Performance Based Communications and Surveillance (PBCS)

ICAO Africa and Latin America Regional Offices
Operational Data Link Seminar
8-11 August 2016
Accra, Ghana

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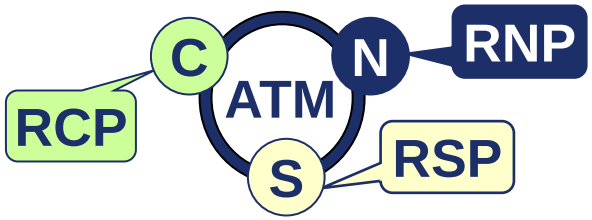
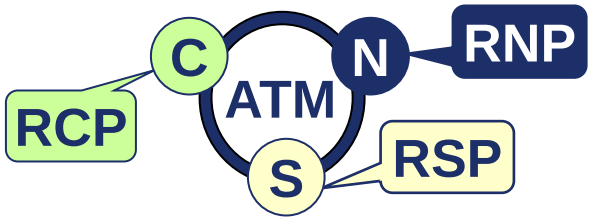
What we will cover today



- NZZO Oceanic FIR – overview of current operations.
- Discuss enabling customer benefits in NZZO in relation to Global Performance Indicators (GPI) 3rd Edition GANP.
- Discuss supporting infrastructure to implementing benefits.
- Discuss the concept of PBCS
- ICAO PBCS – overview of planned amendments/guidance
- Review the PBCS Manual – Doc 9869
- Review ICAO Asia/Pac/ISPACG references to PBCS
- Review current PBCS monitoring by Airways
- Review amendments to Annex 11, Annex 6 and PANS-ATM
- Review a draft PBCS implementation plan template
- Next steps …….

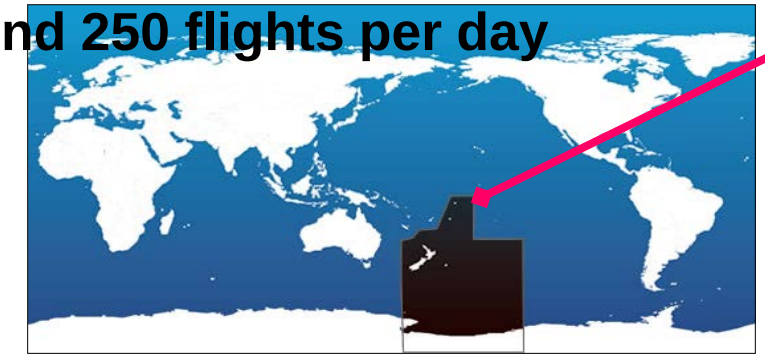
NZZO Oceanic FIR

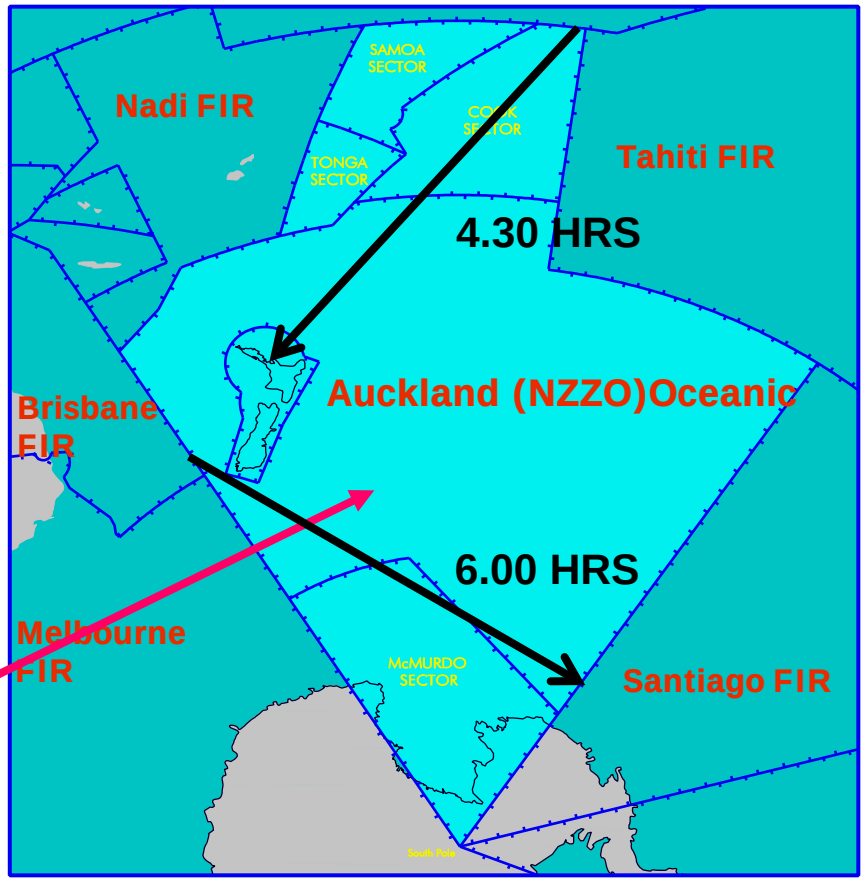


- Normally single sector operation.

- ATM Ground System
  - Oceanic Control System (OCS).
  - Integrated FANS1/A CPDLC & ADS-C
  - Integrated Conflict probe
  - RNP10 Separation – 50/50nm
  - RNP4 Separation – 30/30nm
  - AIDC

- around 250 flights per day





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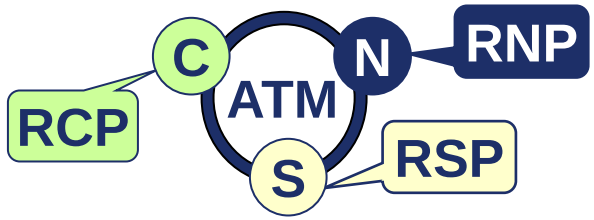
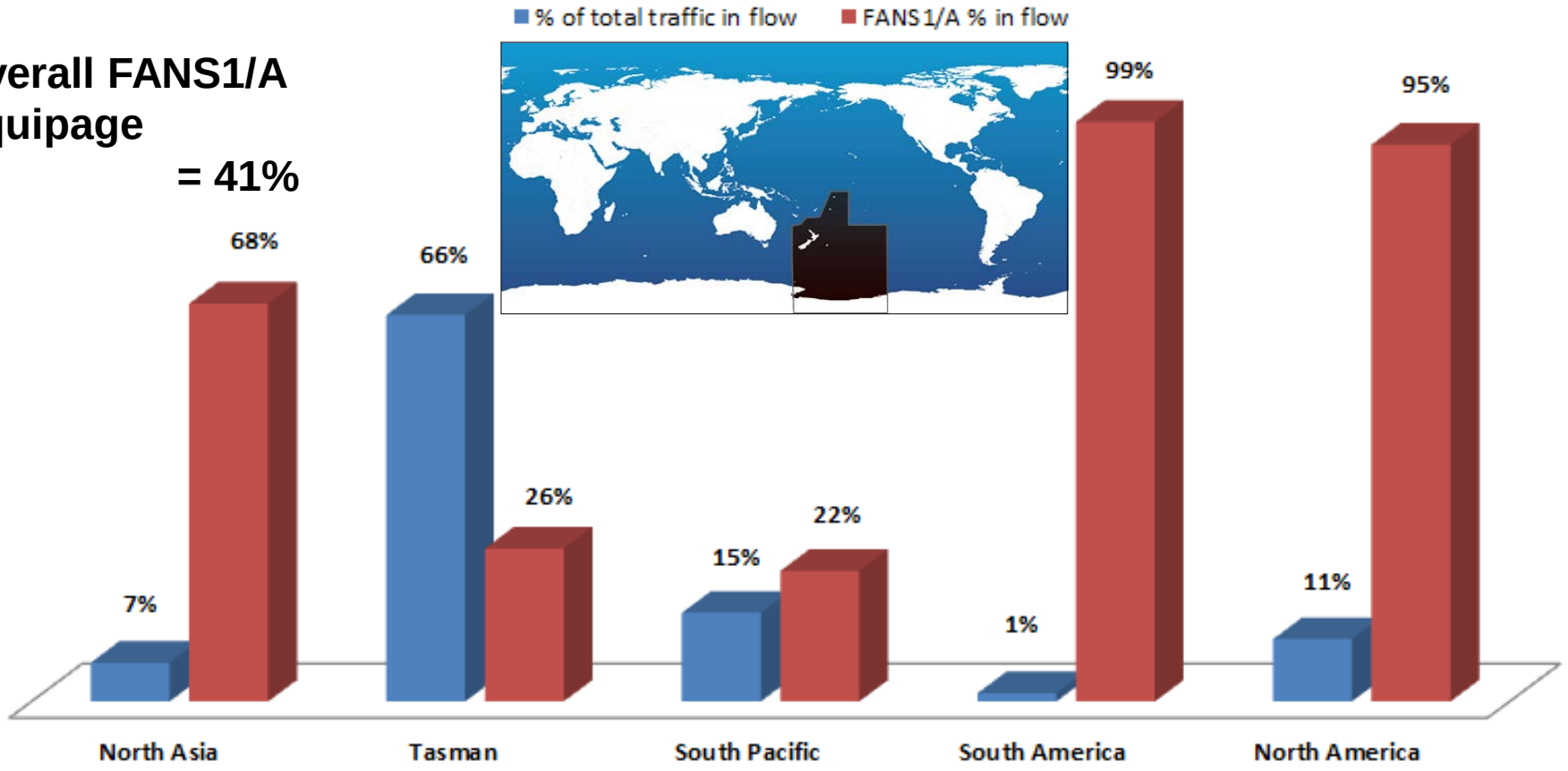
NZZO Oceanic FIR



NZZO Traffic Flows and FANS1/A Equippage April-June 2014

Overall FANS1/A Equipage = 41%



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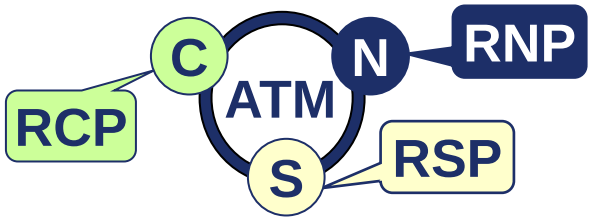
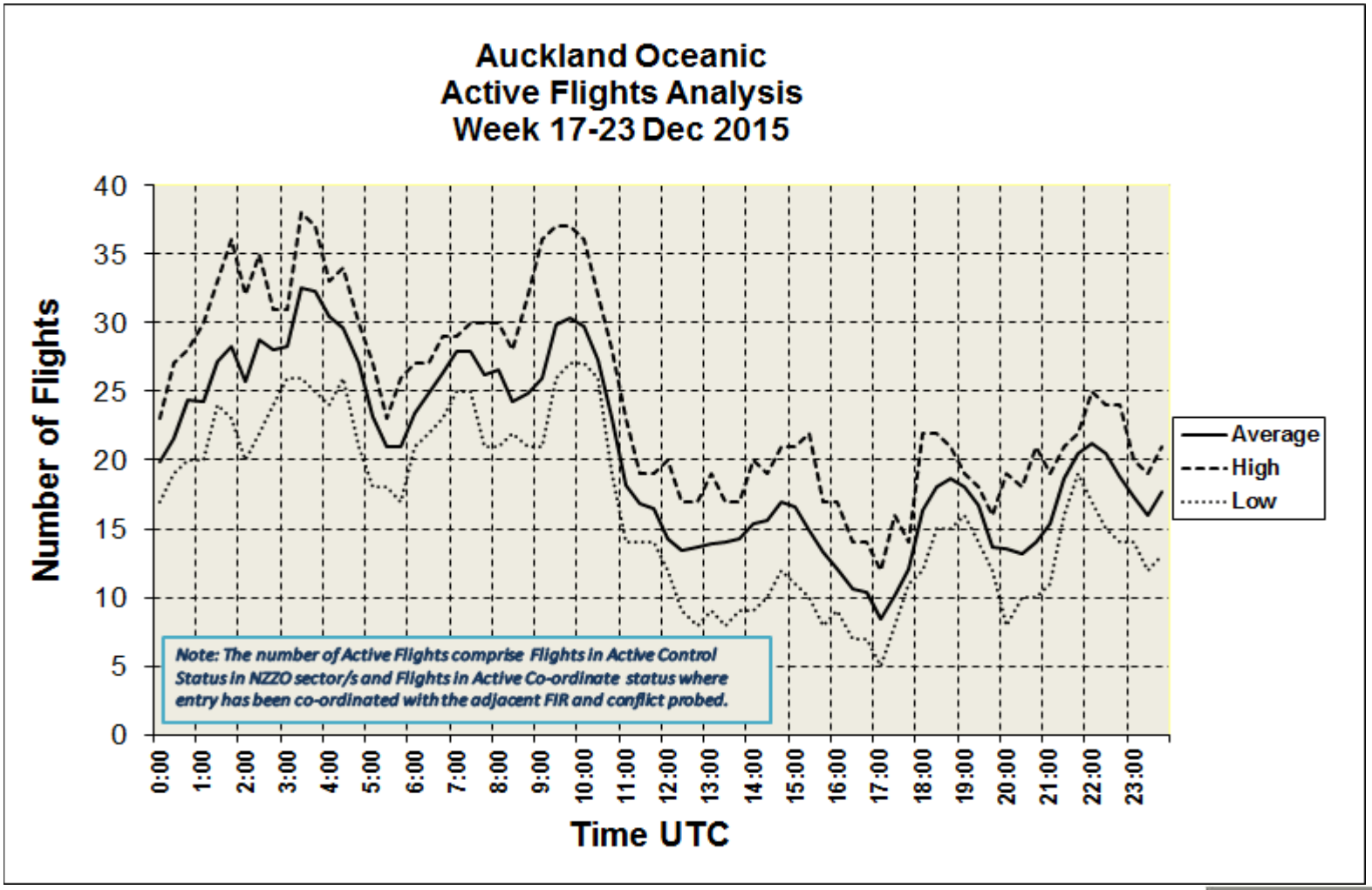
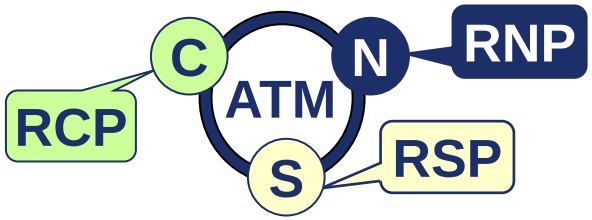
NZZO Oceanic FIR



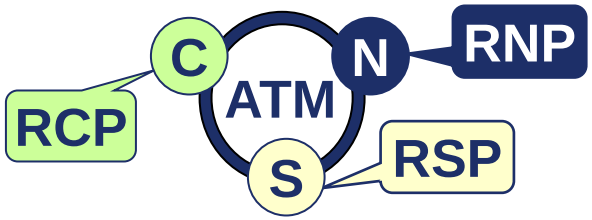


Enabling Benefits



- ***GANP Doc 9750 3rd Edition - GPI-5: RNAV and RNP:***
  - **leads to increased capacity and enhanced efficiency through reductions in separation minima, bringing benefits to aircraft operators that equip to meet performance requirements.**
    - **RNP10**
      - **T10 longitudinal separation**
      - **50NM longitudinal separation**
      - **50NM lateral separation**
    - **RNP4**
      - **30NM longitudinal separation**
      - **30NM lateral separation (SASP 23NM)**

Enabling Benefits

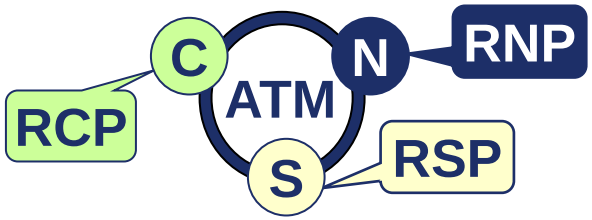


- ***GANP Doc 9750 3rd Edition- GPI-5: RNAV and RNP:***

  - **RNP2/GNSS (2016 and 2018 PANS-ATM Amendments)**
    - **??NM longitudinal separation (expected by 2018)**
    - **15NM lateral separation (intersecting track)**
    - **20NM lateral separation (parallel track – climb through)**

  - **RNP4**
    - **30NM lateral separation changed to 23NM.**

Enabling Benefits



- ***GANP Doc 9750 3rd Edition- GPI-7 : Dynamic and Flexible Route Management.***
  - **Implementation of an ATS routing environment that meets the needs of the airspace users to operate along preferred and dynamic flight trajectories, will increase capacity and increase aircraft operating efficiency.**
  - **User Preferred Routes (UPR) provide considerable benefit to operators by enabling aircraft to fly the most economical route for current weather pattern with no requirement to flight plan by fixed airways.**
    - **Some restrictions on Tasman Sea routes between New Zealand and Australia.**
    - **Most long-haul flights transiting NZZO between Australia/New Zealand and North/South America operate UPR.**
    - **UPR are also available on some routes to Asia.**

