RSP is degraded.

SPR Safety Requirement #14

The Oceanic Safety and Performance Requirements, DO-306/ ED-22 Safety Requirement #14 requires the air traffic service provider to notify the controller when a required response is not received within the required time.

- The RCP 240/D expiry time (210”) is used for those CPDLC equipped aircraft where performance based separations are enabled.
- The RCP 400/D expiry time (370”) is used for all other data-link connected aircraft.
- The controller receives the following message:
  “Clearance read-back expected at [time] is overdue for aircraft [ACID].”

SPR Safety Requirement #15 (ATSP)

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- The Oceanic Safety and Performance Requirements, DO-306/ED-22 Safety Requirement #15 requires the air traffic service provider to notify the controller when a late message is received.
- For WILCO responses that are automatically processed by the system, a message is sent to the controlling sector:

  "[acid]: Late WILCO response received with timestamp [hh:mm:ss] for clearance sent at [hh:mm:ss]
  UL: [clearance text]"

SPR Safety Requirement #15 (Aircraft)

- The Oceanic Safety and Performance Requirements, DO-306/ED-22 Safety Requirement #15 also applies to aircraft.

- All FANS1/A aircraft should have implemented an uplink delay timer (latency monitor) per DO-258A 4.6.6.9 and GOLD 1st Edition 2.1.2.6.

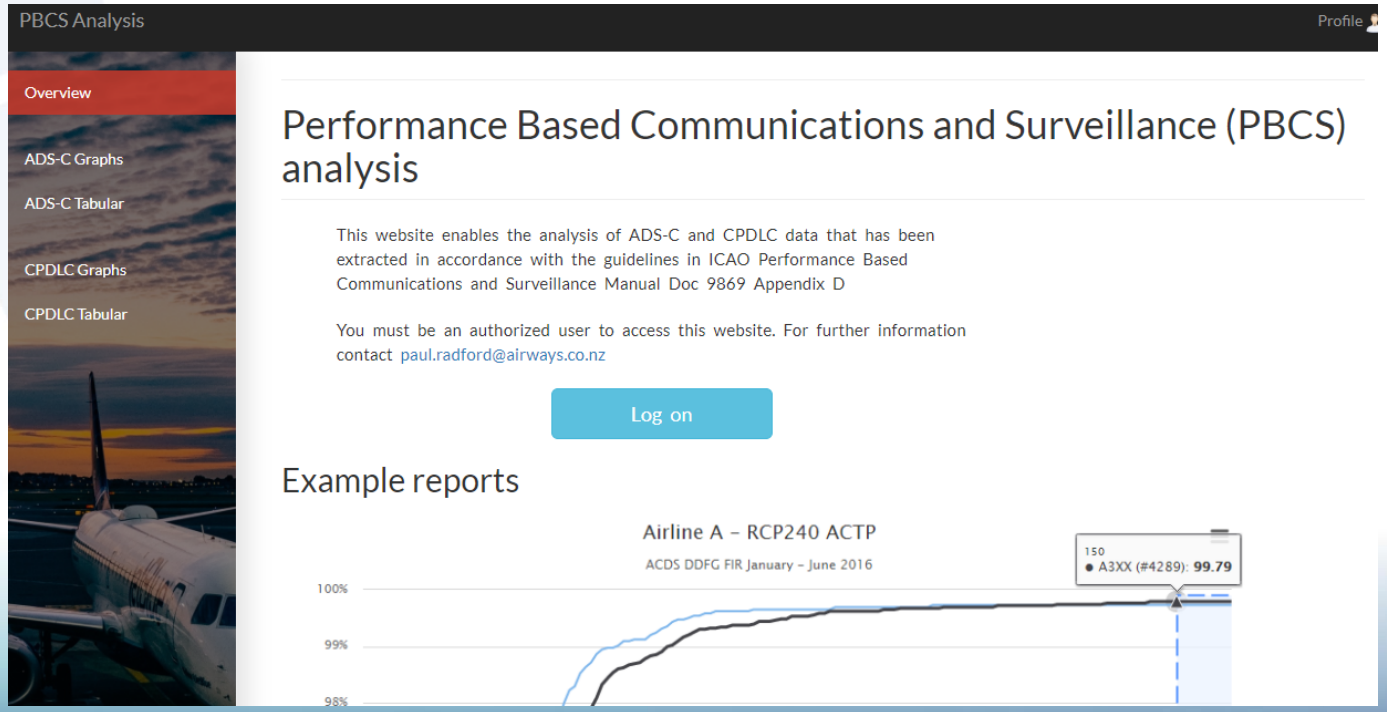
- This is set by the crew on receipt of an ATC instruction:

  UM169: "SET MAX UPLINK DELAY VALUE TO 300 SECONDS"

- The latency monitor uplink is sent to all FANS1/A aircraft on entering New Zealand Oceanic Airspace.

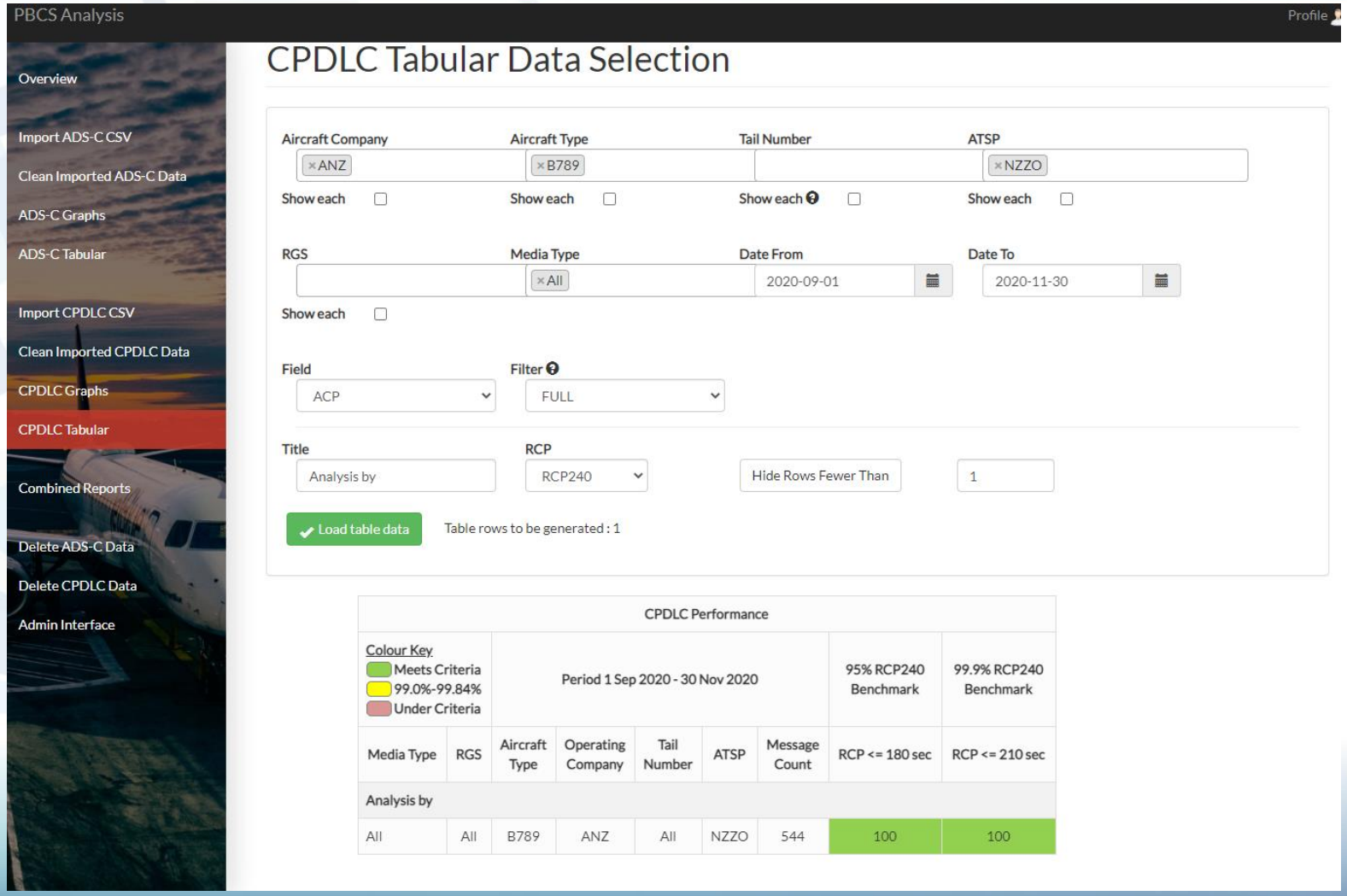
Online PBCS Analysis Tool

Airways developed an online tool to facilitate processing of PBCS analysis data extracted in accordance with PBCS Manual guidance. https://pbcsanalysis.herokuapp.com



Online PBCS Analysis Tool

Asia-Pacific Economic Cooperation



Post Implementation Monitoring

- Airways uses performance-based separations utilizing PBCS RCP240/RSP180 specifications.
- Our local PBCS monitoring program, ensures that the communication and surveillance capabilities continue to meet the RCP/RSP specification, through monitored data, analysis, and corrective action.
- Airways monitors PBCS RCP240/RSP180 performance on a monthly basis.
- A monthly PBCS performance report is submitted to the responsible authority (New Zealand Civil Aviation Authority).
- Identified PBCS performance degradations are raised as problem reports to the Informal South-Pacific ATS Coordinating Group (ISPACG) CRA through the CRA website.
- PBCS aircraft not meeting RCP240/RSP180 95% normal operating requirements are reported to our Regional Monitoring Agency (PARMO).