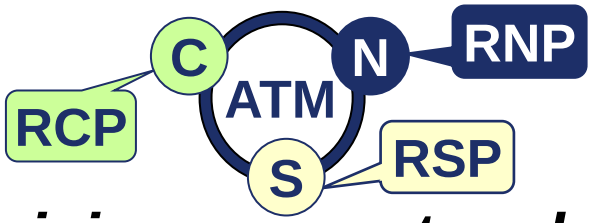
Enabling Benefits

- ***GANP Doc 9750 3rd Edition - GPI-7 : Dynamic and Flexible Route Management.***
  - **DARP (Dynamic Airborne Re-route Procedure) provide significant benefit to operators and are available in NZZO. DARP are re-routes initiated by AOC while aircraft is en-route with aircraft making the request via CPDLC.**
  - **NZZO has no restrictions however some SOPAC ANSP while accepting DARP re-routes are not yet initiating them.**
  - **Uptake from Airlines has been slow. Reasons for this include:**
    - **DARP is AOC resource intensive and staffing is an issue.**
    - **Lack of AOC automation for DARP calculation.**

Enabling Benefits

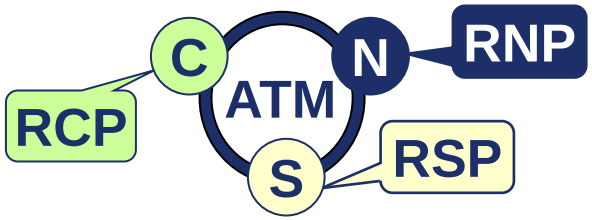
- ***GANP Doc9750 3rd Edition - GPI-9 : Situational Awareness.***
  - **The further implementation of enhanced surveillance techniques (ADS-C or ADS-B) will allow reductions in separation minima and an enhancement of safety, increase in capacity, and improved flight efficiency, all on a cost effective basis.**
    - **Implemented ADS-C distance based 50NM and 30NM longitudinal separation standards.**
    - **2016 – Implement ADS-C Climb Descent procedure (15NM/25NM).**
    - **2017 -2018 – Implement RNP2/GNSS ADS-C distance based longitudinal separation standards.**
    - **2015 – ADS-B Trial implementation in Tonga.**
    - **On Hold – ADS-B In Trail Procedure (no aircraft).**
    - **Under Evaluation - Aireon – space based ADS-B.**
    - **We anticipate separations in order of 15/15NM with FANS1/A CPDLC and RNP2/GNSS**

Enabling Benefits



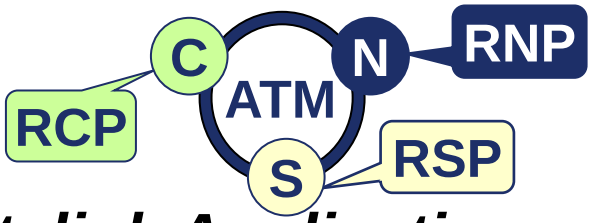
- ***GANP Doc9750 3rd Edition - GPI-16 : Decision support and alerting systems***
  - **Decision support systems facilitate early resolution of potential conflicts, provide basic levels of explorative probing to optimize strategies, and reduce the need for tactical action. The executive role of controllers is thereby enhanced, giving scope for management of more traffic within acceptable workload limits.**
    - **OCS conflict probe.**
    - **Integrated Flight Data Processing.**
    - **OCS automation allows single controller to handle peaks of 40 active flights using procedural control.**
  - **The automation of coordination tasks between adjacent sectors improves the quality of information on traffic transiting between sectors and makes it more predictable, thereby allowing reduced separation minima, decreased workload, increased capacity and more efficient flight operations.**
    - **Automated Inter-facility Data Communications (AIDC)**
    - **Integrated Flight Data Processing.**

Enabling Benefits



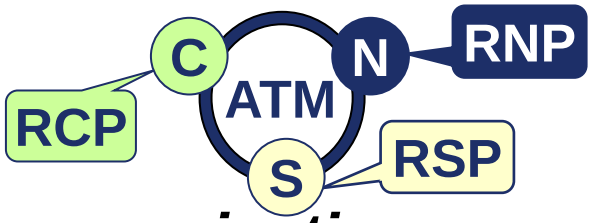
- ***GANP Doc 9750 3rd Edition- GPI-16 : Decision support and alerting systems***
  - **Route Conformance Monitoring.**
    - **Reported ADS-C or CPDLC next and next +1 position automatically checked for conformance against ground system flight data record.**
  - **Level Conformance Monitoring.**
    - **Use ADS-C event contracts (ARC, VRC) and reported level to monitor conformance.**
  - **Speed Conformance Monitoring.**
    - **Reported ADS-C Mach speed updates flight data record if in conformance alerts controller if not.**

Enabling Benefits



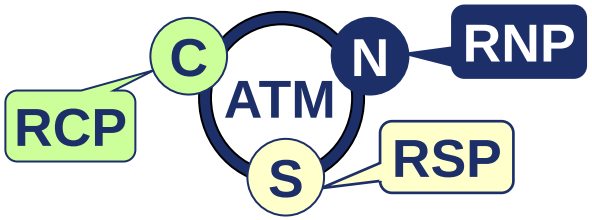
- ***GANP Doc 9750 3rd Edition - GPI-17: Datalink Applications***
  - **Use of CPDLC and implementation of other data link applications can bring significant advantages over voice communication for both pilots and controllers in terms of workload and safety. In particular, they can provide efficient linkages between ground and airborne systems, improved handling and transfer of data, reduced channel congestion, reduced communication errors, interoperable communication media and reduced workload. The reduction of workload per flight translates into capacity increases and enhanced safety.**
    - **FANS1/A CPDLC and ADS-C implemented**
    - **Enhancing safety through performance based communications and surveillance (PBCS)**
  - **Communication data link and data link surveillance technologies and applications should be selected and harmonized for seamless and interoperable global operations.**
    - **SOPAC implemented FANS1/A CPDLC and ADS-C.**
    - **Global Operational Datalink Manual (GOLD)**
    - **Performance Based Communication and Surveillance (PBCS) Manual**
    - **RCP240 and RSP180 Introduction**

Enabling Benefits



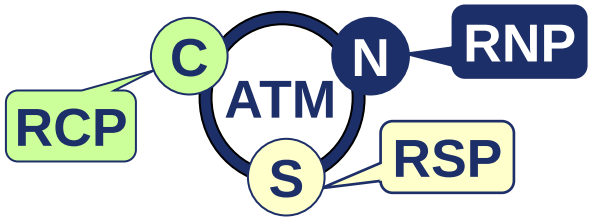
- ***GANP Doc 9750 3rd Edition - GPI-22: Communication Infrastructure***
  - **ATM depends extensively and increasingly on the availability of real-time or near real-time, relevant, accurate, accredited and quality-assured information to make informed decisions. The timely availability of appropriate aeronautical mobile and fixed communication capabilities (voice and data) to accommodate ATM requirements and to provide the adequate capacity and quality of service requirements is essential.**
  - **The gradual introduction of performance-based SARPs and system-level and functional requirements will allow the increased use of commercially available voice and data telecommunication technologies and services. In the framework of this strategy, States should, to the maximum extent possible, take advantage of appropriate technologies, services and products offered by the telecommunication industry.**
  - **Considering the fundamental role of communications in enabling aviation, the common objective is to seek the most efficient communication network service providing the desired services with the required performance and interoperability required for aviation safety levels at minimum cost.**

Supporting Infrastructure



- **FANS1/A data-link requires a supporting infrastructure to enable operational benefits:**
  - **In Oceanic/Remote airspace significant benefits can be realised through separation reduction.**
    - **Requires effective performance monitoring and problem reporting to ensure data link performance meets the required standards for the application of reduced separations.**
  - **In Oceanic/Remote airspace significant benefits can be realised through Dynamic Airborne Reroute Procedure (DARP).**
    - **DARP requires AIDC to communicate route changes to downstream ANSP.**
    - **No AIDC = No DARP.**
  - **Develop a culture of continuous performance**

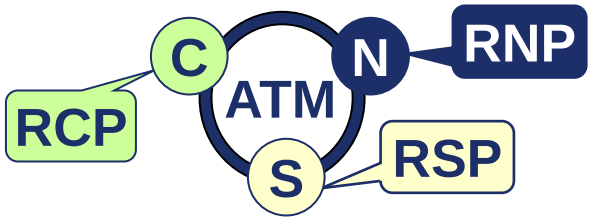
Supporting Infrastructure



- **Operational improvements using FANS1/A CPDLC and ADS-C data-link are predicated on certain communications, surveillance, and navigation requirements.**

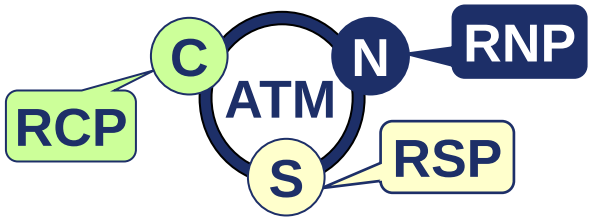
- **We have an obligation to ensure that aircraft and operators are meeting these requirements.**

Supporting Infrastructure



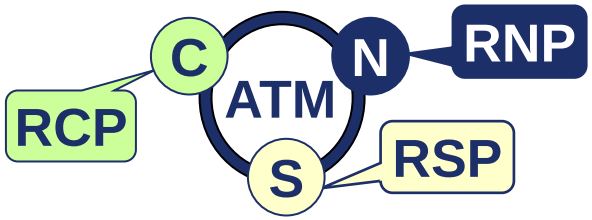
- **Annex 11 Air Traffic Services: 2.27.5 Any significant safety-related change to the ATS system, including the implementation of a reduced separation minimum or a new procedure, shall only be effected after a safety assessment has demonstrated that an acceptable level of safety will be met and users have been consulted. When appropriate, the responsible authority shall ensure that adequate provision is made for post-implementation monitoring to verify that the defined level of safety continues to be met.**
  Note.— When, due to the nature of the change, the acceptable level of safety cannot be expressed in quantitative terms, the safety assessment may rely on operational judgement.

Supporting Infrastructure



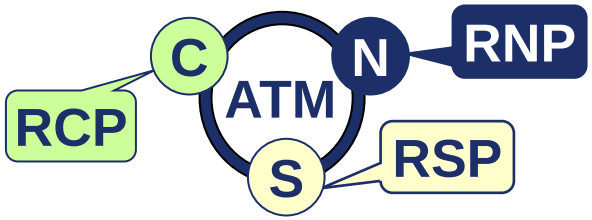
- **If there are no means to quantify system performance, there are risks with current and evolving operations, e.g. the potential exists for misapplying performance-based separation minima to inappropriate aircraft pairs.**
- **Performance based communications and surveillance (PBCS) provides the required framework to quantify system performance.**

Supporting Infrastructure



- **If there is no framework to manage communication and surveillance performance, there will be no means to build confidence and ensure safe operation.**
- **Performance based communications and surveillance (PBCS) provides the required framework to build confidence and ensure safe operation.**

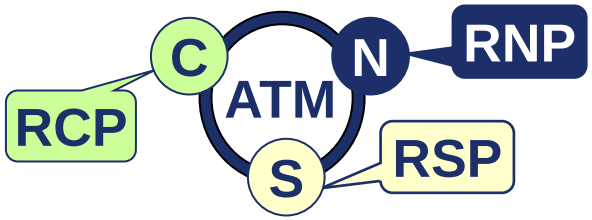
PBCS



- **A PBCS framework assures that the required level of communication and surveillance performance is managed in accordance with globally accepted specifications of required communication performance (RCP) and required surveillance performance (RSP).**
  - ***Performance-based communication (PBC).*** Communication based on performance specifications applied to the provision of air traffic services.

    Note.— An RCP specification includes communication performance requirements that are allocated to system components in terms of the communication to be provided and associated transaction time, continuity, availability, integrity, safety and functionality needed for the proposed operation in the context of a particular airspace concept.

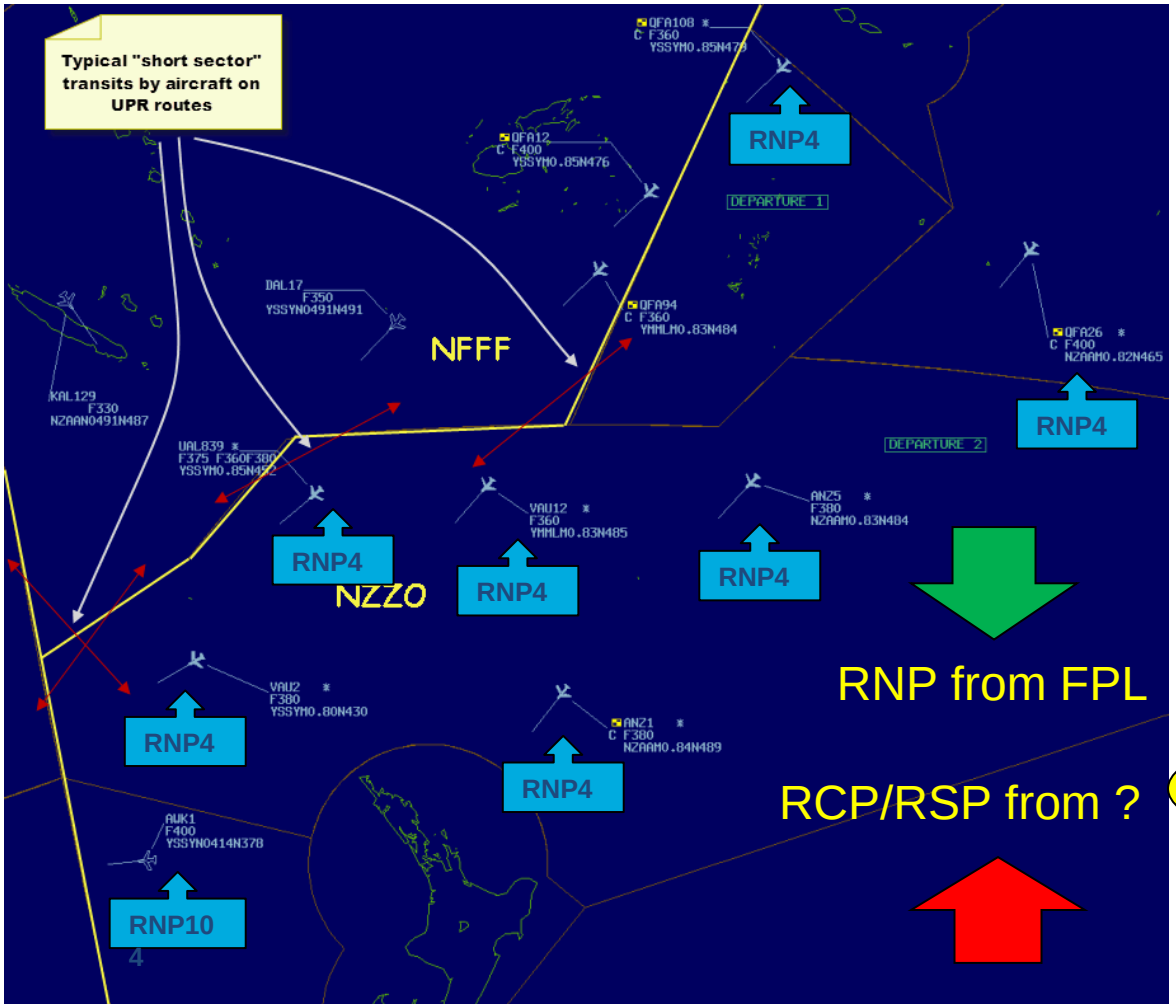
PBCS

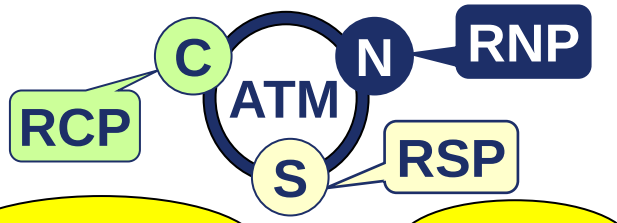


- **A PBCS framework assures that the required level of communication and surveillance performance is managed in accordance with globally accepted specifications of required communication performance (RCP) and required surveillance performance (RSP).**
  - ***Performance-based surveillance (PBS).*** Surveillance based on performance specifications applied to the provision of air traffic services.