Post Implementation Monitoring

- Airways extracts ADS-C and CPDLC data points every month from the Airways Oceanic Control System (OCS) in formats specified in Doc 9869 PBCS Manual Annex D.
- These records are extracted from OCS as .csv files and are manually processed before importing to a website based PBCS analysis tool. The monthly records are also stored as excel files for subsequent analysis.
- The PBCS analysis website can produce combined reports of ADS-C and CPDLC performance over specified periods.
- Airways uses these combined reports for our monthly performance analysis.
- These combined reports are also used as input to the regional reporting of PBCS performance on the CRA website

Post Implementation Monitoring

Asia-Pacific Economic Cooperation

- Excel reports of observed ASP and ACP are created from the analysis tool combined reports

Operator	Aircraft Type	Tail No	ADS-C downlink Message counts	ASP <= 90 sec	ASP <= 180 sec	CPDLC Transaction Counts (WILCO received)	ACP <= 180 sec	ACP <= 210 sec
AAL	B77W	N723AN	99	100.00%	100.00%	2	100.00%	100.00%
AAL	B77W	N725AN	106	98.11%	99.06%	5	100.00%	100.00%
ACA	B77W	CFIVR	105	100.00%	100.00%	3	100.00%	100.00%
ACA	B789	CFVLU	23	100.00%	100.00%	0	-	-
ACI	A339	FONET	189	100.00%	100.00%	0	-	-
AIC	B77L	VTALG	20	100.00%	100.00%	0	-	-
ANZ	A20N	ZKNHA	989	97.88%	99.70%	16	100.00%	100.00%
ANZ	A20N	ZKNHC	759	96.44%	99.34%	18	100.00%	100.00%
ANZ	A20N	ZKNHD	677	96.45%	98.82%	9	100.00%	100.00%

Colour Key
Meets Criteria
99.0%-99.84%
Under Criteria
PBCS Qualified

- We have been using a number of different combined reports to assist in analysis. These include combined reports of individual tail number performance, combined reports of aircraft operator and aircraft type for the current month, and combined reports of the previous three months consolidated data to increase the number of data points available for analysis.

Post Implementation Monitoring

- Individual records in the combined reports are not assessed where the number of data points is less than 100.
- Where records with 100 or greater data points indicate performance deterioration below ASP or ACP criteria, data is extracted from the raw data files for periods where the latency exceeds requirements to facilitate further investigation.

Date	RGS	REP_TYPE	Latitude	Longitude	AC_time	OCS_time	Downlink_time
20200121	XXH	P	-24.4298	177.5677	19:58:15	19:58:56	41
20200121	XXH	W	-25.0039	177.3341	20:03:03	20:07:45	282
20200121	XXA	P	-26.3032	177.0871	20:13:11	20:14:58	107
20200122	XXP	P	-34.415	176.7161	02:15:31	02:26:46	675
20200122	XXP	W	-34.1443	176.9305	02:17:47	02:27:53	606
20200122	XXP	P	-32.5626	178.0324	02:30:27	02:30:43	16
20200122	XXP	P	-32.0013	178.4125	02:34:54	02:36:28	94
20200122	XXH	P	-30.6692	179.2931	02:45:23	02:56:06	643
20200122	XXH	W	-29.9973	179.7264	02:50:42	02:56:31	349
20200122	XXH	P	-29.0291	-179.661	02:58:18	02:59:02	44
20200207	XXH	W	-34.2851	177.7571	21:25:28	21:25:41	13
20200207	XXH	W	-34.482	177.4898	21:27:49	21:27:59	10
20200207	XXA	P	-35.0191	176.8797	21:33:50	21:37:59	249
20200208	XXA	P	-36.4909	174.8304	02:11:01	02:11:07	6

Post Implementation Monitoring

The extracted raw data records are then assessed, and an action plan developed.

For the data illustrated in the previous slide:

***Assessment**:*
Data analysis shows significant latency delays when transitioning between satellite RGS 21/22 January and 7 February and at initial contract establishment on 22 January"

***Action Plan**:*
1. 16/3 Raise FANS problem report to investigate (ACNZ_2020_04).
2. Check Oakland performance for this tail on same dates.
3. Wait for Oakland feedback before action on ASP observed below 95% normal operating. A bad day at the office on 22/1 has skewed performance. If Oakland results OK recommend monitor only at this stage.

The performance degradations assessed each month are consolidated into a report for the New Zealand CAA.

Post Implementation Monitoring

The monthly report to NZ CAA has two parts:

- Previous analysis update – an update on the previous months report.
- Current months analysis.

PBCS Performance Analysis

This month's analysis reviewed both the November, and the consolidated September/October/November data and evaluated performance where data points exceeded 100.

PBCS Performance Summary – November 2020

Previous analysis update:

[redacted] A20N. Significant degradation in vicinity of YSNF continues while performance is met elsewhere in NZZO. See update below.

[redacted] B77W – Mixed fleet operations with Iridium and Inmarsat satcom in use on different tails. Some aircraft with Iridium satcom not meeting RSP180 95% normal operating. See update below.

[redacted] B77W - [redacted] performance was below the 99.0% requirement at 180 seconds in October but no obvious reason for the two delayed reports. No issues with this fleet in November.

[redacted] A332 - [redacted] from August analysis. See update below.

[redacted] A333 (Non-PBCS) – Was below 95% normal operating in October. Meets performance requirements in November showing 95.37% at 95% 90 seconds from 216 data points.

Monthly report to CAA – de-identified sample from November 2020

Post Implementation Monitoring

Asia-Pacific Economic Cooperation

Current Month Analysis:

Each item has a description of the issue followed by an operational impact assessment and our planned follow-up.

Monthly report to CAA – de-identified sample from November 2020

November 2020 Analysis

[redacted] **A20N**

Four A20N operated in November [redacted] with [redacted] showing a continuation of the poor RSP performance seen in previous months indicating below 95% normal operating.

Tail No	ADS-C downlink Message counts	ASP <= 90 sec	ASP <= 180 sec	CPDLC Transaction Counts (WILCO received)	ACP <= 180 sec	ACP <= 210 sec
[redacted]	233	94.85%	97.85%	13	100.00%	100.00%
	208	93.75%	98.56%	6	100.00%	100.00%
	13	100.00%	100.00%	0	-	-
	294	91.16%	96.94%	9	100.00%	100.00%

Again, the deterioration can be attributed to poor performance in the vicinity of Norfolk Island and RSP is achieved in remainder of the NZZO FIR when the NF flight sectors are excluded – see table below.

Tail No	ADS-C downlink Message counts	ASP <= 90 sec	ASP <= 180 sec
All	709	97.74	99.72

Minimal operational impact other than in the vicinity of YSNF. Oceanic are aware of the deterioration in the YSNF area and we will continue monitoring.

Post Implementation Monitoring

Asia-Pacific Economic Cooperation

In addition to monitoring RCP240/RSP180, availability is monitored by maintaining a monthly record of notified CSP outages and an assessment on the operational impact of each outage as shown below for June 2020.

CSP	Date	Advice Received	Outage Start	Outage End	Duration (minutes)	Reason	Operational Impact
RC	10-Jun	1622	1508	1605	57	XXA Network Degradation	No operational impact
RC	29-Jun	1932	1806	1936	90	XXS Pamalau, HI	No operational impact

Post Implementation Monitoring

- Most FANS problem reports raised by NZZO are generated through the monthly PBCS performance monitoring process and are always accompanied by the appropriate data points and investigation notes to facilitate the CRA investigation.
- In addition to monthly performance reports Airways provides PBCS performance data to the Informal South Pacific Coordinating Group (ISPACG) for the annual report to ICAO, and to the FAA who consolidate performance reports for the CRA website.
- The PBCS analysis website is regularly used within Airways to review PBCS performance and update our operators on performance when requested.

Key Points

- This presentation provided a summary of the guidance material and aids available to assist an ANSP with PBCS implementation, and provided implementation examples from an ANSP implementation.
- Attendees are encouraged to make use of the guidance material and examples in this presentation to support their PBCS implementation activities.

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Advancing Free Trade for Asia-Pacific Prosperity

PBCS Monitoring

Day 3

Presented by
Theresa Brewer, United States, ICAO PBCS Project Team lead

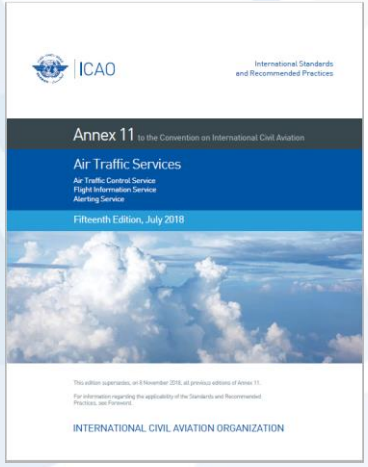
Objective

Asia-Pacific Economic Cooperation

This presentation will provide:

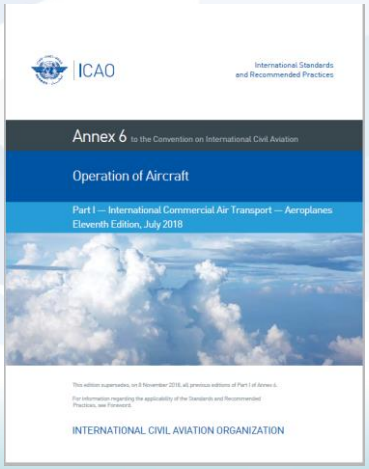
- an overview of the ICAO requirements and guidance for PBCS monitoring programs
- practical information and resources to support implementation of a PBCS monitoring program
- significant lessons learned from existing PBCS monitoring programs

ICAO PBCS Monitoring Requirements



Annex 11, Air Traffic Services, 3.3.5.2

- Where RCP/RSP specifications are applied, programs shall be instituted for monitoring the performance of the infrastructure and the participating aircraft against the appropriate RCP and/or RSP specifications
- The purpose is to ensure that operations in the applicable airspace continue to meet safety objectives