    Note.— An RSP specification includes surveillance performance requirements that are allocated to system components in terms of the surveillance to be provided and associated data delivery time, continuity, availability, integrity, accuracy of the surveillance data, safety and functionality needed for the proposed operation in the context of a particular airspace concept.

PBCS – Why RCP/RSP ?





VHF?

VDL2?

POA?

Inmarsat SBB?

RCP240?

Inmarsat I3?

RCP400?

Inmarsat I4?

SATCOM?

Iridium Next?

RSP180?

Iridium?

RSP400?

MTSAT?

HFDL?

SATCOM+HFDL?

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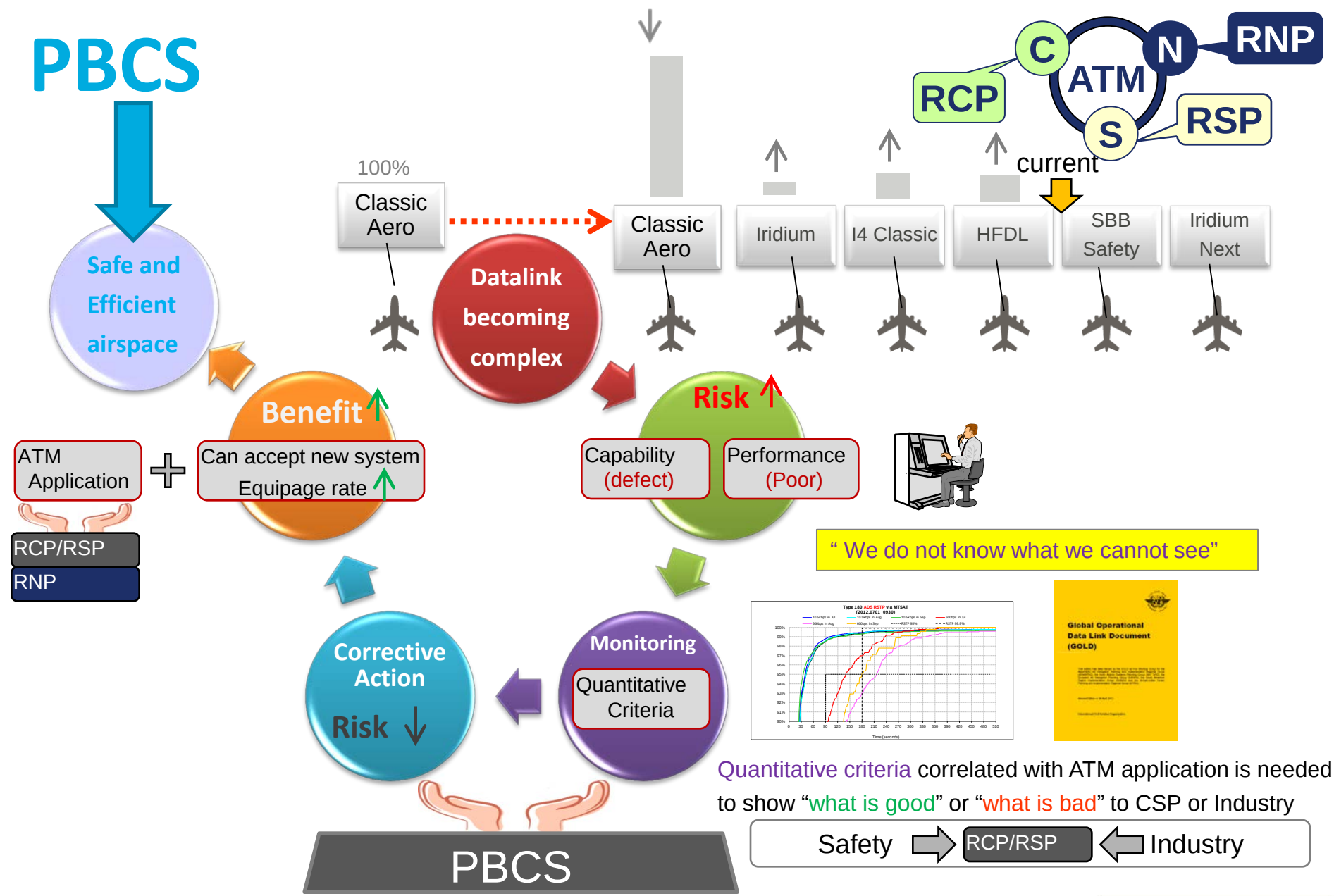
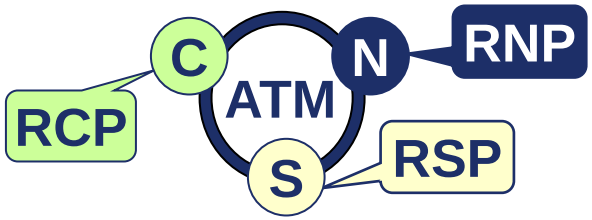
PBCS



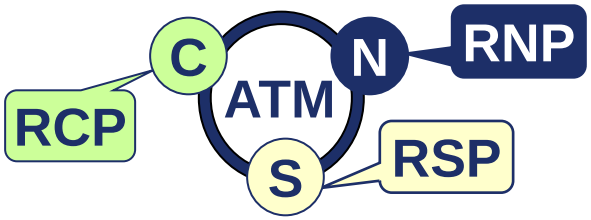
Slide courtesy of JCAB

PBCS



- Need PBCS for oversight of “end-to-end” C and S performance to ensure ATM safety
  - Without PBCS “We do not know what we cannot see”
  - Without PBCS “We will not have continuous performance improvement”
- PBCS will provide oversight of CNS based ATM operations including:
  - 30 NM lateral, 30 NM and 50 NM longitudinal separation minima
  - ADS-B In trail procedure (ITP)
  - ADS-C climb/descent procedure (CDP)
  - proposed RNP2/GNSS separation standards in Oceanic Airspace

PBCS



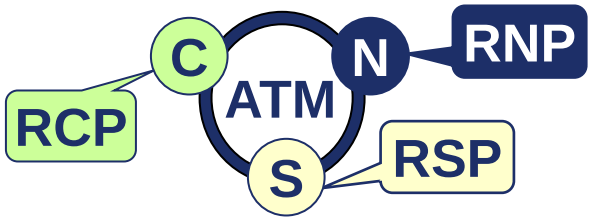
- **There are some differences between the PBCS concept and PBN concept:**

  - **The PBCS concept applies RCP and RSP specifications, which allocate criteria to ATS provision, including communication services, aircraft capability, and the aircraft operator;**
  - **the PBN concept applies RNP/RNAV specifications, which allocate criteria only to the aircraft capability and the aircraft operator; and**

  - **The PBCS concept includes post-implementation monitoring programmes, on a local and regional basis, with global exchange of information;**
  - **the PBN concept includes real time monitoring and alerting functionality in the aircraft capability.**

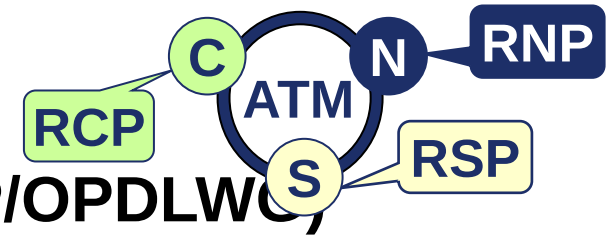
Note.— PBCS includes real time alerts (e.g. when a communication transaction expires or a position report is overdue) that are conceptually different than the PBN alerts (e.g. RNP UNABLE)

PBCS



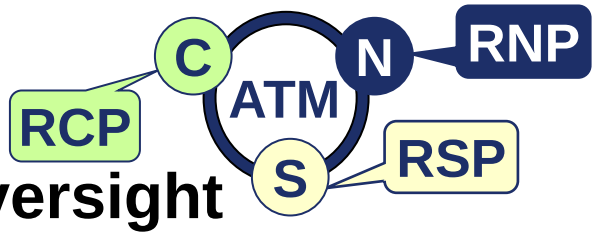
- **The main components of a PBCS framework are as follows:**
  - **prescription of RCP and RSP for air traffic services that are predicated on communication and surveillance performance;**
  - **operational approval of air operators for a communication and/or surveillance capability including aircraft equipage for operations where RCP and/or RSP specifications have been prescribed;**
  - **indication of an aircraft's communication and performance capability in the form of RCP/RSP specifications in the flight plan; and**
  - **monitoring programmes to assess actual communication and surveillance performance against RCP and RSP specifications and to determine corrective action, as applicable, for the appropriate entity.**

PBCS - ICAO



- Operational Data Link Panel (OPLINKP/OPDLWG)
  - November 2016 - Amend Annex 11, Doc 4444 and Doc 9869 to revise PBCS provisions for initial qualification, flight plan provisions and post-implementation monitoring – based on GOLD/PBCS Manual
- Operations Panel (OPS)
  - November 2016 - Amend Annex 6 to revise provisions for PBCS – operational authorization and post-implementation monitoring
- Separation & Airspace Safety Panel (SASP)
  - November 2016 - Will refer to RCP – RSP specifications in procedural separation standards for communication and surveillance performance
- Guidance Material
  - November 2016 - Publish Doc 9869 PBCS Manual

PBCS – Doc 9869

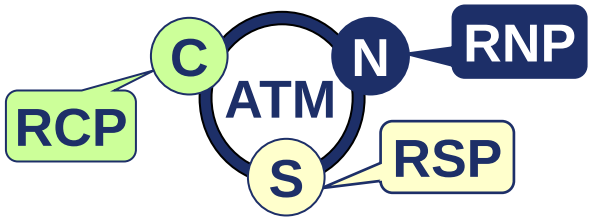


➢ Relationship of PBCS to State safety oversight

- Annex 19 requires States to establish a State safety programme for the management of safety in the State, to achieve an acceptable level of safety performance in civil aviation. The relationship of the PBCS concept to each of the components of a State safety programme is highlighted as follows:

  - *State safety policy and objectives* – The PBCS concept provides means to establish a safety policy with objectives to ensure responsible parties manage, commit, and account for achieving acceptable level of performance for communication and surveillance systems;
  - *State safety risk management* – The PBCS concept provides a basis for initial and ongoing compliance determination, including hazard identification, risk assessment, and mitigation, through the application of RCP/RSP specifications to communication and surveillance systems;
  - *State safety assurance* – The PBCS concept supports safety oversight by providing allocated functional, safety and performance requirements, which are contained in RCP/RSP specifications, and a means of compliance framework for approval of the different communication and surveillance system components, and identify substandard performance for appropriate action. These components include, for example, the aircraft operator, aircraft type/system, ANSP, CSP/SSP, and others, as appropriate; and
  - *State safety promotion* – The PBCS concept is global in nature, to support State activities to effectively and efficiently promote the safety of communication and surveillance capabilities by applying RCP/RSP specifications, and exchanging information on a regional and global basis, such as through workshops and monitoring programmes.

PBCS – Doc 9869



➢ The PBCS framework

- ❑ **The PBCS concept provides a framework to apply RCP and RSP specifications to ensure the acceptable communication and surveillance capabilities and performance of an operational system. The PBCS concept applies RCP and RSP specifications in any one or more of the following ways:**
  - o **Air traffic services (ATS) provision and prescription (in accordance with ICAO Annex 11, PANS, Doc 7030 and/or the AIP (or equivalent publication)) of an RCP specification for a communication capability and/or an RSP specification for a surveillance capability, either of which is required for the ATS in a particular airspace;**
  - o **Operator approval (under Air Operator Certificate, special authorization or equivalent, in accordance with ICAO Annex 6) of a communication and/or surveillance capability including aircraft equipage where RCP and/or RSP specifications have been prescribed for the communications and/or surveillance capabilities supporting the ATS provision; and**
  - o **Local and regional monitoring programmes to assess actual communication and surveillance performance against RCP and RSP specifications and to determine corrective action, as applicable, for the appropriate entity.**

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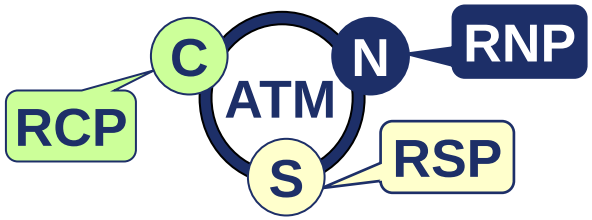
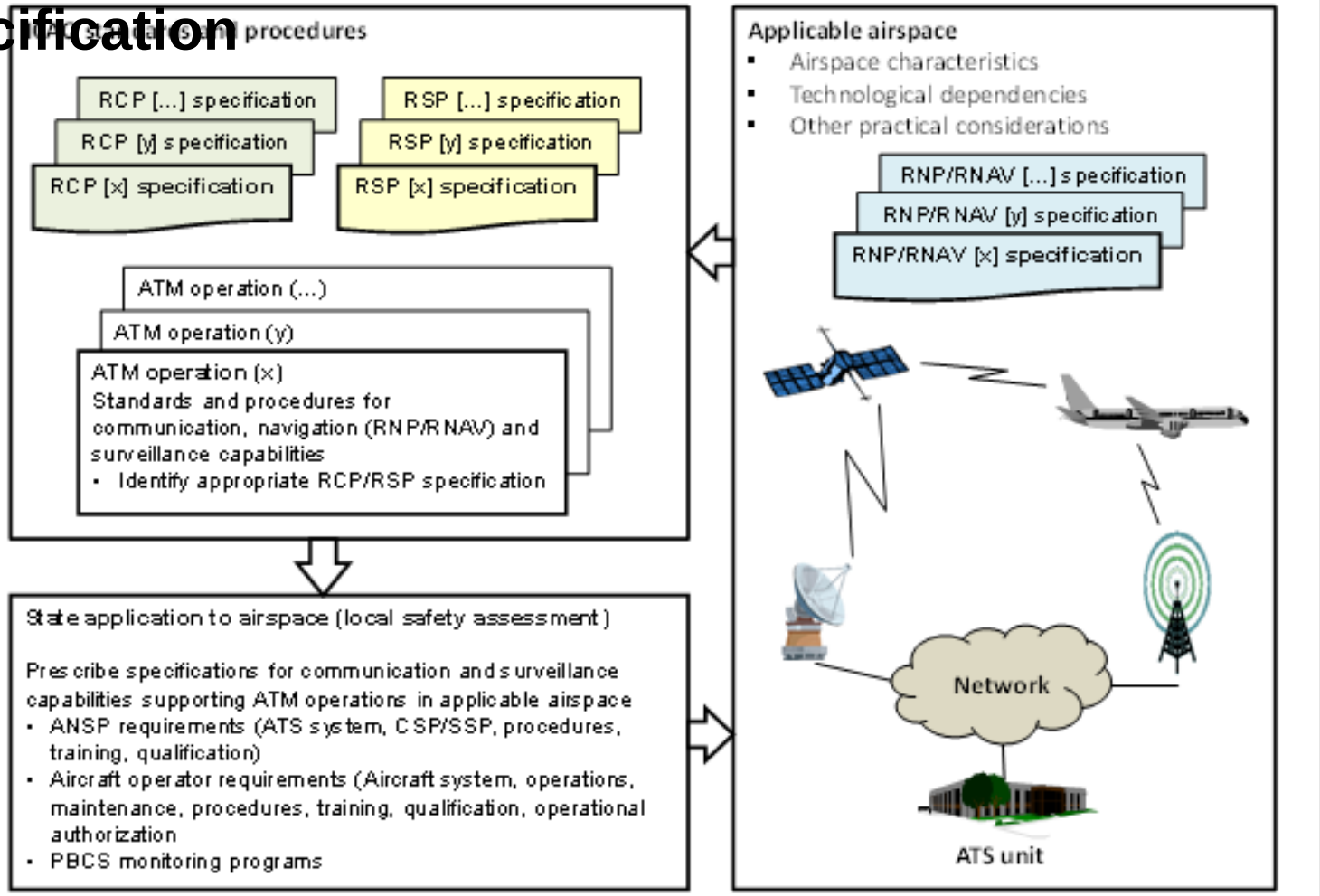


- **Applying an RCP/RSP specification**



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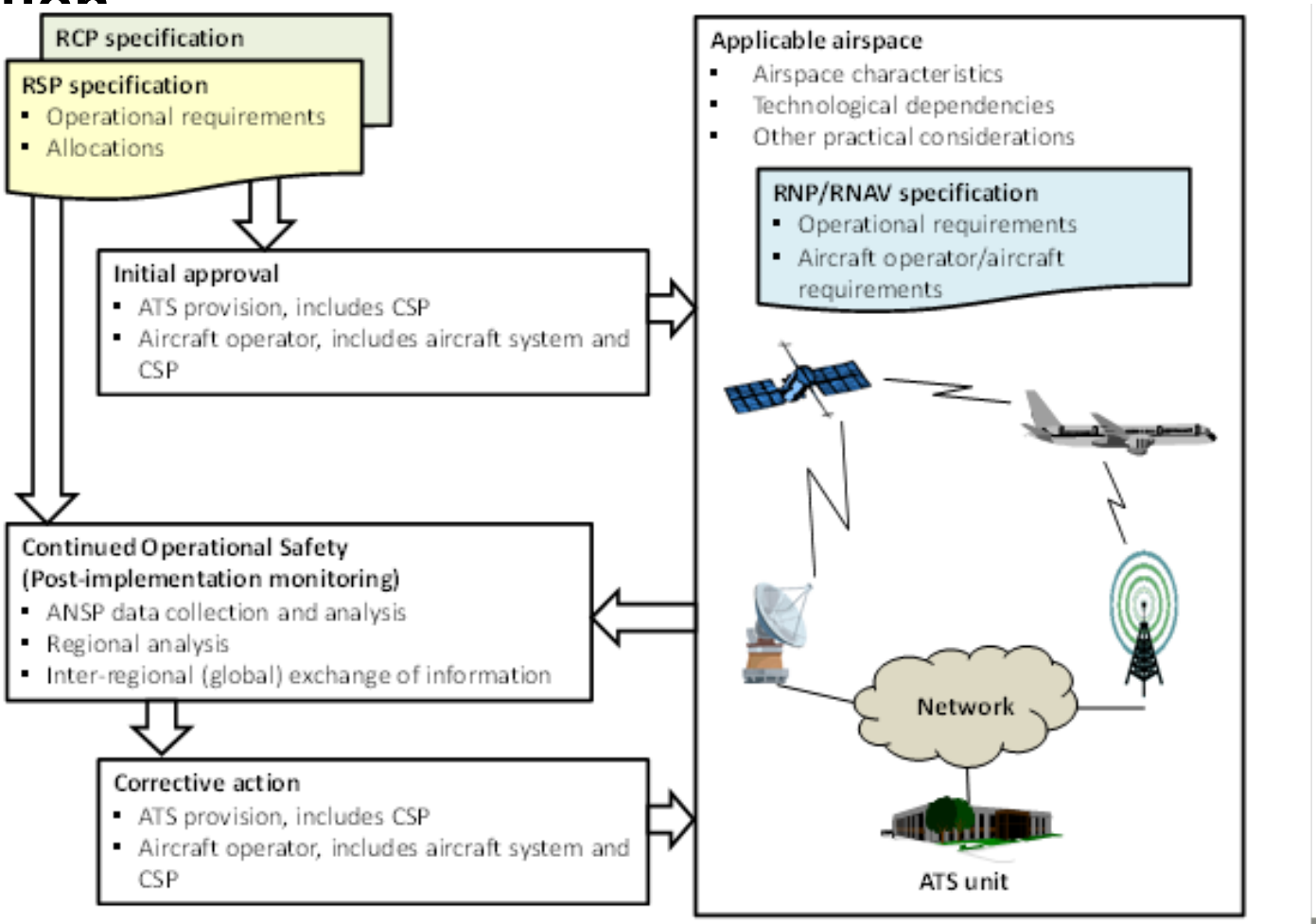
- **Complying with an RCP/RSP specification**



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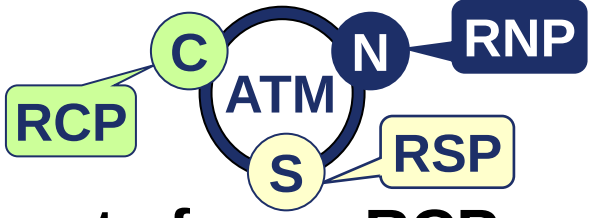

- **RCP Specifications: The set of requirements for an RCP specification are based on the following parameters:**
  - **RCP transaction time. The maximum time for the completion of the operational communication transaction after which the initiator should revert to an alternative procedure;**
  - **RCP continuity. The minimum proportion of operational communication transactions to be completed within the specified RCP transaction time, given that the service was available at the start of the transaction;**
  - **RCP availability. The required probability that an operational communication transaction can be initiated; and**
  - **RCP integrity. The required probability that an**

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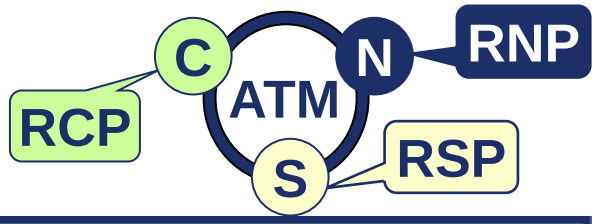
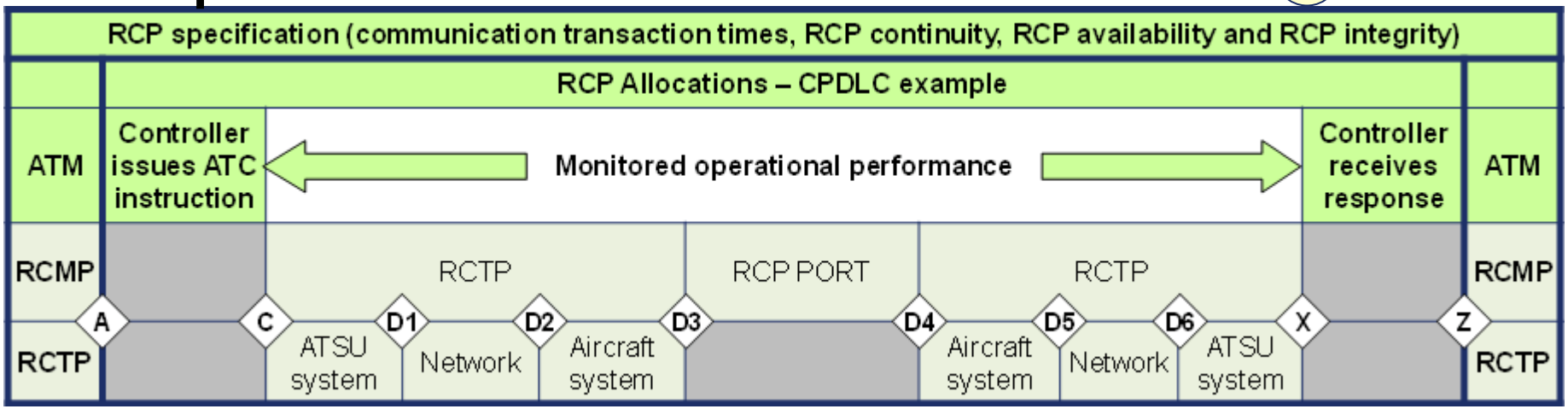


➢ RCP Specifications



RCP specification	RCP transaction time (sec)	RCP continuity (probability)	RCP availability (probability)	RCP integrity (acceptable rate/flight hour)
RCP 240	240	0.999	0.999 0.9999 (efficiency) *(See Note 3)*	10^{-5}
RCP 400	400	0.999	0.999	10^{-5}

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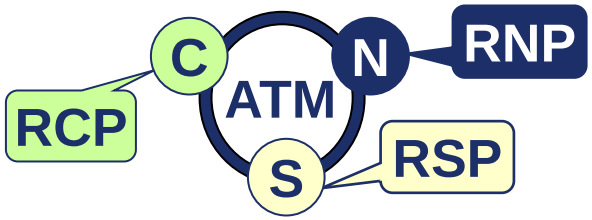

- **RCP transaction time and continuity**
  - **The value for the RCP transaction time is based on the time needed to complete the most stringent transaction for controller intervention.**
    - **For separation assurance, the RCP transaction time can be determined by collision risk modeling. Collision risk modeling considers the RCP transaction times in the communications and controller intervention buffer supporting separation assurance.**

      Note: Refer slide # 37- operational communication transaction in the context of communications and controller intervention buffer.
    - **In practice, the RCP transaction time is specified for a nominal continuity (TT) and for an operational continuity (ET). The time associated with the operational continuity is called expiration time (ET), as this is associated with the time the controller takes action upon receiving an alert provided by the expiration of the ground timer. These times are associated directly with the RCP continuity requirements for the controller's communication and intervention capability.**
    - **The TT value is used in statistical analysis during post-implementation monitoring and is not monitored in real time. The TT value is known as the nominal time (i.e. the time at which 95% of the communication transactions in a data sample are completed).**
    - **The ET value is monitored in real time for each transaction by the ATC system. When a response to an ATC instruction has not been received within the ET value, the ATC system provides an indication to the controller for appropriate action. The ET value is associated with a continuity requirement of 0.999 (99.9%), which was determined by an operational safety assessment, in accordance with DO 264/ED 78A.**

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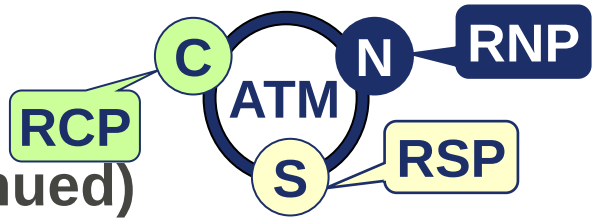

- **RCP transaction time and continuity(continued)**
  - **The TT value is used in statistical analysis during post-implementation monitoring and is not monitored in real time. The TT value is known as the nominal time (i.e. the time at which 95% of the communication transactions in a data sample are completed).**
  - **The ET value is monitored in real time for each transaction by the ATC system. When a response to an ATC instruction has not been received within the ET value, the ATC system provides an indication to the controller for appropriate action. The ET value is associated with a continuity requirement of 0.999 (99.9%), which was determined by an operational safety assessment, in accordance with DO 264/ED 78A.**
  - **In this case, the operational safety assessment concluded that under worst case conditions, a frequent occurrence of this indication to the controller (i.e. that a WILCO response has not been received by the ET value) could result in a significant increase in controller workload. This is considered to be a "Class 4" "minor" hazard. The corresponding safety objective is that the occurrence of a WILCO response exceeding the ET value is no greater than 10^{-3} (or 99.9% of WILCO responses are received within the ET value)**
  - **From a performance perspective, RCP continuity is associated with the required level of usability. This puts a maximum on the number of interrupted transactions after which it becomes annoying or less productive from a usability viewpoint to use CPDLC.**

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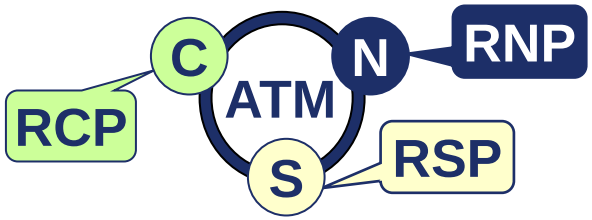

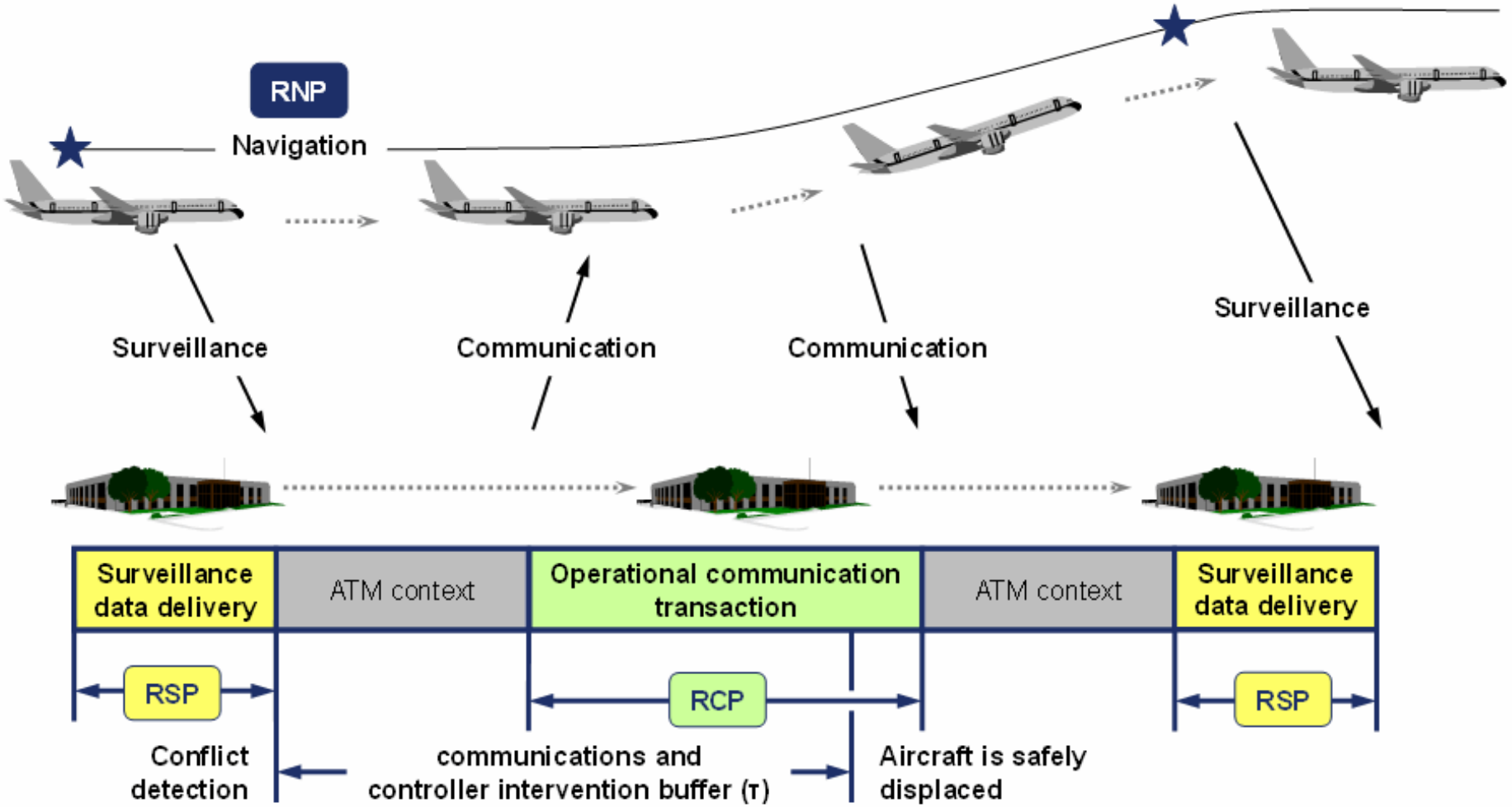

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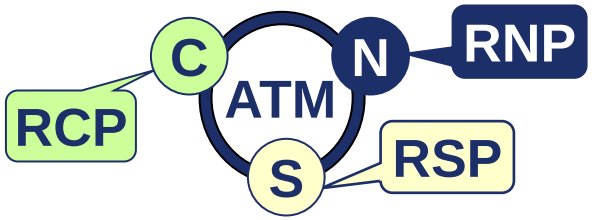

- **RCP availability**
  - The RCP availability (RCP A) is a system requirement, associated with the communication service, which is at the disposal of the flight crew and controller. RCP A is the required probability that the communication system is in service, measured over a period of time.
  - The RCP availability requirement of 99.9% was determined based on an operational safety assessment (per DO-264/ED-78A) that classified the effect of loss of service as “minor” provided procedural mitigations are in place to transition to a different separation minimum (those not predicated on RCP 240 performance).
  - For RCP 240, RCP availability is ensured initially in contract/service agreements with the CSP/SSP and approval of aircraft CPDLC equipment. Post-implementation monitoring evaluates service availability from unplanned outage events on a per center basis if the outage exceeds 10 minutes and if it affects multiple aircraft.