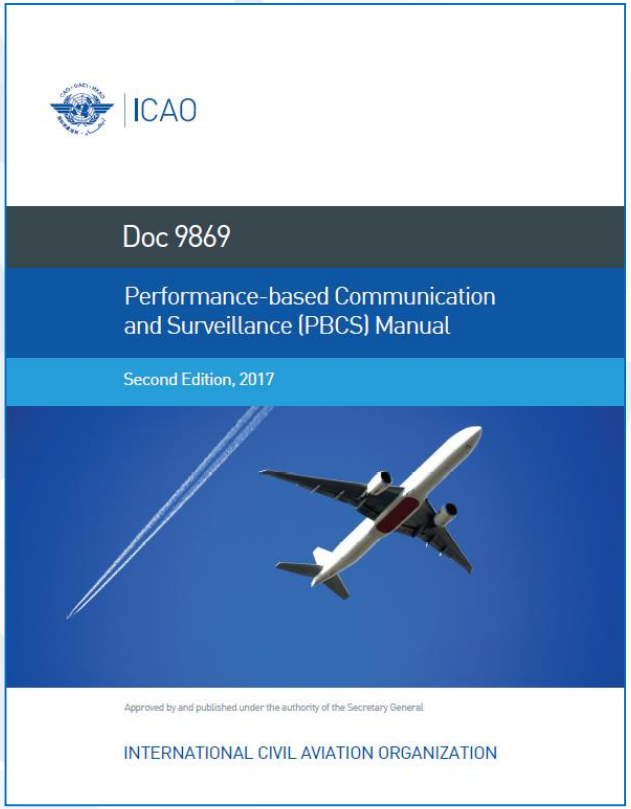
Annex 6, Operation of Aircraft, Part I, 7.1.5, 7.3.4; Part II, 2.5.1.9, 2.5.3.5

- The appropriate authority shall ensure that adequate provisions exist for:
  - receiving reports of observed communication performance issued by monitoring programs established in accordance with Annex 11, Chapter 3, 3.3.5.2
  - taking immediate corrective action for individual aircraft, aircraft types or operators, identified in such reports

RCP: Required Communication Performance

RSP: Required Surveillance Performance

ICAO PBCS Monitoring Guidance
(1 of 2)



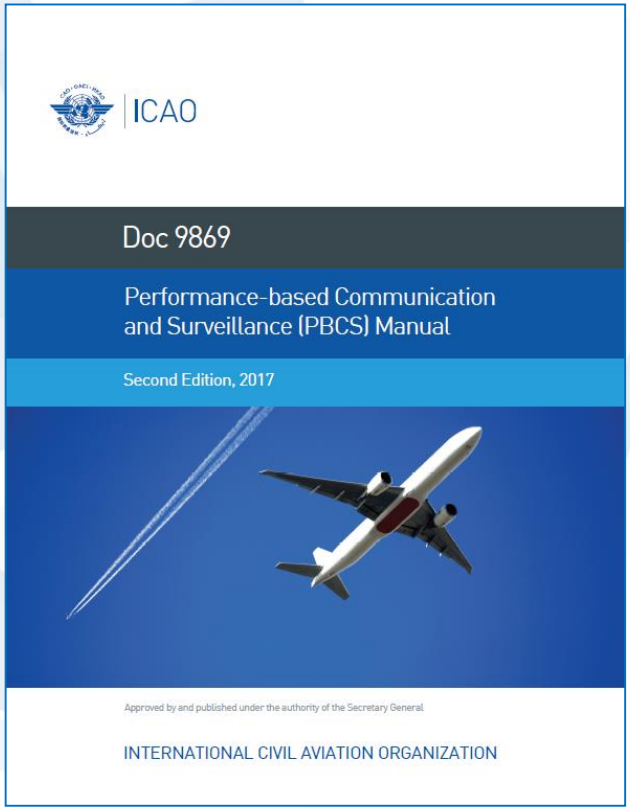
4.5.2.3 To determine continued operational compliance, the ANSP should monitor communication and surveillance capabilities in the applicable airspace to detect and correct performance degradations due to potential instabilities or variations in overall system performance, or changes to any of the various subsystems.

4.5.2.4 The ANSP should also be the entity to perform local analysis, as it possesses the necessary operational expertise, local area knowledge and control, when identifying problems and taking corrective action.

ICAO Doc 9869, Edition 2, PBCS Manual
Chapter 4. Complying with and RCP/RSP specification

ICAO PBCS Monitoring Guidance
(2 of 2)

Asia-Pacific Economic Cooperation



4.5.2.6 The ANSP should perform an analysis of ACP and ASP at an interval suitable to verify system performance, and enable continuous performance improvement by detecting where specific infrastructure, aircraft operator fleet, aircraft type, or individual aircraft is not meeting the RCP/RSP specification.

4.5.2.7 The ANSP should also perform an analysis of service availability at an interval suitable to verify the acceptable number and duration of unplanned service outages affecting a significant portion of flights in the applicable airspace.

4.5.2.8 The ANSP should report to the regional PBCS monitoring programme any problems that may have a regional or global impact, or affect aircraft operators in its airspace, including any non-compliance with an RCP/RSP specification.

ICAO Doc 9869, Edition 2, PBCS Manual
Chapter 4. Complying with and RCP/RSP specification

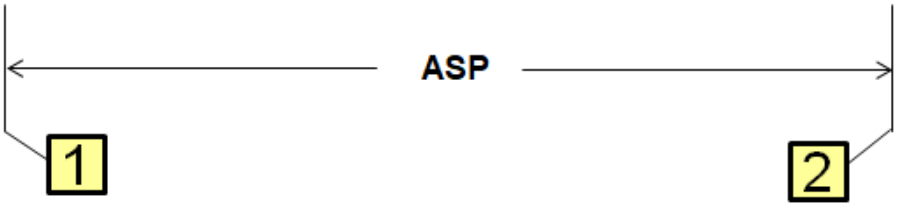
Important note:
ANSP changing to ATSP

Asia-Pacific Economic Cooperation

- To better align with Annex 11, Air Traffic Services, the term air navigation service provider (**ANSP**) currently used in ICAO Doc 9869, Edition 2, PBCS Manual will be replaced with air traffic service provider (**ATSP**) for Edition 3
- Note that some PBCS monitoring programs have begun incorporating this change in anticipation of Edition 3 publication

Actual Surveillance Performance (ASP)

RSP 180 specification (surveillance data delivery times and RSP continuity)				
RSP	180			RSP
95%	90			95%
	RSP 180/D allocations – CPDLC or ADS-C example			
Time +/- 1 second at position (RNP at UTC)	Monitored operational performance			ATM (ATSU system updated)
99.9%	180			OT
95%	90			DT
RSMP/RSTP A	Aircraft system D1	Network D2	ATSU system Z	RSMP/RSTP
99.9%	5	170	5	99.9%
95%	3	84	3	95%



1	Downlink sent	Aircraft time at position
2	Downlink received	Date/time ATSU receives position report

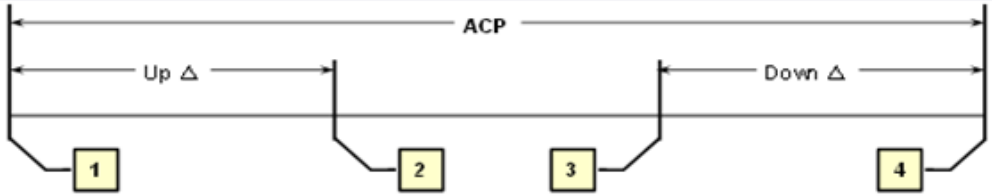
ATM: air traffic management
ATSU: air traffic service unit
ADS-C: automatic dependent surveillance - contract
CPDLC: controller pilot data link communication
RSMP: required surveillance monitored performance
RSTP: required surveillance technical performance
ASP: actual surveillance performance

Actual Communication Performance (ACP)

Asia-Pacific Economic Cooperation

RCP 240 specification (communication transaction times and RCP continuity)										
RCP	240									RCP
95%	210									95%
	RCP 240/D allocations – CPDLC example									
ATM	Controller issues ATC instruction	Monitored operational performance							Controller receives response	ATM
99.9%	$P_{C/ATSU}(30)$	210							$P_{C/ATSU}(30)$	ET
95%	$P_{C/ATSU}(30)$	180							$P_{C/ATSU}(30)$	TT
RCMP		RCTP			RCP PORT	RCTP				RCMP
99.9%		$P_{RCTP}(150)$			60	$P_{RCTP}(150)$				99.9%
95%		$P_{RCTP}(120)$			60	$P_{RCTP}(120)$				95%
RCTP	A	C ATSU system	D1 Network	D2 Aircraft system	D3	D4 Aircraft system	D5 Network	D6 ATSU system	X	Z RCTP
99.9%		$P_{ATSU}(15)$	$P_{NET}(120)$	$P_{AIR}(15)$		$P_{AIR}(15)$	$P_{NET}(120)$	$P_{ATSU}(15)$		99.9%
95%		$P_{ATSU}(10)$	$P_{NET}(100)$	$P_{AIR}(10)$		$P_{AIR}(10)$	$P_{NET}(100)$	$P_{ATSU}(10)$		95%

Note. — $P_{[SUBSCRIPT]}([value])$ means part of the specified [value], and that the combination of all the allocations in the row, denoted by, $P_{[SUBSCRIPT]}$, equals the [value] specified.