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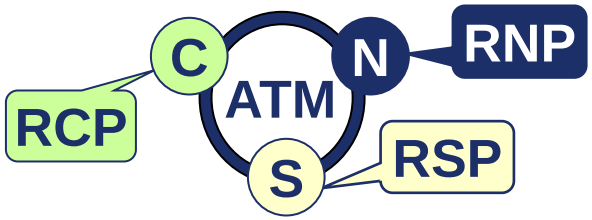

- RCP integrity
  - **The value for the RCP integrity parameter is selected based on the results of an operational hazard assessment. The operational hazard assessment should include a severity-of-effects analysis of communication transactions with undetected errors. Undetected errors include, but are not limited to:**
    - **Undetected corruption of one or more messages within the transaction;**
    - **Undetected misdirection of one or more messages within the transaction;**
    - **Undetected delivery of messages in an order that was not intended;**
    - **Undetected delivery of a message after the RCP transaction time; and**
    - **Undetected loss of service or interruption in a communication transaction.**
  - **RCP integrity is demonstrated by procedures, design assurance, design features and system architecture characterized by interoperability standards (e.g. RTCA DO-258A/EUROCAE ED-100A for FANS 1/A) and safety and performance requirements (SPR) standards (e.g. RTCA DO-306/RTCA ED-122 for Oceanic/Remote airspace).**
    - **For example. RTCA DO-258A/EUROCAE ED-100A employs a cyclic redundancy check (CRC) algorithm that is implemented in the CPDLC and ADS-C application (RTCA DO-178C/EUROCAE ED-12C level C software) to eliminate the potential risk of undetected corruption of message content and message address caused by communication services as required by the SPR standard**

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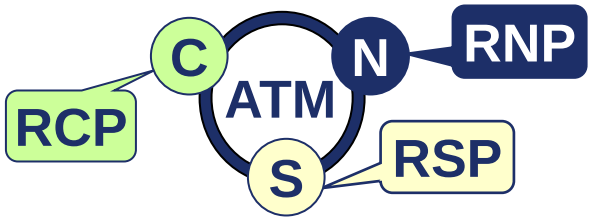

- **RSP Specifications**
  - **The set of requirements for an RSP specification are based on the following parameters:**
    - **RSP surveillance data transit time. The maximum time for the reception of the surveillance data after which the controller should revert to an alternative procedure;**
    - **RSP continuity. The minimum proportion of surveillance data delivery to be completed within the specified RSP surveillance data delivery time, given that the service was available at the start of the delivery;**
    - **RSP availability. The required probability that surveillance data can be provided; and**
    - **RSP integrity. The required probability that surveillance data delivery is completed with no undetected errors.**

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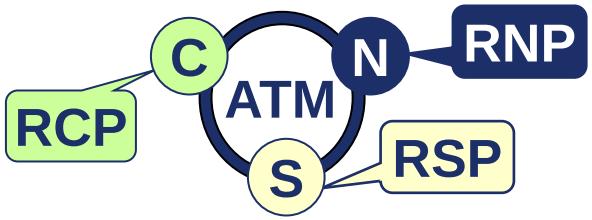

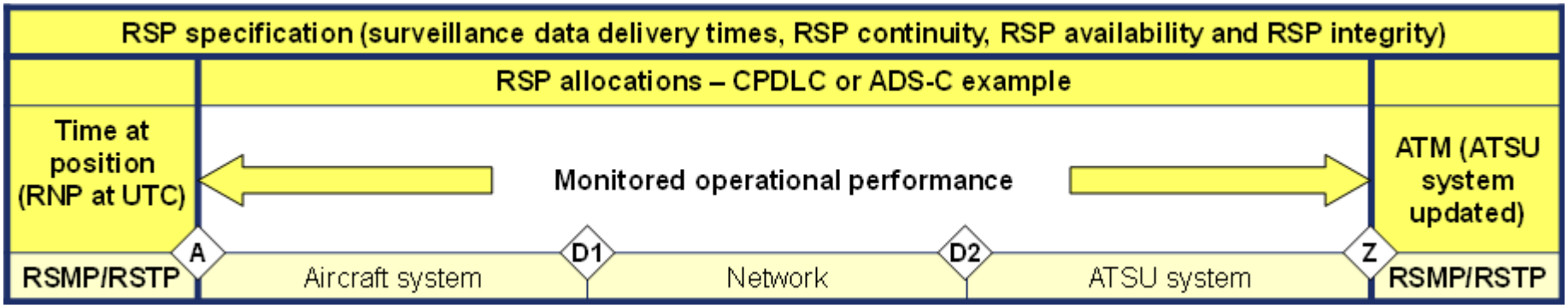

RSP specification	RSP delivery time (sec)	RSP continuity (probability)	RSP availability (probability)	RSP integrity (acceptable rate/flight hour)
RSP 180	180	0.999	0.999 0.9999 (efficiency) *(See Note 3)*	FOM = Navigation specification Time at position accuracy = +/- 1 sec Data integrity (malfunction) = 10^{-5}
RSP 400	400	0.999	0.999	FOM = Navigation specification Time at position accuracy = +/- 30 sec Data integrity (malfunction) = 10^{-5}

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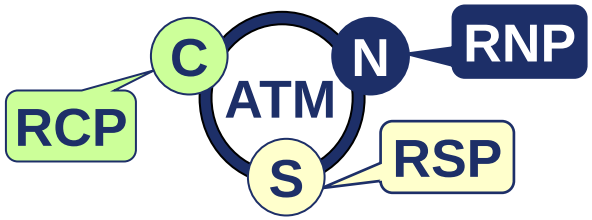

- **RSP delivery time and continuity**
  - **The value for the RSP data delivery time is based on the time when the surveillance data delivery is considered overdue.**
    - **For separation assurance, the RSP data delivery can be determined by collision risk modeling. Collision risk modeling considers the RSP delivery times in the surveillance data delivery and controller intervention buffer supporting separation assurance.**

Note: Refer slide # 33 - operational communication transaction in the context of communications and controller intervention buffer.

    - **In practice, the RSP data delivery time is specified for a nominal continuity (DT) and for an operational continuity (OT). The time associated with the operational continuity (OT) is called overdue time, as this is associated with the time the controller takes action upon receiving an alert provided by the expiration of the ground timer. These times are associated directly with the RSP continuity requirements for the controller's surveillance capability.**
    - **The DT value is used in statistical analysis during post-implementation monitoring and is not monitored in real time. The DT value is known as the nominal delivery time (i.e. the time at which 95% of the surveillance reports in a data sample are delivered).**

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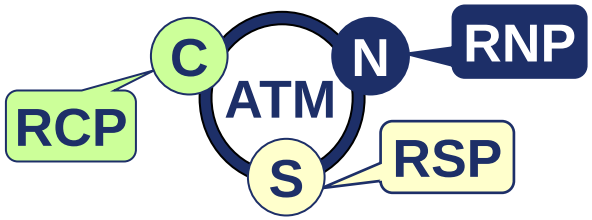

- **RSP delivery time and continuity (continued)**
  - **The OT value is monitored in real time for each surveillance report by the ATC system. When the surveillance report is not received within the OT value (i.e. the report is overdue), the ATC system provides an indication to the controller for appropriate action.**
  - **The OT value is associated with a continuity requirement of 0.999 (99.9%), which was determined by an operational safety assessment, in accordance with DO-264/ED-78A.**
  - **In this case, the operational safety assessment concluded that under worst case conditions, a frequent occurrence of this indication to the controller (i.e. that a surveillance report is overdue) could result in a significant increase in controller workload. This is considered to be a "Class 4" hazard. The corresponding safety objective is that the occurrence of an overdue surveillance report is no greater than 10^{-3} (or 99.9% of surveillance reports are received within the OT value); and**
  - **The time values at 95% and at the operational continuity criterion (e.g. 99.9%) apply to the RSP data delivery and RSTP. It should be noted that only the RSP time value at the operational RSP continuity criterion (which coincides with the RSTP) has an expiration timer (OT).**

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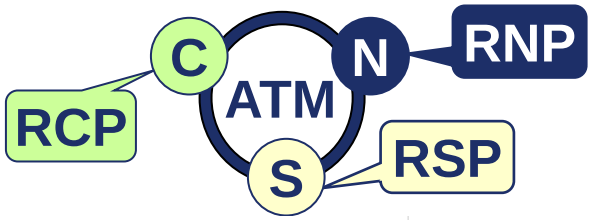


- **Prescribing an RCP/RSP specification**

Standards and procedures for ATM operation (x)
- Operational requirements
- RNP/RNAV specification
- RCP specification
- RSP specification

Prescription (AIP or equivalent publication)	
Applicable airspace	Seldok FIR
ATM operation (x)	Application of 5-minute longitudinal separation minimum to authorized operators
Communication	Normal: **FANS 1/A CPDLC – RCP 240**
	Alternate: HF or, optionally, **(SATVOICE/radio – RCP 400)**
Surveillance	Normal: **FANS 1/A ADS-C – RSP 180**
	Alternate: HF or, optionally, **(SATVOICE/radio – RSP 400)**
Other relevant criteria	As applicable, for example: a) Navigation – RNP 4 b) **SATVOICE/radio – RCP 400** applies when required for aircraft equipment carriage requirements (i.e., MEL)

Applicable airspace – ATM operation (x)

Aircraft operator requirements (includes aircraft system and CSP/SSP)

NORMAL COMMUNICATION required for ATM operation (x)

FANS 1/A CPDLC RCP 240

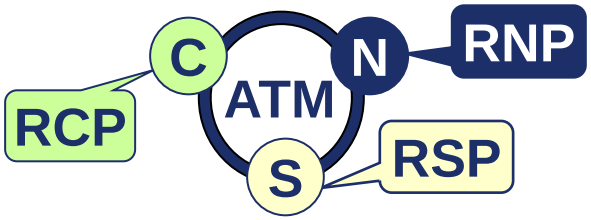
NORMAL SURVEILLANCE required for ATM operation (x)

FANS 1/A ADS–C RSP 180

ALTERNATE COMMUNICATION and SURVEILLANCE required for ATM operation (x) (required to operate in airspace)

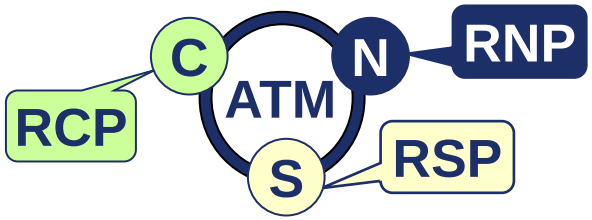
HF or, optionally, (SATVOICE/radio RCP 400/RSP 400)

ATS provision requirements (includes CSP/SSP)

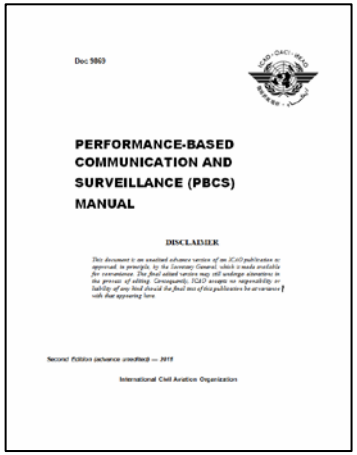


- **Informal South Pacific Coordinating Group (ISPACG)**
  - **Australia, Chile, Fiji, New Zealand, PNG, Tahiti, USA**
    - **Observers - Japan, Singapore, Mexico**
  - **Drives regional CNS/ATM improvements. Meetings attended by:**
    - ✓ **ATSP**
    - ✓ **CAA**
    - ✓ **Airlines**
    - ✓ **Aircraft Manufacturers**
    - ✓ **ICAO**
    - ✓ **IATA**
    - ✓ **CSP's (Inmarsat, ARINC, SITA, Iridium)**

PBCS – ICAO & ISPACG



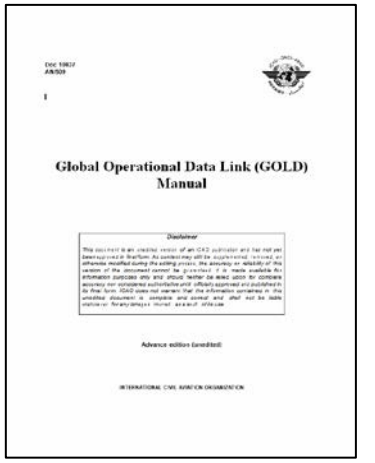
- APANPIRG Conclusion 22/20 – Second Satellite Data-link Operational Continuity (SOCM/2) and Seminar on Satellite Data-link Communication (Feb 2012)
- APANPIRG Conclusion 23/13 – Data Link Performance Monitoring Seminar (Mar 2013)
- APANPIRG Conclusion 23/24 – Workshop on RCP and RSP (May 2013)
- Since 2011 and on-going – ISPACG and IPACG planning for PBCS implementation
- APANPIRG Conclusion 24/24 ADS-C and CPDLC problem reporting and analysis
- APANPIRG Conclusion 24/25 En-route monitoring agency role and tasks
- APANPIRG Conclusion 24/34 Adopt GOLD Edition 2
- APANPIRG Decision 24/33 APAC RCP/RSP Implementation Framework.
- ISPACG March 2016 – Updated ISPACG implementation plan
- ICAO - PBCS Seminar Bangkok May 2016


Doc 9869

PERFORMANCE-BASED COMMUNICATION AND SURVEILLANCE (PBCS) MANUAL

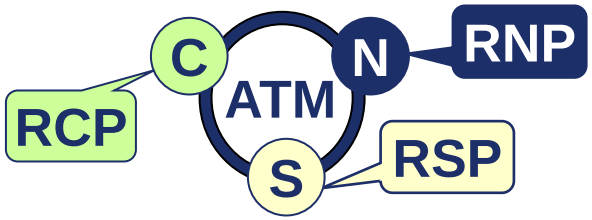
DISCLAIMER

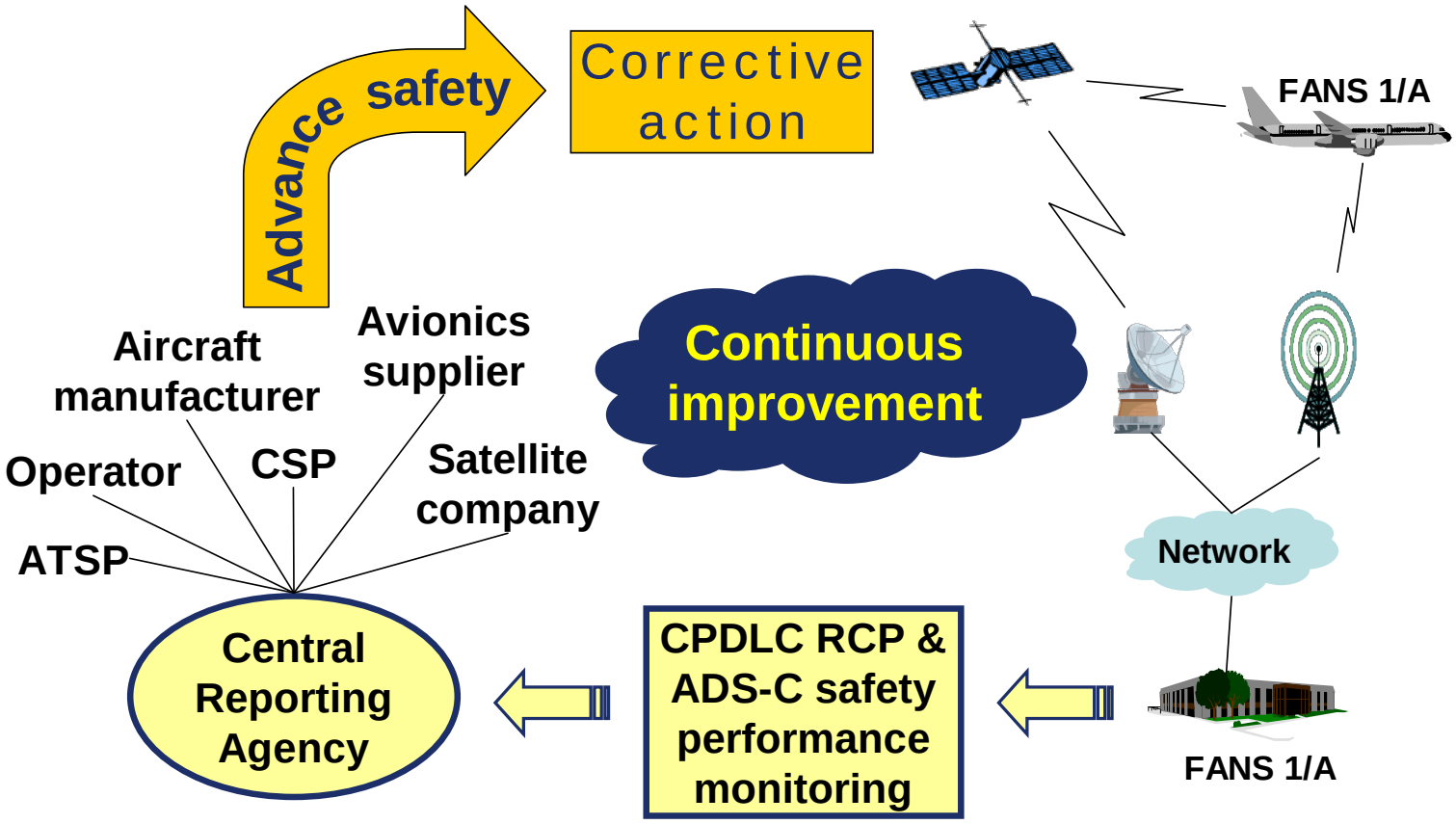
International Civil Aviation Organization


Global Operational Data Link (GOLD) Manual

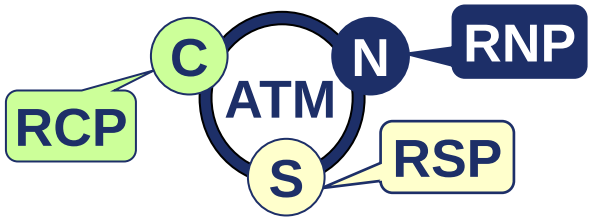
Disclaimer

PBCS - Monitoring





PBCS - Monitoring



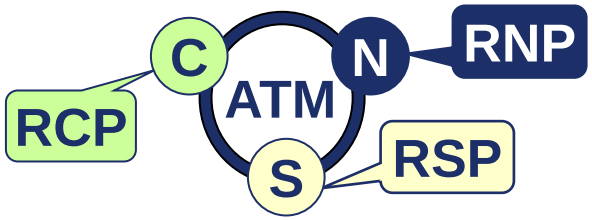
ISPACG Central Reporting Agency Website

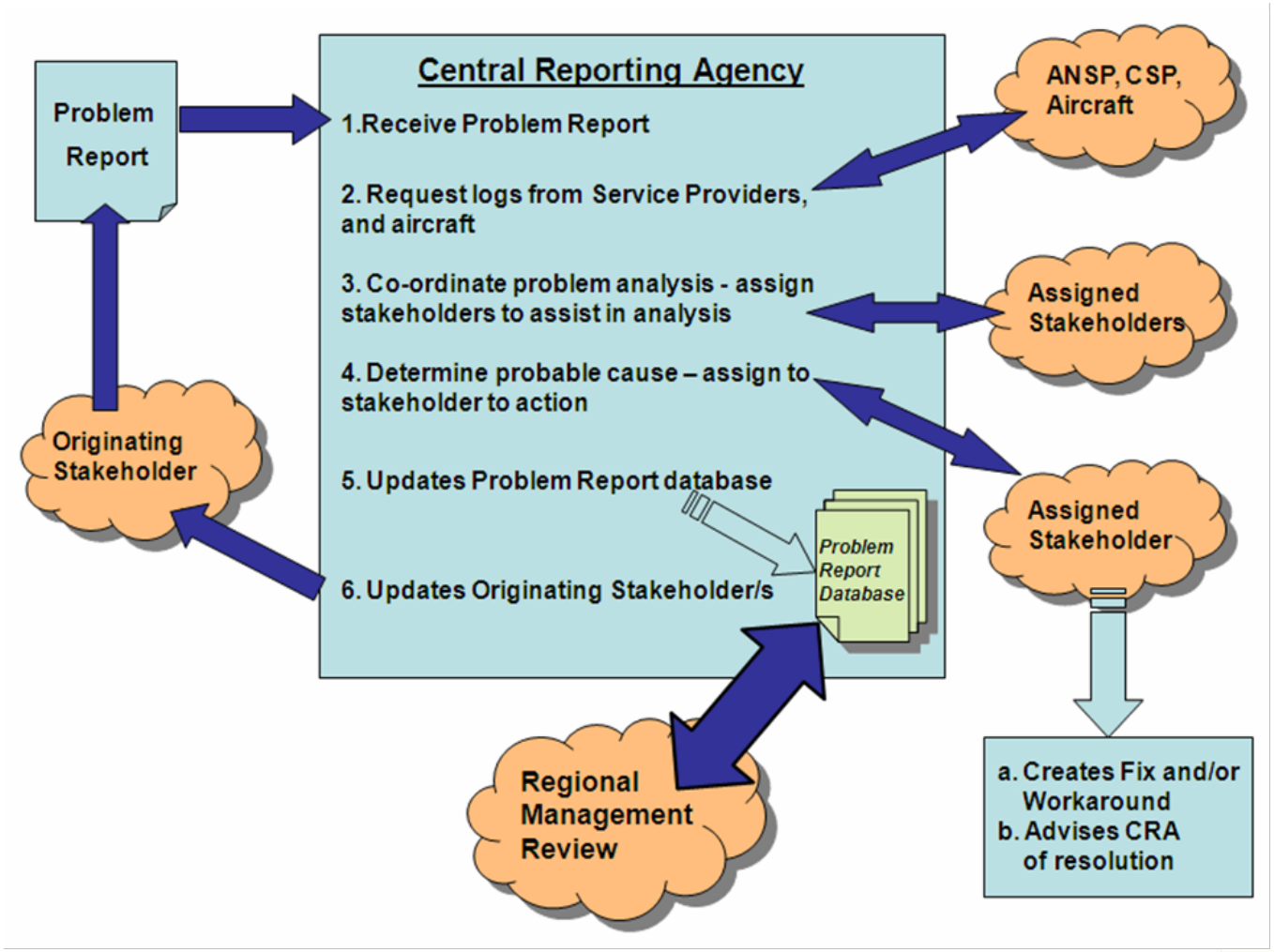
http://www.ispacg-cra.com/

- **Provides online problem reporting of FANS1/A issues.**
  - **ISPACG CRA**
  - **NAT DLMA**
  - **FIT Asia**
- **Website update in progress. http://ispacg-cra.herokuapp.com/**

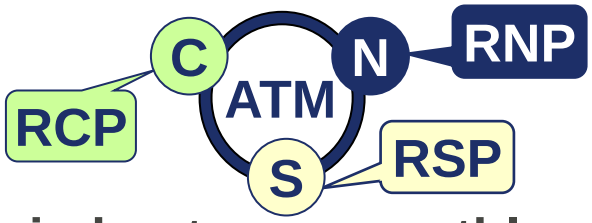
- **We have been leaders in monitoring performance against RCP240/RSP180 standards since 2009.**

PBCS - Monitoring





PBCS - Monitoring



- Typically post implementation monitoring is carried out on a monthly basis using the guidelines contained in previous editions of the Global Operational Data-link Manual (GOLD) and now PBCS Manual

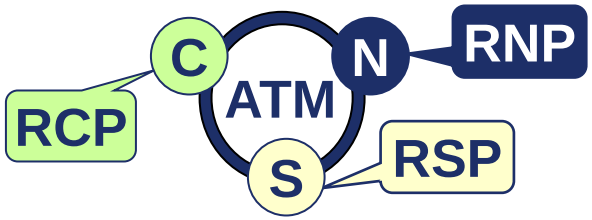
99.9% Criteria

- When using data link to provide reduced separations the RCP240 Expiry Time (210 seconds) and RSP180 Overdue Time (180 seconds) are the times after which if a CPDLC intervention transaction is not completed or an ADS-C position report is not received then the controller is obliged to revert to alternative separation procedure as defined in the separation specification.

  - If monthly monitoring shows that a specific fleet is not meeting the criteria then a local safety assessment by the ANSP should be carried out to assess if the reduced separation standard can continue to be applied.

  - While RCP 240, RCP 400, RSP 180 and RSP 400 specify operational continuity criteria of 99.9%, early implementations of PBCS for CPDLC and ADS-C services have indicated that an operational continuity of 99% is acceptable. However, as ATM operations become more dependent on communication and surveillance performance, the operational continuity may need to be more stringent.

PBCS - Monitoring

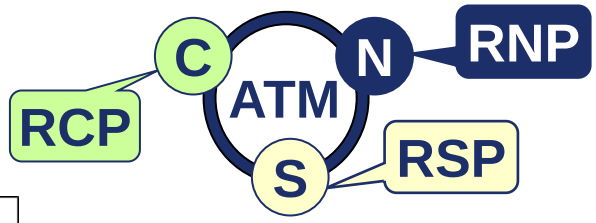


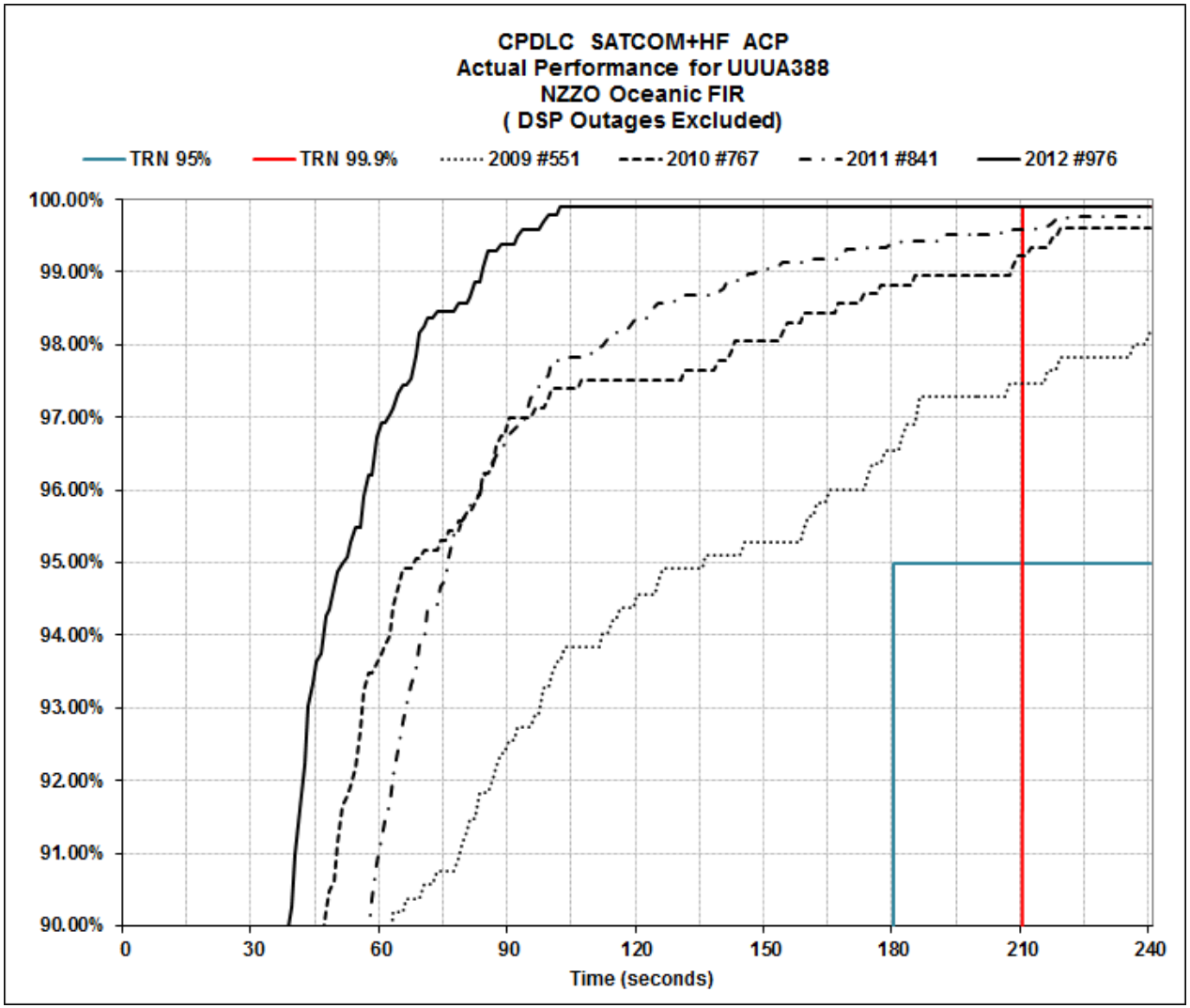
95% Criteria

- The 95% criteria define the nominal time acceptable for normal operations.

- For CPDLC (RCP240 = 180 seconds) and for ADS-C (RSP180 = 90 seconds).
  - If monthly monitoring shows that measured performance is consistently below the 95% criteria then consideration may be given to the withdrawal of data link services to the fleet.
  - Experience has shown that observed fleet performance below the specified RCP240/RSP180 95% criteria will usually be accompanied by controller complaints of unacceptable performance by that fleet.

PBCS - Monitoring



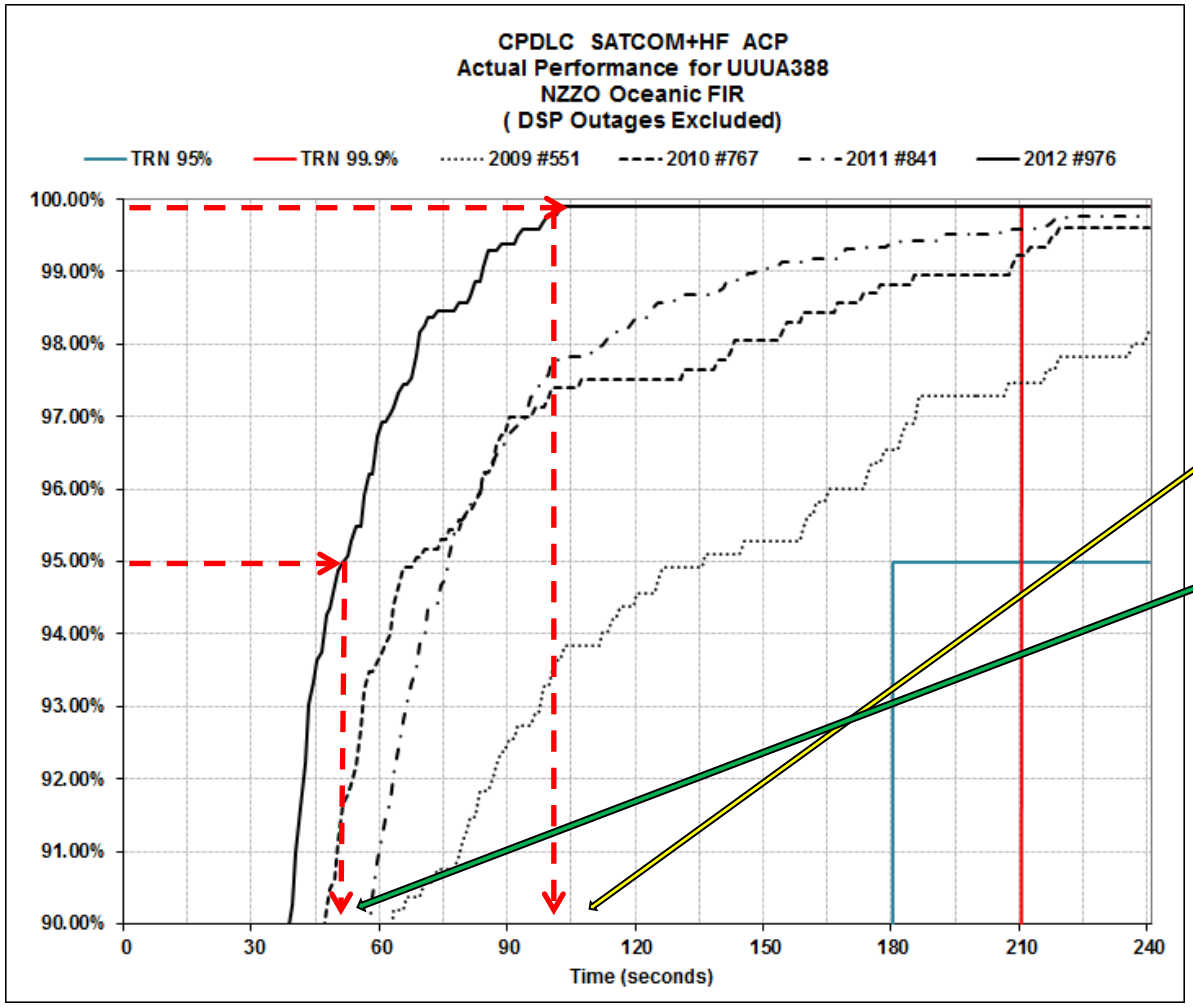


Reading a cumulative frequency distribution. In this example:

2012 - Actual Communications Performance (ACP) meets the RCP240 requirements of 95% message responses received within 180 seconds and 99.9% of message responses received within 210 seconds.