1	Uplink Sent	Date/time ATSU sent CPDLC clearance to the aircraft
2	MAS Received	Date/time ATSU receives the MAS for the CPDLC clearance
3	WILCO Sent	Date/time aircraft sends WILCO response for the CPDLC clearance
4	WILCO Received	Date/time ATSU receives WILCO response for the CPDLC clearance

CPDLC: controller pilot data link communication
ATM: air traffic management
ATSU: air traffic service unit
RCMP: required communication monitored performance
RCTP: required communication technical performance
ACP: actual communication performance
ACTP: actual communication technical performance
PORT: pilot operational response time
MAS: message assurance

Reporting Airspace Performance

Asia-Pacific Economic Cooperation

<ATSP> Reporting on ADS-C Actual Surveillance Performance (ASP)

Period: **Jan 01, XXXX to Jun 30, XXXX (6 months)**

Color key:
- Meets criteria
- 99.0%-99.9%
- Under criteria

Media Type		Message Counts	95% RSP 180 Benchmark RSP <=90 sec	99.9% RSP 180 Benchmark RSP <=180 sec
All				
SAT				
VHF				
HF				

<ATSP> Reporting on CPDLC Actual Communication Performance (ACP)

Period: **Period: Jan 01, XXXX to Jun 30, XXXX (6 months)**

Color key:
- Meets criteria
- 99.0%-99.9%
- Under criteria

Media Type	Message Counts	95% RCP 240 benchmark ACP <=180 sec	95% RCP 240 benchmark ACTP <=120 sec	99.9% RCP 240 benchmark ACP <=210 sec	99.9% RCP 240 benchmark ACTP <=150 sec
All					
SAT					
VHF					
HF					
SAT/VHF					
VHF/SAT					
…					
…					

ATSP: air traffic service provider
SAT: satellite
VHF: very high frequency
HF: high frequency

Regional Airspace Report Example

Asia-Pacific Economic Cooperation

REQUIRED SURVEILLANCE PERFORMANCE						
Region	Asia-Pacific Region					
Performance Criteria	RSP180					
Time Period	2019 January-June			2019 July-December		
Colour key: Meets criteria / 99.0%-99.9% / Under criteria	No. Messages	Criteria 95% % < = 90sec	Criteria 99.90% % <= 180sec	No. Messages	Criteria 95% % < = 90sec	Criteria 99.90% % <= 180sec
Aggregate All RGS						
KZAK	4,880,557	98.40%	99.40%	4,994,635	98.50%	99.50%
NFFF	285,717					
NTTT	74,795					
NZZO	428,959					
PAZA	1,315,506					
RJJJ	2,454,906					
RPHI	232,422					
VCCF	598,937					
VOMM	501,815					
VVTS	244,731					
VYYF	312,442					
WAAF	290,831					
WMFC	648,166					
WSJC	1,189,990					
YBBB	1,325,093					
YMMM	1,003,859					
ZLLL	344,490					
ZWWW	190,925					

REQUIRED COMMUNICATION PERFORMANCE										
Region	Asia-Pacific Region									
Performance Criteria	RCP240									
Time Period	2019 January-June					2019 July - December				
Colour key: Meets criteria / 99.0%-99.9% / Under criteria	No. Messages	ACP Criteria 95%	ACP Criteria 99.90%	ACTP Criteria 95%	ACTP Criteria 99.90%	No. Messages	ACP Criteria 95%	ACP Criteria 99.90%	ACTP Criteria 95%	ACTP Criteria 99.90%
Aggregate All RGS		% <= 180sec	% <= 210sec	% <= 120sec	% <= 150sec		% <= 180sec	% <= 210sec	% < = 120sec	% <=150sec
KZAK	295,992	99.10%	99.40%	99.50%	99.60%	306,146	99.20%	99.50%	99.30%	99.60%
NFFF	9,533	99.55%	99.74%	99.65%	99.73%	9,731	99.44%	99.65%	99.60%	99.69%
NTTT	2,195	99.68%	99.72%	99.86%	99.86%	2,183	99.72%	99.90%	99.86%	99.86%
NZZO	12,133	99.42%	99.59%	99.60%	99.71%	11,741	99.60%	99.59%	99.77%	99.72%
PAZA	84,241	99.05%	99.23%	99.33%	99.44%	85,796	98.35%	98.16%	98.76%	98.68%
RJJJ	51,506	99.46%	99.62%	99.38%	99.62%	54,855	99.50%	99.64%	99.47%	99.70%
RPHI	9,311	97.24%	98.71%	97.47%	98.81%	17,727	97.39%	98.62%	97.58%	98.88%
VCCF	29,676	98.31%	99.27%	99.24%	99.69%	32,594	98.12%	99.21%	99.39%	99.68%
VOMM	133,127	99.29%	99.50%	99.55%	99.71%	133,189	99.29%	99.51%	99.55%	99.71%
VVTS	27,923	94.67%	99.13%	95.37%	99.48%	30,462	94.58%	99.15%	95.29%	99.48%
VYYF	59,919	98.52%	98.90%	98.85%	99.18%	67,469	98.31%	98.69%	98.66%	99.04%
WAAF	41,583	98.61%	99.21%	98.88%	99.44%	38,744	96.46%	99.63%	97.31%	99.68%
WMFC	20,441	97.97%	98.73%			30,246	97.67%	98.45%		
WSJC	31,694	98.47%	98.27%	98.93%	98.88%	47,765	98.74%	98.62%	99.16%	99.09%
YBBB	36,891	98.99%	99.26%	99.82%	99.13%	40,094	99.30%	99.52%	99.16%	99.42%
YMMM	38,326	99.43%	99.58%	99.39%	99.57%	42,827	99.48%	99.64%	99.54%	99.69%
ZLLL	2,805	99.14%	99.35%	98.36%	98.89%	3,080	99.22%	99.41%	98.40%	99.18%
ZWWW	787	97.83%	98.22%	96.56%	97.20%	558	98.74%	99.28%	97.13%	97.84%

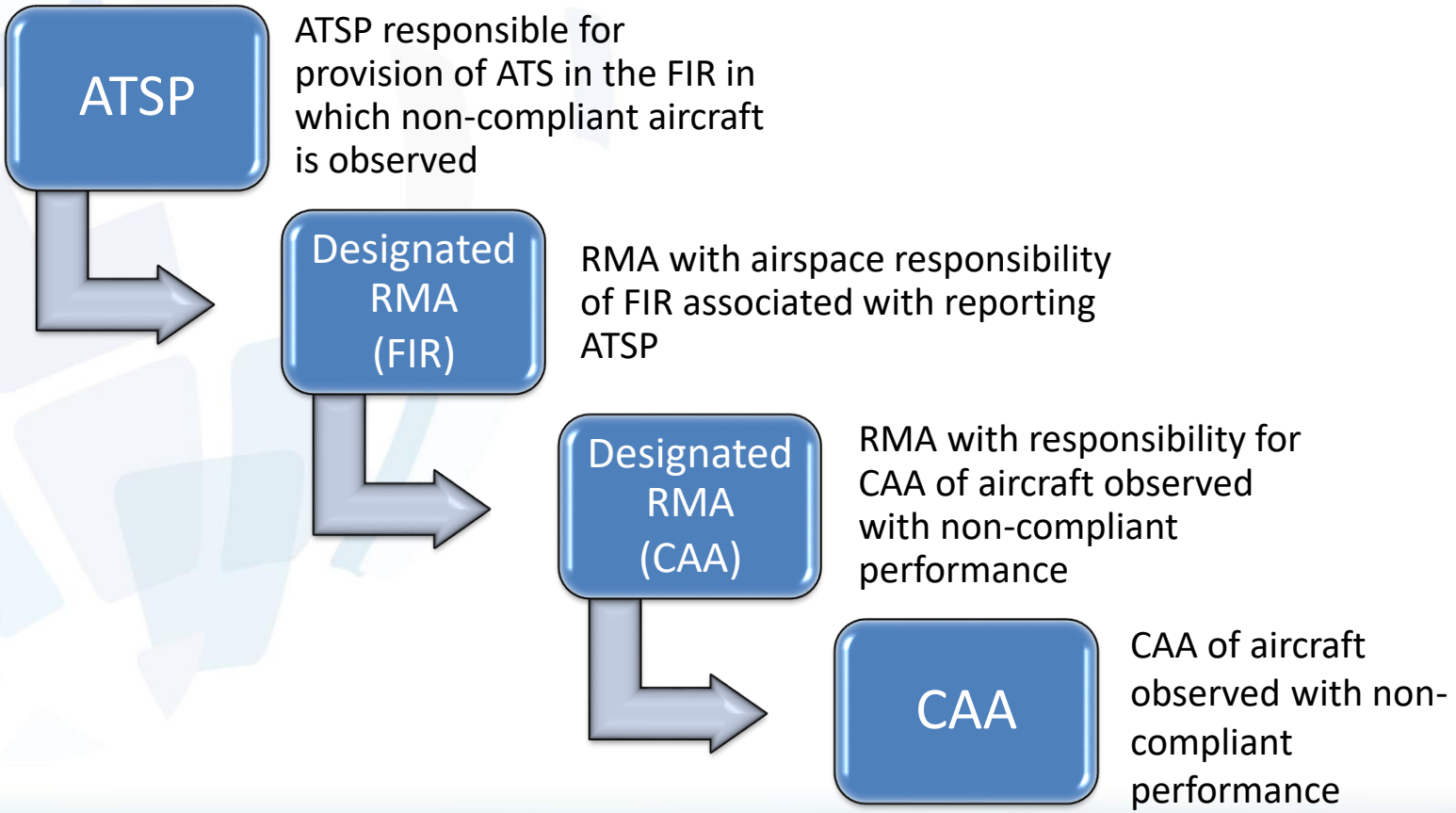
RGS: remote ground station

Regional Reporting of Aircraft Performance

Asia-Pacific Economic Cooperation

- Semi-annual reports compiled and posted on www.FANS-CRA.com for:
  - **North Atlantic** - Gander, New York, Santa Maria, Shanwick, Reykjavik
  - **Pacific** - Anchorage, Auckland, Fukuoka, Nadi, Oakland, Tahiti
- Annual reports for Asia-Pacific
  - Data compiled through and reported to the FANS Interoperability Team – Asia (FIT-Asia) group
- When "red" performance is observed operators are directed to contact relevant monitoring programs for more details to confirm any need for corrective action