2009, 2010, 2011 – ACP not met at 99.9% 210 seconds but all better than 95% 180 seconds

PBCS - Monitoring

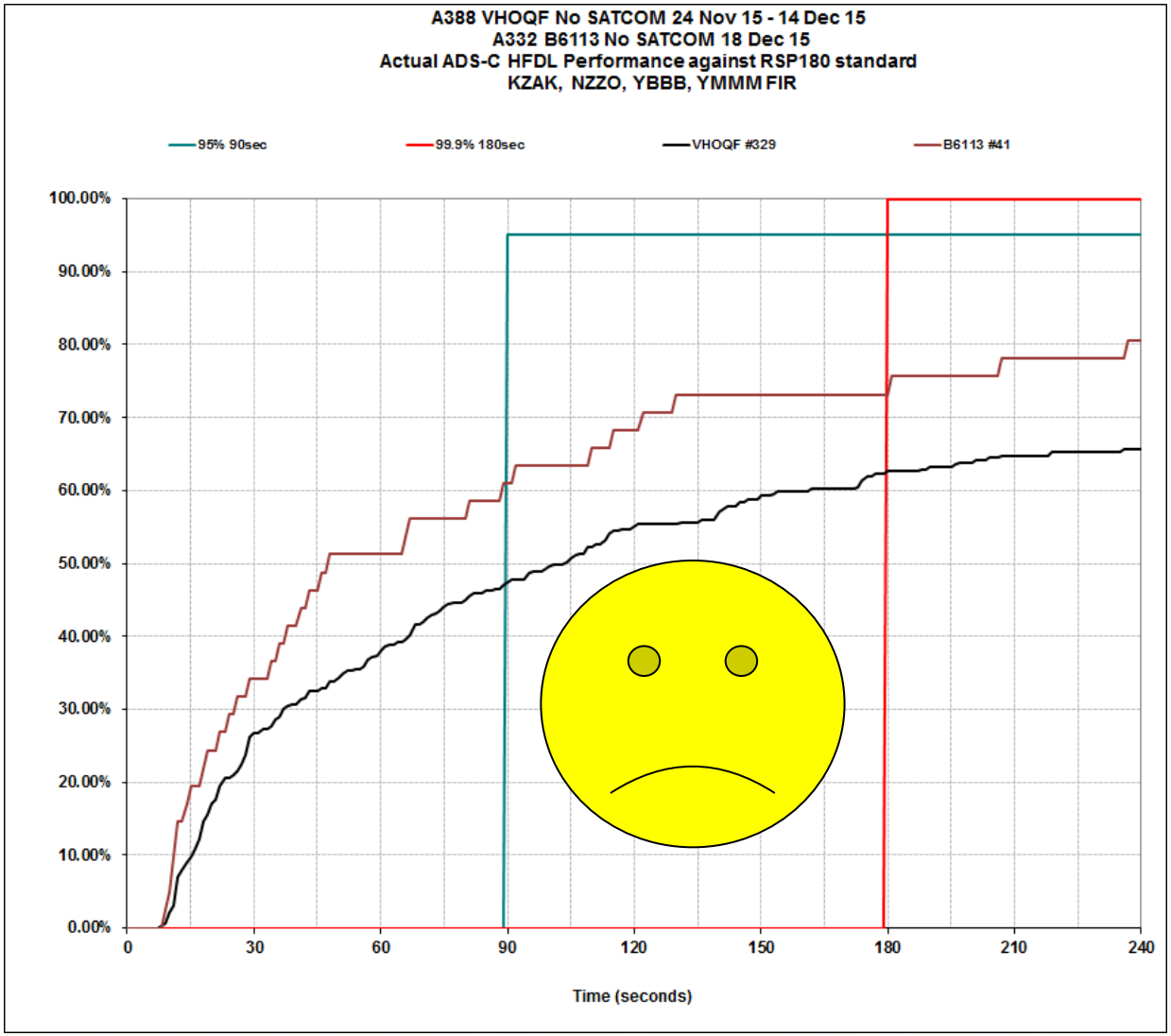


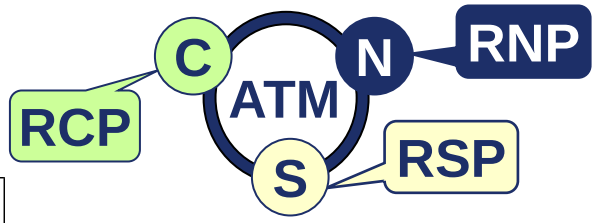
Reading a cumulative frequency distribution. In this example:

2012 Actual Communications Performance meets the RCP240 requirements:

- **99.9% of transactions completed in 103”**
- **95% of transactions completed in 52”**

PBCS - Monitoring





In this example:

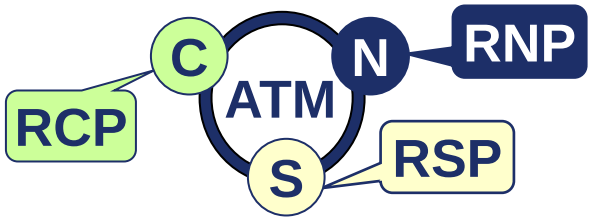
VH-OQF - Apparent SATCOM radio failure on 24th and continued operating without SATCOM through 18 December. After the 24th QFA filed Item10 - correctly indicating only CPDLC HFDL (J2) and CPDLC VDL Mode2 (J4).

B6113 – FPL as filed indicated aircraft had serviceable SATCOM (J5) plus CPDLC HFDL (J2) and CPDLC VDL Mode2 (J5).

Note 1: All ISPACG ground systems require upgrades if they are to identify non-SATCOM equipped CPDLC.

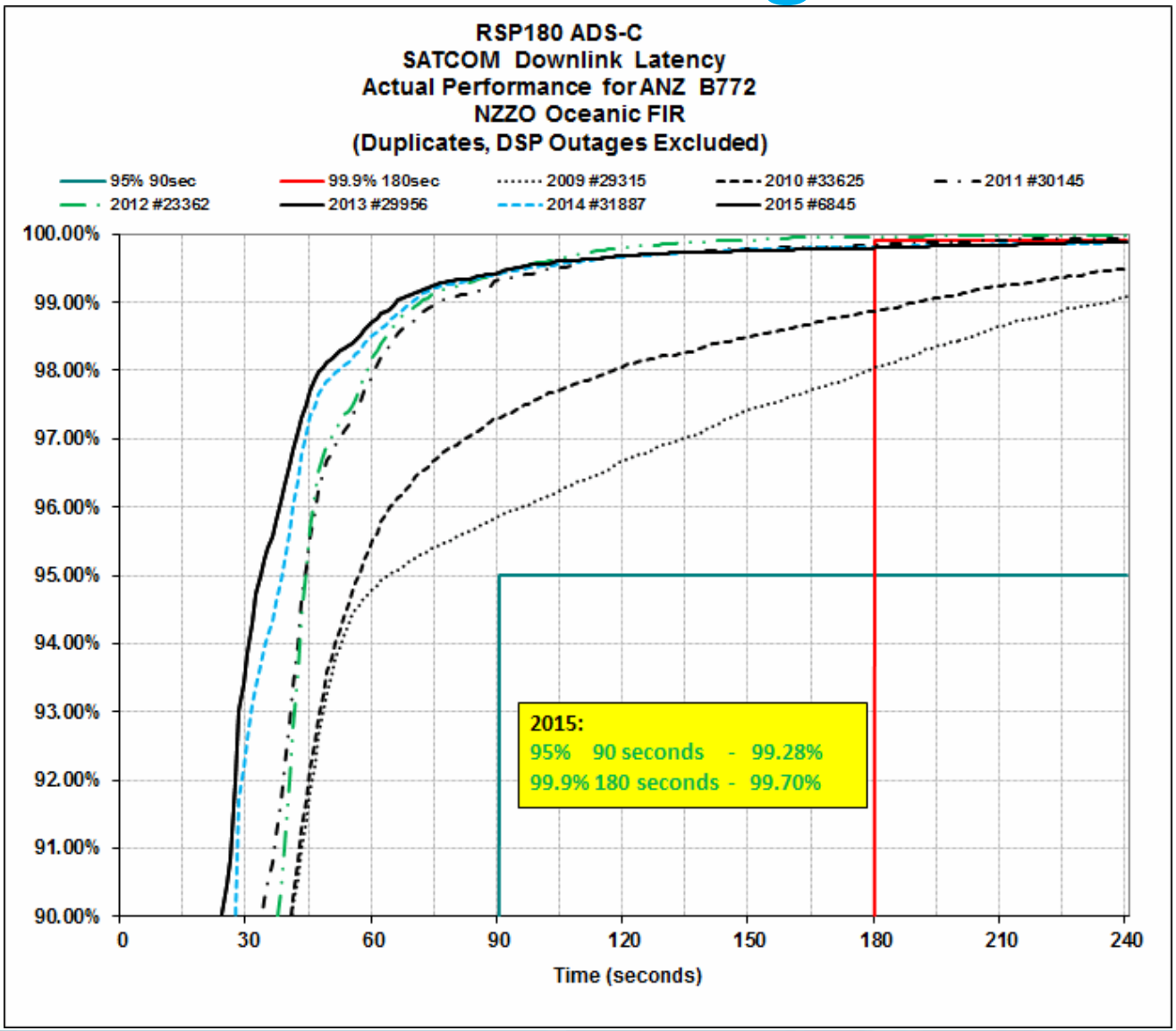
Note2: Current FPL for surveillance capability only has indication for Item 10b D1 = ADS-C FANS1/A

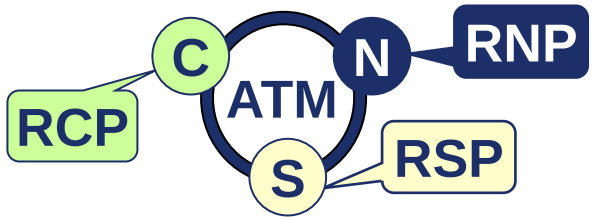
PBCS - Monitoring



Colour Key Meets Criteria 99.0%-99.84% Under Criteria	Three Month Period 1 Jan 15 - 31 Mar 15			95% RSP180 Benchmark	99.9% RSP180 Benchmark
	Aircraft Type	Operating Company	Message Count	RSP <= 90 sec	RSP <= 180 sec
Analysis by Media Type					
SATCOM I3	All	All	41554	98.96%	99.53%
SATCOM I4	All	All	22930	98.39%	99.35%
SATCOM MTSAT	All	All	10778	99.16%	99.68%
SATCOM Iridium	All	All	722	92.80%	97.37%
VHF	All	All	16416	99.78%	99.93%
HF	All	All	1380	85.58%	93.91%
Analysis by Media Type - Aircraft Type - Operating Company					
SATCOM I4	B772	ANZ	679	98.97%	99.85%
	B77W	ANZ	4999	98.16%	99.16%
SATCOM MTSAT	B772	ANZ	4999	99.14%	99.62%
	B789	ANZ	1902	98.53%	99.63%

PBCS - Monitoring



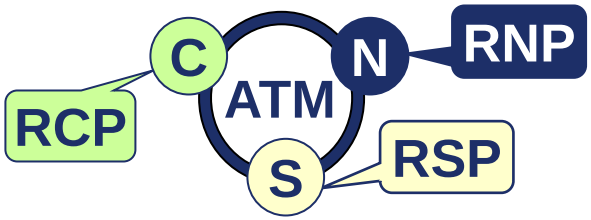


We have been monitoring FANS1/A performance against the RCP240 and RSP180 specifications since 2009.

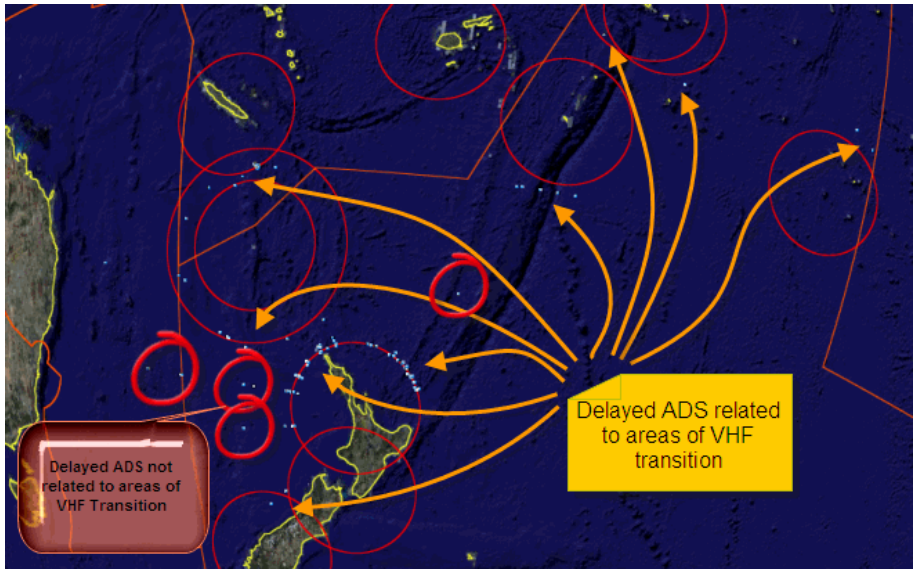
We have been quite successful in identifying and having fixed a number of significant FANS1/A performance issues over the period.

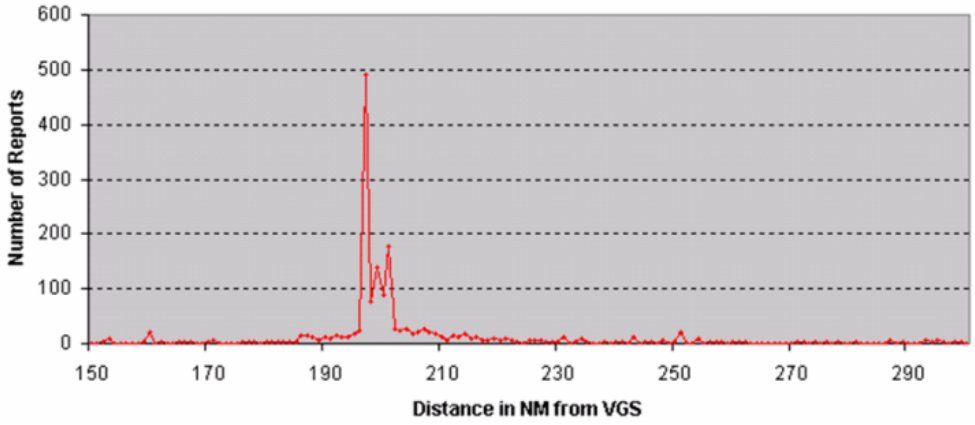
Support the demonstrated need for a PBCS framework.

PBCS - Monitoring



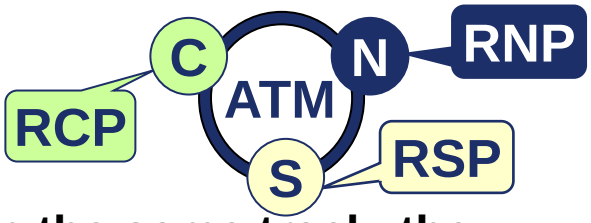
- **B777 VHF-SATCOM transition delays**
  - **We reported issue with significant ADS-C downlink delays in VHF transition areas in 2009.**





  - Boeing identified an issue with transitions into SATCOM from SITA VHF coverage.
  - Software fix was implemented in the AIMS Block Point 14 upgrade

Current Doc4444 standard



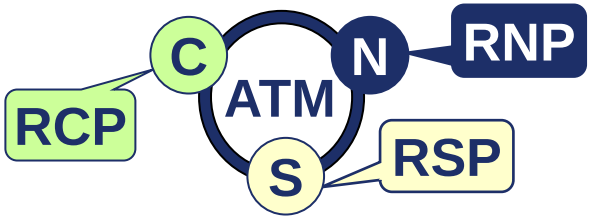
5.4.2.6.4.3 For aircraft cruising, climbing or descending on the same track, the following separation minima may be used:

Separation minima	*RNP type*	*Maximum ADS-C periodic reporting interval*
93 km (50 NM)	10	27 minutes
	4	32 minutes
55.5 km (30 NM)	4	14 minutes

5.4.2.6.4.3.2 The communication system provided to enable the application of the separation minima in 5.4.2.6.4.3 shall allow a controller, within 4 minutes, to intervene and resolve a potential conflict by contacting an aircraft using the normal means of communication. An alternative means shall be available to allow the controller to intervene and resolve the conflict within a total time of 10½ minutes, should the normal means of communication fail.

5.4.2.6.4.3.3 When an ADS-C periodic or waypoint change event report is not received within 3 minutes of the time it should have been sent, the report is considered overdue and the controller shall take action to obtain the report as quickly as possible, normally by ADS-C or CPDLC. If a report is not received within 6 minutes of the time the original report should have been sent, and there is a possibility of loss of separation with other aircraft, the controller shall take action to resolve any potential conflict(s) as soon as possible. The communication means provided shall be such that the conflict is resolved within a further 7½ minutes.