Global Coordination for Aircraft Non-compliance



RMA: regional monitoring agency

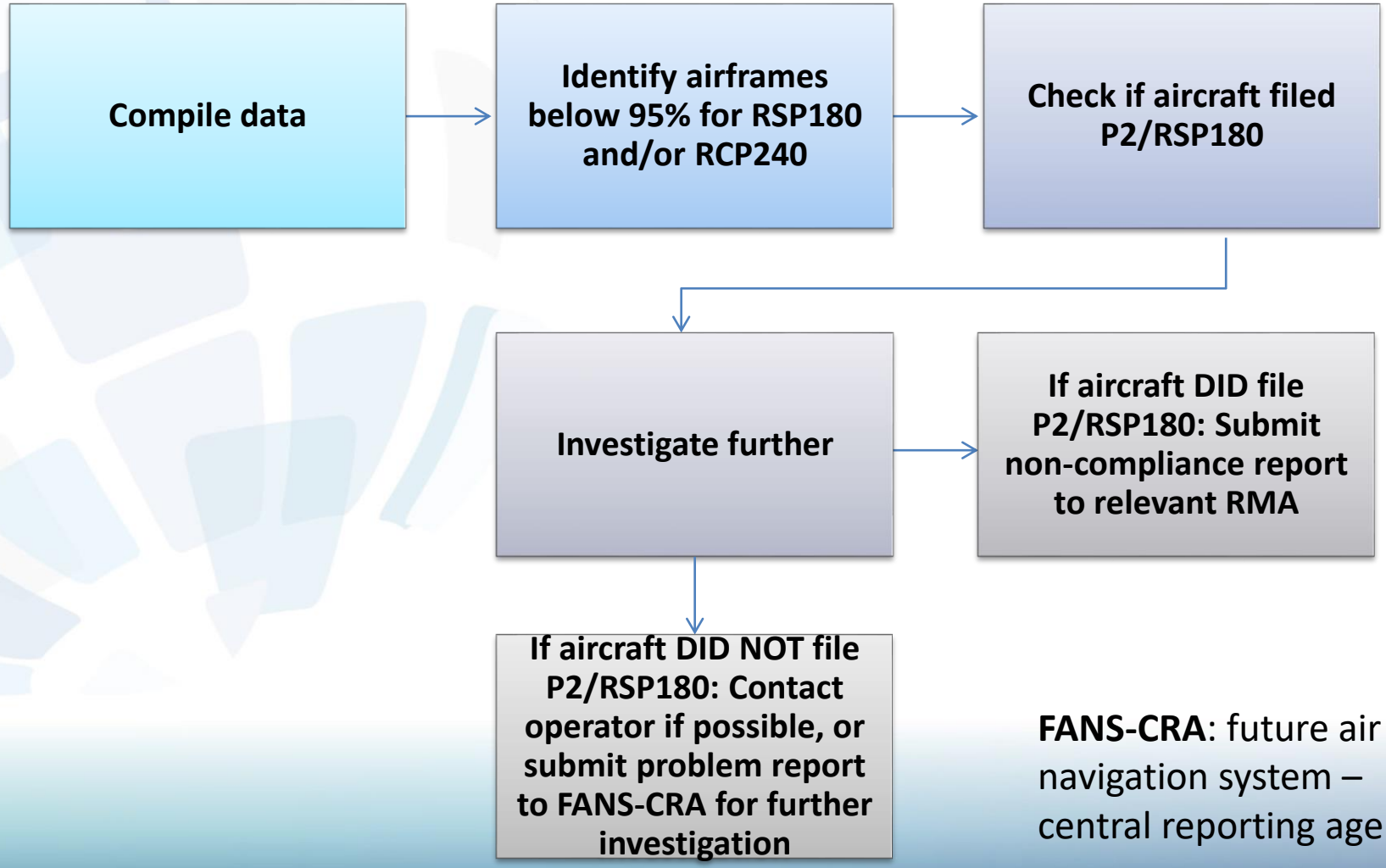
FIR: flight information region

ICAO Endorsed Regional Monitoring Agencies (RMAs)

Asia-Pacific Economic Cooperation

AAMA	Australian Airspace Monitoring Agency
ARMA	African and Indian Ocean (AFI) Regional Monitoring Agency
CARSAMMA	Caribbean and South American Monitoring Agency
China RMA	China Regional Monitoring Agency
EurAsia RMA	Regional Monitoring Agency Eurasia
Eur RMA	European Regional Monitoring Agency
Japan RMA	Japan Regional Monitoring Agency
MAAR	Monitoring Agency for Asia Region
Mid RMA	Middle East Regional Monitoring Agency
NAARMO	North American Approvals Registry and Monitoring Org
NAT CMA	North Atlantic Central Monitoring Agency
PARMO	Pacific Approvals Registry and Monitoring Organization
SATMA	South Atlantic Monitoring Agency

Monitoring Aircraft Performance for Non-compliance



FANS-CRA: future air navigation system – central reporting agency

ATSP Investigation Considerations

Asia-Pacific Economic Cooperation

- Check if performance issue occurred on one leg during monitoring period and was subsequently resolved
- Check media types of reports > 90 seconds (and reports before and after)
  - Helps identify or confirm HF data link problems, media transition problems, specific media/path problem
- Plot position reports and check locations of reports > 90 seconds
  - Helps identify if delays occur in VHF/SAT or SAT/SAT transition areas, FIR boundaries
- Check performance in 2 previous months
  - Helps identify ongoing vs. new problems, scope of problem
- Check estimated PORT if ACP < 95%
  - *May* help identify abnormal pilot response behavior

FAA PBCS Analysis Tool

Asia-Pacific Economic Cooperation

Select Menu: ADS-C airframe report under 95%

Select a View 2: ADS-C Performance Und... / Filed ADS-C Performance

FIR Boundaries: (Multiple values)

Select a View 1: CPDLC performance by oper/actype / ADS-C by Path ID / Data

Select a (Map) View: Density Map / Lat/Long Points

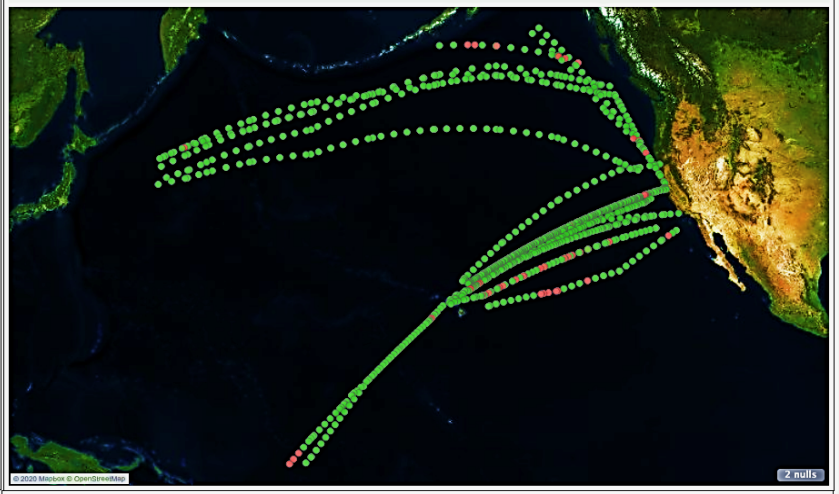
DATE: 2/1/2020 — 3/31/2020

All airframes by media type

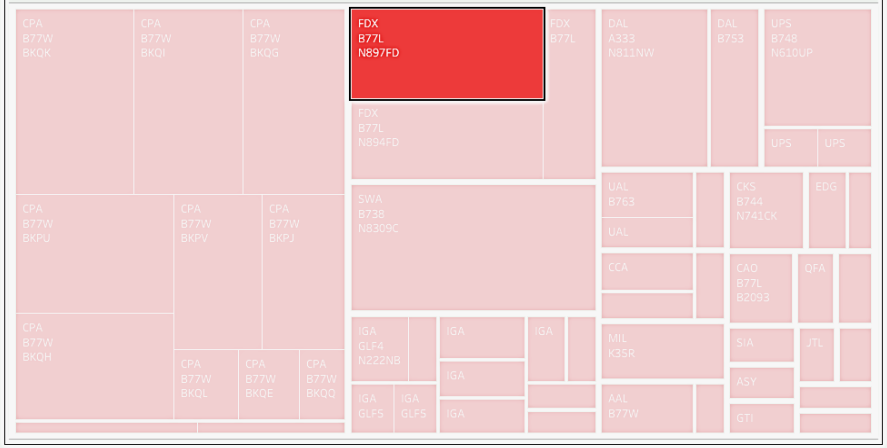
COMTYPE	ADS-C message downlink counts	95% RSP 180 benchmark ASP < 90 secs	99.9% RSP 180 benchmark ASP <= 180 sec
Aggregate	1,063	94.45%	96.14%
SAT	907	96.36%	97.91%
VHF	119	99.16%	100.00%
HF	37	32.43%	40.54%

COMTYPE	CPDLC Transaction counts	95% RCP 240 benchmark ACP <= 180 sec	99.9% RCP 240 benchmark ACP <= 210 sec
Aggregate	1,604	98.69%	98.94%
SAT	1,457	99.25%	99.38%
VHF	66	100.00%	100.00%
HF	13	53.85%	53.85%
HF-SAT	57	92.98%	96.49%
SAT-VHF	6	100.00%	100.00%
VHF-SAT	5	100.00%	100.00%

All Airframes Map



ADS-C airframe report under 95% by operator/aircraft type



Data of airframe report under 95% by operator/aircraft type

DATE	STIME	DEL (bin)	ACID	LAT	LONG	RGS	TYP	COMTYPE	ITV
2/7/2020	8:11:11 AM	3	FDX802	21.9717	-153.6817	ITOV	PER	VHF	9999
	8:19:20 AM	3	FDX802	22.2369	-152.4139	ITOV	PER	VHF	9999
	8:20:47 AM	283	FDX802	22.2831	-152.1878	H05	PER	HF	9999
	8:22:45 AM	392	FDX802	22.3503	-151.8828	AME1	WCE	SAT	9999
	8:24:00 AM	317	FDX802	22.4314	-151.7067	AME1	PER	SAT	9999
	8:27:44 AM	111	FDX802	22.6839	-151.1883	AME1	PER	SAT	9999
	8:30:23 AM	8	FDX802	22.8633	-150.8167	AME1	PER	SAT	9999
	8:40:00 AM	705	FDX802	23.5	-149.4739	H05	PER	HF	9999
	8:44:11 AM	582	FDX802	23.7742	-148.8833	H05	PER	HF	9999
	8:59:12 AM	771	FDX802	24.7261	-146.7756	H02	PER	HF	9999
	9:07:45 AM	463	FDX802	25.2447	-145.5842	H02	PER	HF	9999
	9:08:18 AM	430	FDX802	25.2772	-145.5078	H02	WCE	HF	9999
	9:08:48 AM	507	FDX802	25.3069	-145.4386	AME1	PER	SAT	9999
	9:18:24 AM	63	FDX802	25.865	-144.115	AME1	PER	SAT	9999
	9:28:00 AM	375	FDX802	26.4061	-142.7903	H02	PER	HF	9999
	9:32:23 AM	134	FDX802	26.6458	-142.1894	H02	PER	HF	9999
	9:37:37 AM	12	FDX802	26.9244	-141.4794	H02	PER	HF	9999
	9:47:13 AM	7	FDX802	27.4217	-140.1814	AME1	PER	SAT	9999
	9:56:49 AM	517	FDX802	27.8969	-138.8972	H02	PER	HF	9999
	9:57:09 AM	780	FDX802	27.9128	-138.8531	H02	WCE	HF	9999
	10:01:36 AM	513	FDX802	28.1247	-138.2658	H02	PER	HF	9999
	10:06:25 AM	719	FDX802	28.3472	-137.6392	H02	PER	HF	9999
	10:16:01 AM	608	FDX802	28.7811	-136.3839	H02	PER	HF	9999
	10:25:37 AM	847	FDX802	29.1994	-135.1294	H02	PER	HF	9999

Report Form Adopted by NAT and APAC

Asia-Pacific Economic Cooperation

PBCS ATSP Non-compliance Report Form	
Report Date:	7/27/2020
Period of observed non-compliance:	January-March 2020
Reporting Air Traffic Service Provider (ATSP):	FAA - Oakland
Contact email address(es) at Reporting ATSP:	FAAPBCSmonitoring@faa.gov
Reporting to Regional Monitoring Agency (RMA):	PARMO
ICAO CODE:	XXX
Airline Operator:	XXX Inc.
Economy of Operator/Registry:	United States

PBCS Data

FIR	4-letter ICAO Aircraft Type	Registration	ADS-C downlink Message Counts	95% RSP 180 Benchmark ASP <=90 sec	CPDLC Transaction Counts	95% RCP 240 benchmark ACP <=180 sec	Issue code
KZAK	B772	Reg 1	410	93.41%	25	96.00%	(*1)(*3)
KZAK	B772	Reg 2	290	94.48%	21	95.24%	(*1)

Monitoring Flight Plans and PBCS Authorization Status

- ICAO Doc 9869, Edition 2, PBCS Manual, **4.2.3.8** states that the CAA should establish a means to verify that aircraft operators filing PBCS capabilities in the flight plan are authorized
- RMAs have agreed to support this activity, but require the necessary data, which consists of:
  - Records from CAAs indicating which aircraft have obtained operational authorization for RCP240 and/or RSP180
  - Traffic movement data from ATSPs that includes whether each flight filed P2 in item 10 and RSP180 in item 18
- CAAs should coordinate with their RMA to ensure that the necessary data is provided, as appropriate

Monitoring Availability of Network

- Difficult to measure (ongoing work by PBCS Project Team)
- ATSPs should track reports from communication service providers and collect data on impacts to determine acceptability of network performance
  - Impacts detected by observations of:
    - Increase in delays of ADS-C Reports (>180 seconds)
    - Increase in CPDLC uplink failures
    - Increase in controller workload
  - Air traffic impacts not always matched to CSP impacts
    - Depends on traffic loading at the time of outage and redundancies in place (e.g. overlapping satellite coverage, multiple ground stations)

Problem Reporting, Investigation and Resolution

- Data collection typically involves obtaining logs from involved parties
- May include:
  - aircraft maintenance system logs
  - built-in test equipment data dumps for some aircraft systems
  - SATCOM (satellite communications) activity logs
  - logs/printouts from the flight crew and recordings/logs from the ATSPs involved in the problem
- Crucial for events to be reported shortly after event so that entity conducting investigation can request and obtain necessary data in a timely manner (much of it subject to limited retention)

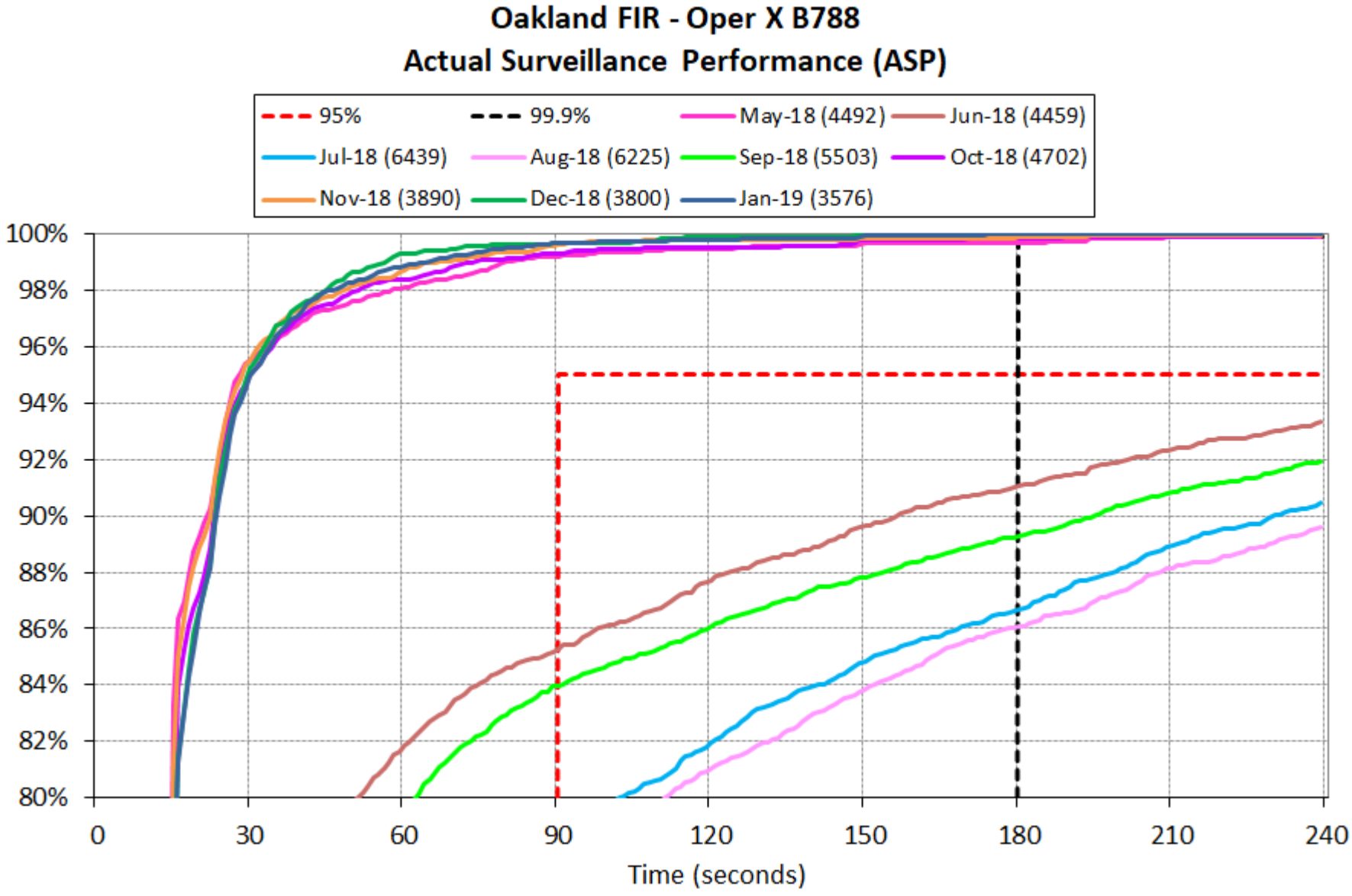
Centralized Location for PBCS Tools and Information

NAT and PAC Central Reporting Agency (CRA) www.FANS-CRA.com

1. Users register for account to obtain secure access
   - Available to any FANS (future air navigation system) data link stakeholder
   - Only 1 account per company/organization
2. Users can:
   - Log data link problem reports
   - View common data link problems, solutions, and recommended software versions in the “FANS Problem Solution Tracker”
   - Sign up for the PBCS Charter
   - View semi-annual regional monitoring results provided by fleet and by registration numbers for contributing FIRs

Monitoring example 1: Performance degradation for B788 fleet

- Performance deterioration occurred May and June 2018
  - notable increase in HF Datalink messaging
- Feedback from Boeing to modify subnetwork order of preferences for ATC (FANS CPDLC and ADS-C) downlink messages
  - order should be (1) VHF, then (2) SATCOM, and then (3) HF (provide successively poorer performance)
  - **Note**: Boeing's statement that 787 meets RCP240 and RSP180 is based on HF being the last preference (or not a preference at all) for ATC downlink messages in the CMF (communication management function) AMI (airline modifiable information)
- Performance notably improved in October 2018 after changes made


Oakland FIR - Oper X B788
Actual Surveillance Performance (ASP)
95%
99.9%
May-18 (4492)
Jun-18 (4459)
Jul-18 (6439)
Aug-18 (6225)
Sep-18 (5503)
Oct-18 (4702)
Nov-18 (3890)
Dec-18 (3800)
Jan-19 (3576)
100%
98%
96%
94%
92%
90%
88%
86%
84%
82%
80%
0
30
60
90
120
150
180
210
240
Time (seconds)