New Doc4444 standard



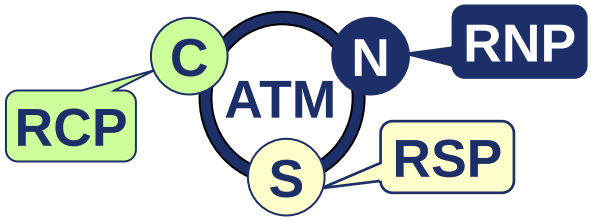
5.4.2.9.2 For aircraft cruising, climbing or descending on:
a) the same track; or
b) crossing tracks provided that the relative angle between the tracks is less than 90 degrees, the following separation minima may be used:

Separation minima	*RNP*	RCP	RSP	*Maximum ADS-C periodic reporting interval*
93 km (50 NM)	10	240	180	27 minutes
	4	240	180	32 minutes
55.5 km (30 NM)	2 or 4	240	180	12 minutes
5 minutes	2 or 4 or 10	240	180	14 minutes

5.4.2.6.4.3.2 becomes 5.4.2.9.3 unchanged text

5.4.2.6.4.3.3 becomes 5.4.2.9.4 unchanged text

PBCS – Annex 11



Chapter 2 – General

2. Performance-based communication (PBC) operations

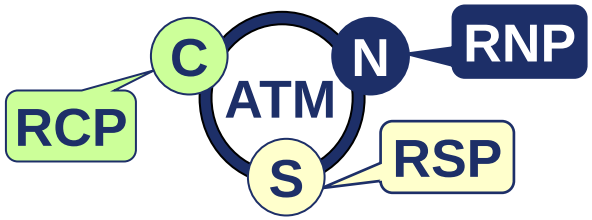
2.8.1 In applying performance-based communication (PBC), RCP specifications shall be prescribed by States. When applicable, the RCP specification(s) shall be prescribed on the basis of regional air navigation agreements.

Note.— In prescribing an RCP specification, limitations may apply as a result of communication infrastructure constraints or specific communication functionality requirements.

2.8.2 The prescribed RCP specification shall be appropriate to the air traffic services provided.

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).

PBCS – Annex 11



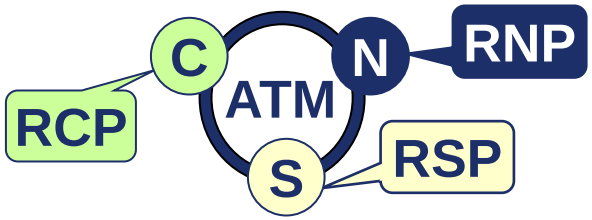
Chapter 3 – Air Traffic Control Service

3.3.5.2 Where RCP/RSP specifications are applied, programmes shall be instituted for monitoring the performance of the infrastructure and the participating aircraft against the appropriate RCP and/or RSP specifications, to ensure that operations in the applicable airspace continue to meet safety objectives. The scope of monitoring programmes shall be adequate to evaluate communication or surveillance performance.

Note.— Guidance material relating to RCP and RSP specifications and monitoring of communication and surveillance performance is contained in the* Performance-based Communication and Surveillance (PBCS) Manual *(Doc 9869).

3.3.5.32 When applicable, arrangements shall be put in place, through interregional agreement, for the sharing between regions of data and/or information from monitoring programmes.

PBCS – Annex 11

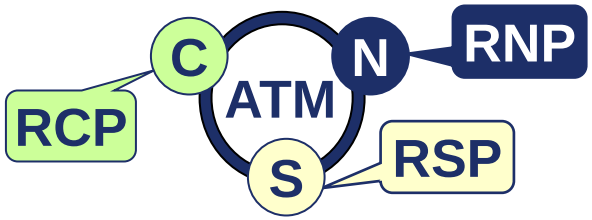


Chapter 6 – ATS Requirements for communications

6.1.1.2 Where an RCP specification has been prescribed by States for performance-based communication, ATS units shall, in addition to the requirements specified in 6.1.1.1, be provided with communication equipment which will enable them to provide ATS in accordance with the prescribed RCP specification(s).

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).

PBCS – Annex 6



7.1 – Communication Equipment

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:

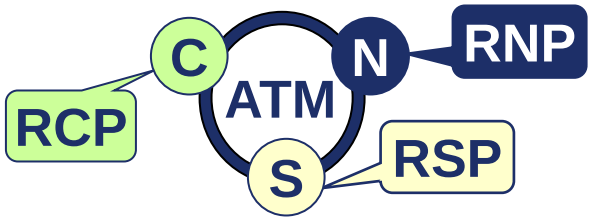
a) be provided with communication equipment which will enable it to operate in accordance with the prescribed RCP specification(s);

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).

PBCS – Annex 6



7.1 – Communication Equipment

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:

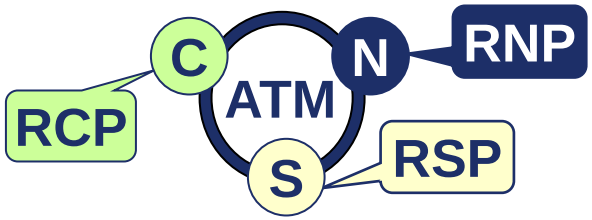
a) normal and abnormal procedures, including contingency procedures;

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.

PBCS – Annex 6



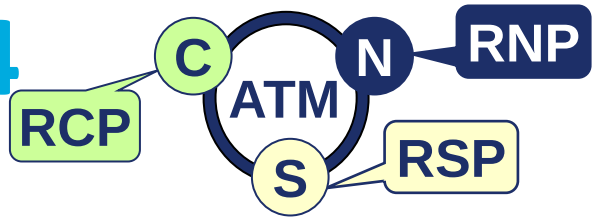
7.1 – Communication Equipment

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 the 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.

PBCS – PNS-ATM Doc 4444



Chapter 4 – Flight Plan

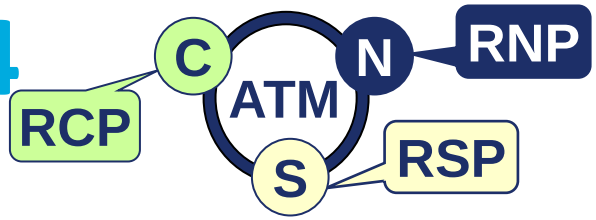
4.4.1.4 An operator shall, prior to departure:

. . .

c) ensure that, where the flight is intended to operate where an RCP specification is prescribed, an appropriate operational approval has been granted, and that all conditions applying to that approval will be satisfied;

d) ensure that, where the flight is intended to operate where an RSP specification is prescribed, an appropriate operational approval has been granted, and that all conditions applying to that approval will be satisfied.

PBCS – PNS-ATM Doc 4444



Appendix 2 – Flight Plan Item 10

…

P1 CPDLC RCP 400 (See Note 7)
P2 CPDLC RCP 240 (See Note 7)
P3 SATVOICE RCP 400 (See Note 7)
P4–P9 Reserved for RCP

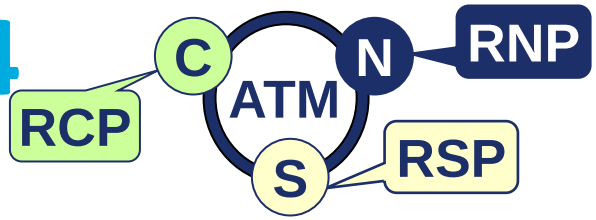
…

Note 5.— If the letter Z is used, specify in Item 18 the other equipment carried or other capabilities, preceded by COM/, NAV/, and/or DAT/ and/or SUR/, as appropriate.

. . .

Note 7.— Guidance material on the application of performance-based communication, which prescribes RCP to an air traffic service in a specific area, is contained in the* Performance-based Communication and Surveillance (PBCS) Manual *(Doc 9869).

PBCS – PNS-ATM Doc 4444



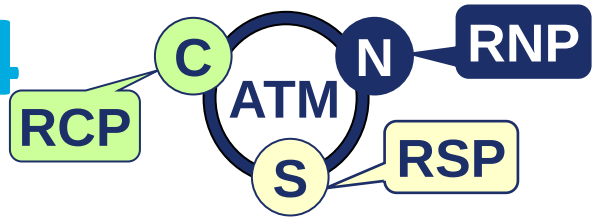
Appendix 2 – Flight Plan Item 10

Surveillance equipment and capabilities

Note 1.— The RSP specification(s), if applicable, should be listed in Item 18 following the indicator SUR/. Guidance material on the application of performance-based surveillance, which prescribes RSP to an air traffic service in a specific area, is contained in the Performance-based Communication and Surveillance (PBCS) Manual *(Doc 9869).*

Note 2.— Additional surveillance equipment or capabilities should be listed in Item 18 following the indicator SUR/, as required by the appropriate ATS authority.

PBCS – PNS-ATM Doc 4444



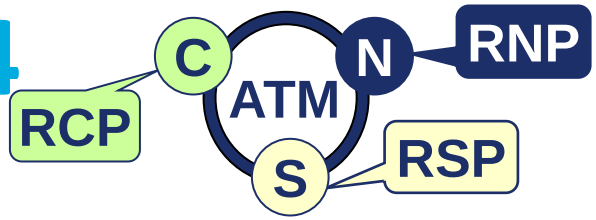
Appendix 2 – Flight Plan Item 18

COM/ Indicate communications equipment and capabilities not specified in Item 10 a).

DAT/ Indicate data communication equipment and capabilities not specified in 10 a).

SUR/ Indicate surveillance equipment and capabilities not specified in Item 10 b). Indicate the appropriate RSP specification(s) here.

PBCS – PNS-ATM Doc 4444



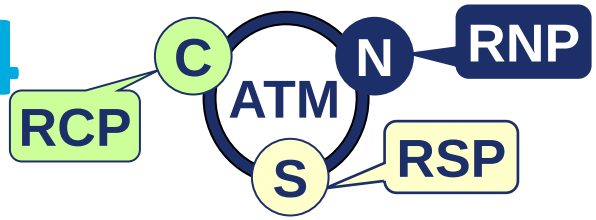
5.4.1 Lateral Separation

5.4.1.2.1.6 *Lateral separation of aircraft on parallel or non-intersecting tracks or ATS routes.*

…

b) for a minimum spacing between tracks of 42.6 km (23 NM) a navigational performance of RNP 4 or RNP 2 shall be prescribed. The communication system shall satisfy required communication performance 240 (RCP 240) and the surveillance system shall satisfy required surveillance performance 180 (RSP 180). Conformance monitoring shall be ensured by establishing an ADS-C event contract with a lateral deviation change event with a maximum of 5 NM threshold and a waypoint change event;

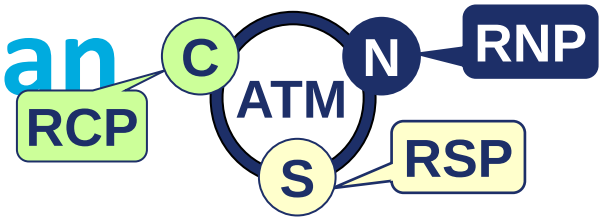
PBCS – PNS-ATM Doc 4444



5.4.1 Lateral Separation

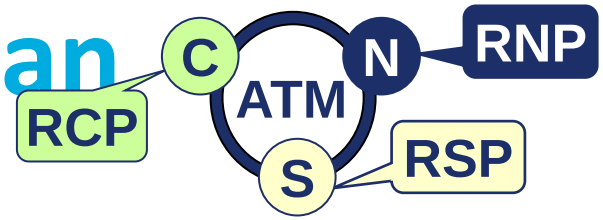
- *SASP Note: Collision risk calculations have shown that lateral separation between any combination of RNP 4 and RNP 2 aircraft can safely be reduced from 55.5 km (30 NM) to 42.6 km (23 NM). Apart from being an overall global improvement in airspace management, this also satisfies the North Atlantic (NAT) operational requirement to separate aircraft laterally by 25 NM (aircraft operating on half degree tracks within the NAT track structure).*
- *Opportunity is also taken to align the separation minima with the RCP and RSP concepts as developed by the OPLINK panel and published in the Performance-based Communication and Surveillance (PBCS) Manual (Doc 9869).*

PBCS – Implementation Plan



- **PBCS Manual - APPENDIX A.**
  - **This appendix provides a checklist in Table A-1 that should be used as a guide for planning the implementation of PBCS operations. The checklist is organized as follows:**
    - **Group A tasks – State/region preparation;**
    - **Group B tasks – ANSP general project development and management;**
    - **Group C tasks – ANSP implementation activities – ATS service provision;**
    - **Group D tasks – Aircraft operator, aircraft type/system (airworthiness) eligibility; and**
    - **Group E tasks – All stakeholders – post-implementation monitoring.**

PBCS – Implementation Plan



Task ID	Task Descriptor	Task Detail	Reference(s)
Group A tasks – State/region preparation			
A-1	AIP – Prescription of an RCP/RSP specification	Prescribe the appropriate RCP/RSP specification in the AIP (or equivalent publication). If applicable, common AIP language may be based on a bilateral, multilateral or regional air navigation agreement.	Chapter 4
A-2	ANSP – PBCS policies, objectives supporting safety oversight	Identify means to apply RCP/RSP specifications and compliance criteria for initial approval and continued compliance, including: a) ATS provision requirements, and requirements for ATS unit's system and CSP/SSP service agreements, if applicable; b) flight plan requirements; and c) monitoring, alerting and reporting requirements.	Chapter 5 Section 5.2.1 Section 5.2.2

Task ID	Task Descriptor	Task Detail	Reference(s)
Group A tasks – State/region preparation			
A-3	Operator and aircraft system – PBCS policies, objectives supporting safety oversight	Identify means to determine aircraft operator eligibility requirements for PBCS operations, including requirements for operations, maintenance, aircraft system and CSP/SSP service agreements, if applicable: a) establish State airworthiness requirements; b) establish operational policy/procedures requirements for operational approval; c) prepare State inspectors to perform tasks for operational approval; d) develop plan to issue operational approval to national operators. Train pilots and, if applicable, dispatchers on PBCS operations; and e) develop and distribute operations manuals, pilot bulletins or other appropriate documents containing PBCS policy and/or procedures. ***Note.— State of the Operator identifies means for commercial air transport operations. State of Registry identifies means for general aviation operations. State of Design identifies means for design approval of the aircraft system.***	Chapter 5 Section 5.2.1 Section 5.2.3

Task ID	Task Descriptor	Task Detail	Reference(s)
Group A tasks – State/region preparation			
A-4	*Regional Supplementary Procedures* (Doc 7030) for PBCS operations, if applicable	On behalf of a region, a State may develop a proposed amendment to the *Regional Supplementary Procedures* (Doc 7030), if applicable.	Chapter 4 Chapter 5

Group B tasks – ANSP general project development and management			
B-1	PBCS Implementation Plan	Establish PBCS implementation team and prepare a plan outlining the tasks for PBCS implementation. Include interdependencies between tasks, when each task is to be completed, lead point of contact and any coordination required.	State/region specific, this appendix serves as a guide.
B-2	Target dates for PBCS and relevant ATM operations	Identify key target dates for implementing PBCS supporting specified ATM operation(s) and the tasks identified in the plan.	State/region specific.

Group B tasks – ANSP general project development and management			
B-3	RCP/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). Existing RCP/RSP specifications may be appropriate for a new ATM operation predicated on RCP/RSP specifications (e.g. application of performance-based separation minimum), or when implementing an emerging technology to provide a communication or surveillance capability (e.g. SATVOICE) supporting an existing ATM operation. If a new RCP or RSP specification is needed, establish a task to coordinate with ICAO on the development of the appropriate RCP/RSP specifications for update to Doc 9869.	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.	This manual Doc [GOLD] Doc [SVOM]

Group C tasks – ANSP implementation activities – ATS service 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/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.	This manual Doc [GOLD] Doc [SVOM]

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 5 Section 5.4

Group C tasks – ANSP implementation activities – ATS service 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 5 Section 5.5 Appendix D Appendix E

Group C tasks – ANSP implementation activities – ATS service 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 5 Section 5.2.2 Section 5.3.1 Section 5.3.2 Appendix D Appendix E

Group D tasks – Aircraft operator, Aircraft type/system (airworthiness) eligibility			
D-1	**Confirm initial operator and/or aircraft type/system compliance with RCP/RSP specifications**	**Prior to operational approval, confirm CPDLC and ADS-C aircraft equipment and operator capabilities comply with RCP/RSP specifications:** **a) measure actual performance against RCP/RSP specifications for compliance to support initial approval of operator, including aircraft system approval and CSP/SSP service agreement, if applicable;** **b) identify any aspect of aircraft type/system and/or capability performance that is not compliant with the RCP/RSP specifications; and** **c) take appropriate action to mitigate.**	**Chapter 5** **Section 5.2.3** **Section 5.3.2** **Section 5.3.3** **Section 5.3.4** **Appendix D** **Appendix E**

Group E tasks – All stakeholders – post-implementation monitoring			
E-1	PBCS monitoring – post-implementation	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 5 Section 5.5 Appendix D Appendix E Doc 9937 Doc [PBHSM]

Thank you