Monitoring Example 2: Poor Performance for B738 Fleet

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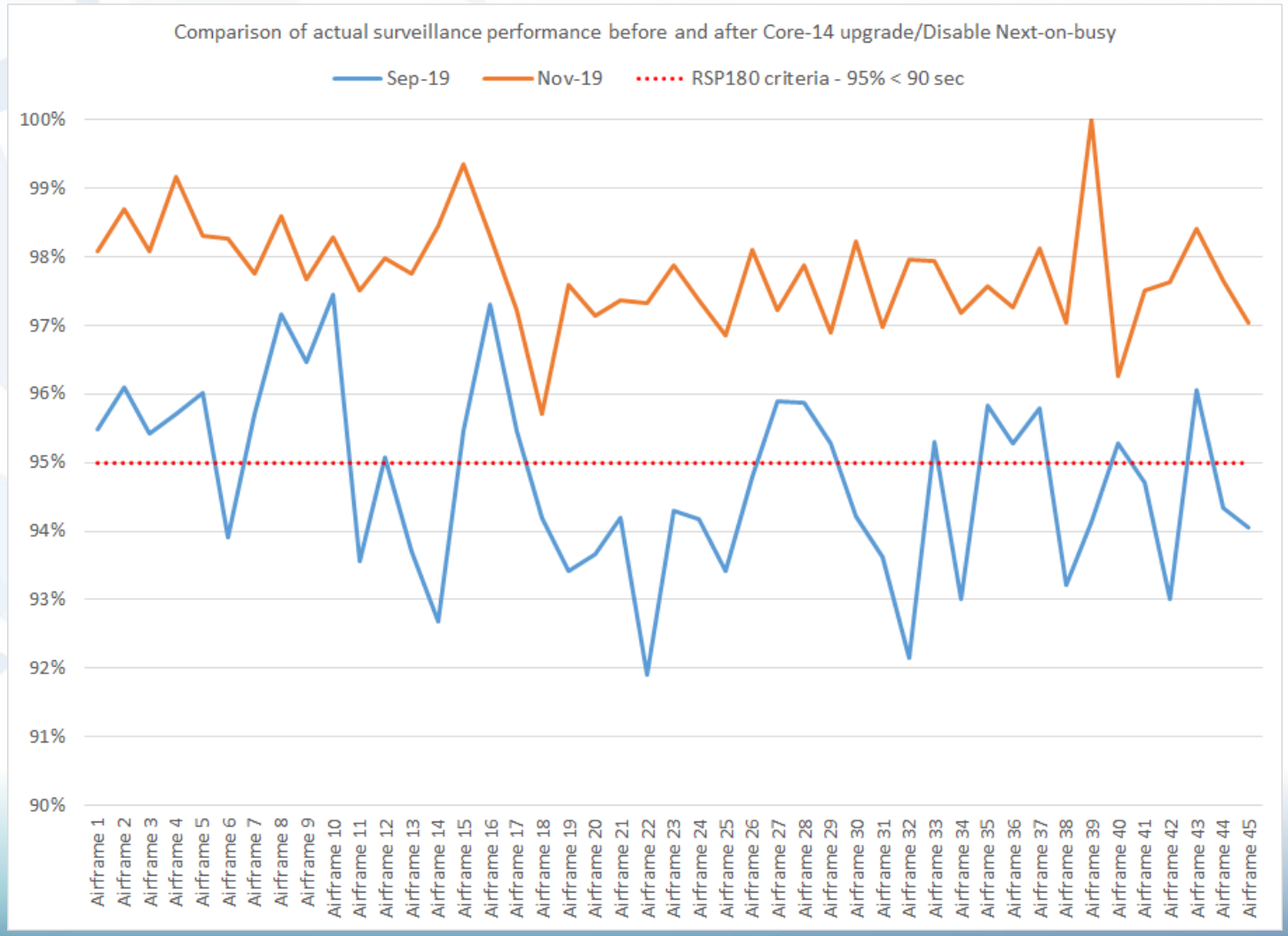

Monitoring Example 3: Network Delivery Path

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- Significant increase in delays > 180 sec via Iridium SITA delivery path - end of January into February 2018
- Assessment of performance by day traced problem to SITA maintenance work in late January

ANCHORAGE	Dec 2017			Feb 2018		
Provider	ADS-C cnt	% < 90	% < 180	ADS-C cnt	% < 90	% < 180
ARINC Iridium	7,514	93.8%	98.0%	8,884	95.0%	98.8%
SITA Iridium	5,347	95.6%	97.8%	4,873	86.6%	91.3%
Fleets using SITA Iridium	**ADS-C cnt**	**% < 90**	**% < 180**	**ADS-C cnt**	**% < 90**	**% < 180**
Fleet 1	433	98.9%	99.8%	275	86.6%	91.3%
Fleet 2	1,610	96.2%	98.1%	1,359	88.7%	92.6%
Fleet 3	1,132	93.0%	95.3%	419	89.3%	93.3%
Fleet 4	1,092	95.5%	98.7%	1,623	82.9%	88.5%
Fleet 5	13	100%	100%	16	56.2%	75%

Key Points

- This presentation provided a summary of:
  - ICAO requirements and guidance for PBCS monitoring programs
  - practical information to support implementation
  - notable examples of problems identified through monitoring
- Attendees are encouraged to make use of the resources provided throughout this presentation to support PBCS implementation activities

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Advancing Free Trade for Asia-Pacific Prosperity

PBCS: An ANSP Regulator's Perspective

Day 3

Presented by
Jennifer Kileo, Manager, International Integration Staff,
Air Traffic Safety Oversight Service, FAA

Purpose/Overview

Asia-Pacific Economic Cooperation

This presentation will provide information on:

- ICAO PBCS Air Navigation Service (ANS) Safety Oversight Standards
- ANSP PBCS Compliance
- PBCS ANS Safety Oversight Concepts

ICAO PBCS ANS
Safety Oversight Standards

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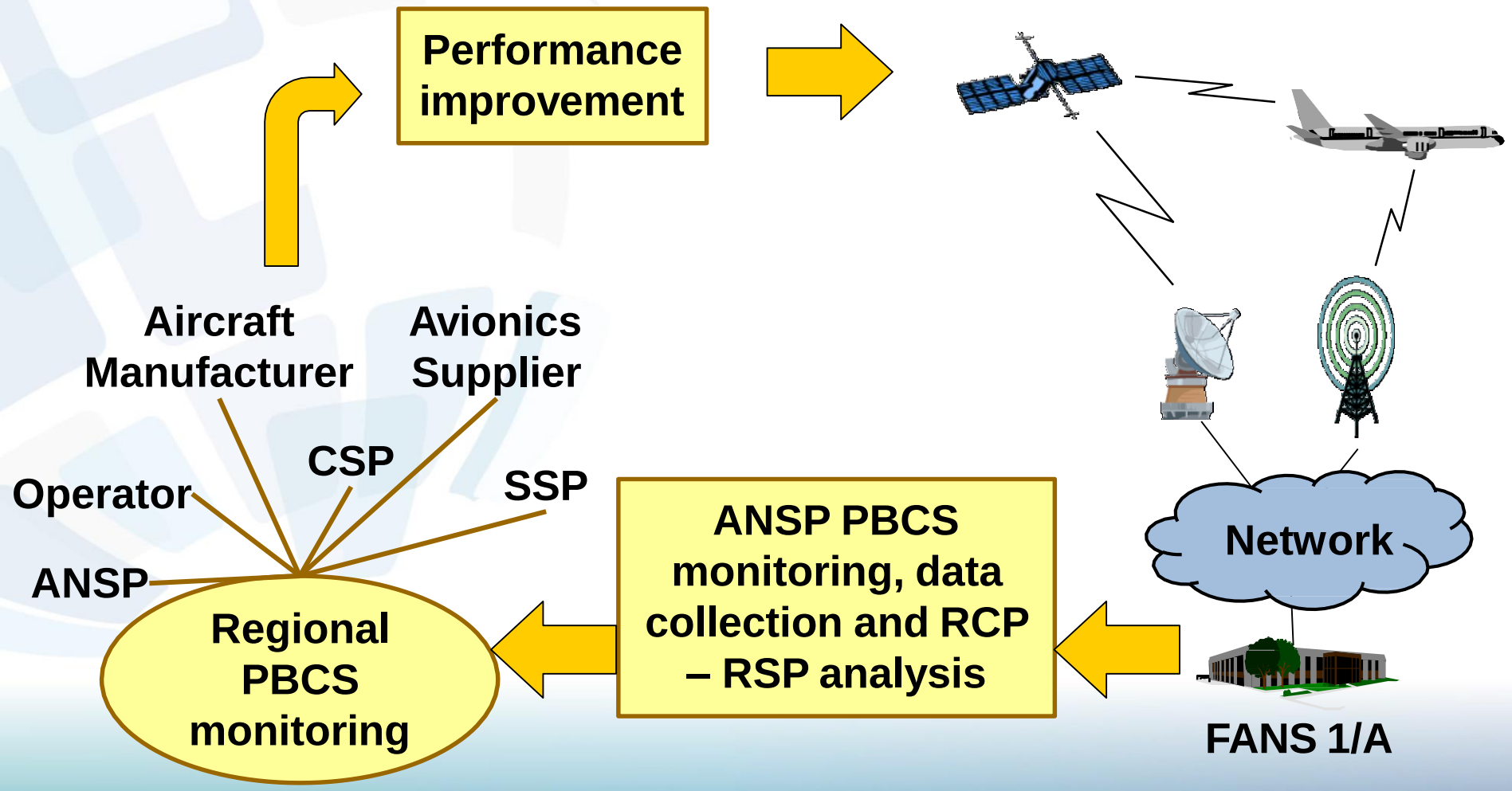
PBCS Manual (ICAO Document 9869), paragraph 1.3.5

- In accordance with Annex 19, the Civil Aviation Authority (CAA) provides safety oversight to ensure safe, regular and efficient conduct of operations.
- The PBCS concept applies RCP and RSP specifications to support CAA safety oversight in accordance with the following:
  - **Annex 1** contains standards for training and qualification of personnel associated with licensing a flight crew member, aircraft maintenance personnel, flight operations officer/flight dispatcher, air traffic controller or aeronautical station operator;
  - **Annex 6** contains standards for safety oversight of aircraft operators, including airworthiness of aircraft systems and equipment in accordance with Annex 8.
  - **Annex 8** contains standards for safety oversight in the type design and manufacture of aircraft; and
  - **Annex 11** contains standards for safety management, including monitoring programmes, for the provision and operation of air traffic services.

PBCS Compliance



ICAO PBCS ANS *(continued)* Safety Oversight Standards

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4.2.2 CAA safety oversight of an ANSP

4.2.2.1 When an RCP/RSP specification is prescribed, **the CAA should ensure** that the **ANSP establishes means to assess the actual performance of communication and surveillance services in a particular airspace** prior to operational implementation of associated ATM operations. In addition to ensuring that the ANSP adheres to the guidelines of section 4.3.1, the ANSP should determine that the actual performance within the applicable airspace complies with the RCP/RSP specification.

4.2.2.2 **The CAA should also ensure** that the **ANSP performs ATM operations predicated on RCP/RSP** specifications in the applicable airspace only to aircraft operators that file the appropriate PBCS capability in the flight plan, in accordance with section 4.4.

ICAO Doc 9869, Edition 2, PBCS Manual
Chapter 4. Complying with and RCP/RSP Specifications

ICAO PBCS ANS *(continued)* Safety Oversight Standards

Asia-Pacific Economic Cooperation

4.2.2.3 To determine compliance in the applicable airspace, **the CAA should obtain a sufficient sample** from the applicable airspace of the actual communication performance (ACP) of relevant communication transactions and actual surveillance performance (ASP) of surveillance data delivery measured against RCP/RSP (Required) time values…

4.2.2.4 **The CAA should ensure** that the **ANSP establishes a means to notify the operator** and the Economy of the Operator or the CAA of Registry when the actual performance of the operator's fleet, taking into account different aircraft types/systems, does not comply with an RCP/RSP specification.

4.2.2.5 **The CAA should ensure** that the **ANSP establishes a means to assess the risk of any non-compliance** with the RCP/RSP specification and take appropriate action to correct the related deficiency and provide notification, as appropriate.

ICAO Doc 9869, Edition 2, PBCS Manual
Chapter 4. Complying with an RCP/RSP specification

Complying with RCP/RSP Specifications

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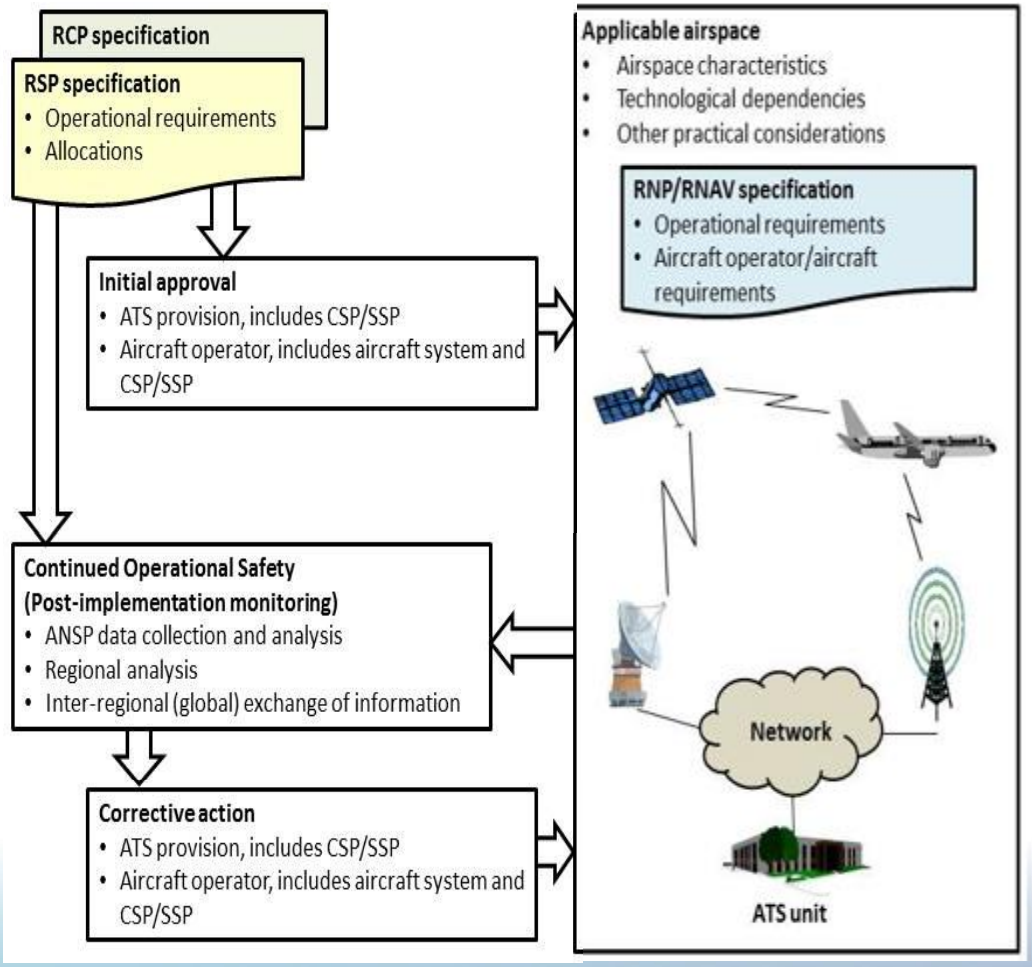
- **Initial compliance**
  - ANSP (CSP, SSP)
  - Aircraft type/system
  - Operator (aircraft, CSP, SSP)
- **Post-implementation monitoring**
  - ANSP data collection and analysis
  - Regional analysis
  - Inter-regional exchange of information
- **Performance improvement**
  - ANSP (CSP, SSP)
  - Operator (aircraft, CSP, SSP)



PBCS ANS Safety Oversight Concepts

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1. **Establish a formal internal policy or process to ensure compliance that would determine roles and responsibilities** in assessing the actual performance of communication and surveillance services in accordance with the PBCS guidance, such as:
   The responsible party(s) to:
   - Establish and conduct effective monitoring process (para. 4.2.2.1 and 4.2.2.3)
   - Publish and receive data reports
   - Establish a means to notify when performance does not comply with RCP/RSP specifications (para. 4.2.2.4)
   - Oversee the risk assessment process, resolution of issues, and monitoring of corrective action plans (para. 4.2.2.5)

PBCS ANS Safety Oversight Concepts *(continued)*

Asia-Pacific Economic Cooperation

2. Establish effective data management and analysis

- Determine available data and sources
- Determine data required for regulatory activities
  - Reliability of the system (RCP and RSP > 95%)
  - Actual Communication Performance (ACP) and Actual Surveillance Performance (ASP)
- Establish reporting agreements to include format, frequency, tracking and dissemination of information, issue identification and resolution, with the data sources
- Create position description, job aids and guidance materials to capture the responsibilities of the report recipients (data analysis, identification of corrective actions plans and mitigations)
- Conduct data analysis and identify trends

PBCS ANS Safety Oversight Practices *(continued)*

Asia-Pacific Economic Cooperation

3. Establish a surveillance and audit process

- Include the authority, and roles and responsibilities of offices involved and Safety Inspectors and management
- Conduct appropriate surveillance activities (audits, assessments, investigations, inspections), according to safety standards and mandatory requirements (data collection and briefings)
- Include record management tools, work instructions, and templates
- Conduct post surveillance activities that would validate findings
- Resolve non-compliance and non-performance issues and monitor corrective action plans

Key Points

- Based on ICAO PBCS Safety Oversight Standards, ANS Regulators should ensure the ANSP:
  - establishes means to assess the actual performance of communication and surveillance services in a particular airspace
  - performs ATM operations predicated on RCP/RSP
  - establishes a means to notify the operator… when the actual performance of the operator's fleet does not comply with an RCP/RSP specification
  - establishes a means to assess the risk of any non-compliance

- ANS Regulators should establish a formal internal policy or process to ensure compliance that would determine roles and responsibilities, effective data management and analysis, and a surveillance and audit process

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Free Trade for Asia-Pacific
Prosperity

Day 3 Recap of PBCS: Putting it All Together

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Day 3 Wrap-up

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ANSP Key Points:

- Guidance material and aids are available to assist an ANSP with PBCS implementation, and provided implementation examples from an ANSP implementation.
- Attendees are encouraged to make use of the guidance material and examples in this presentation to support their PBCS implementation activities.

Day 3 Wrap-up

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Monitoring Key Points:

- Monitoring ensures continued compliance of the end-to-end system as well as the individual airspace, aircraft, and networks
- Monitoring enables continuous system improvement through the reporting, investigation, and resolution of problems
- Practical information to support implementation of a PBCS monitoring program is provided on the website: www.FANS-CRA.com

Day 3 Wrap Up

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ANSP Regulator Key Points:

- Based on ICAO PBCS Safety Oversight Standards, ANS Regulators should ensure the ANSP:
  - establishes means to assess the actual performance of communication and surveillance services in a particular airspace
  - performs ATM operations predicated on RCP/RSP
  - establishes a means to notify the operator… when the actual performance of the operator's fleet does not comply with an RCP/RSP specification
  - establishes a means to assess the risk of any non-compliance

- ANS Regulators should establish: a formal internal policy or process to ensure compliance that would determine roles and responsibilities, effective data management and analysis, and a surveillance and audit process

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