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Doc 9869

Performance-based Communication and Surveillance (PBCS) Manual

Second Edition, 2017



Approved by and published under the authority of the Secretary General

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AMENDMENTS

Amendments are announced in the supplements to the *Products and Services Catalogue*; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

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FOREWORD

HISTORICAL BACKGROUND

In 1983, the Council of the International Civil Aviation Organization (ICAO) established the Special Committee on Future Air Navigation Systems (FANS) which was tasked to study, identify and assess new technologies, including the use of satellites, and propose recommendations for the future development of air navigation for civil aviation. The FANS Committee determined that the development of new systems were required to overcome the limitations of conventional systems, thereby expanding air traffic management (ATM) capabilities on a global scale.

In September 1991, 450 representatives from eighty-five ICAO Member States and thirteen international organizations gathered at ICAO Headquarters in Montréal, Canada, for the Tenth Air Navigation Conference (AN-Conf/10) to consider and endorse the concept of a future air navigation system, as developed by the FANS Committee, that would meet the needs of the civil aviation community well into the next century. The FANS concept, which came to be known as the communications, navigation, surveillance/air traffic management (CNS/ATM) systems concept, involves a complex and interrelated set of technologies, dependent largely on satellites.

The endorsement of the CNS/ATM systems concept reached at AN-Conf/10 signalled the beginning of a new era for international civil aviation and paved the way for the activities related to the planning and implementation of new systems around the world.

The fourth meeting of the Aeronautical Mobile Communications Panel (AMCP/4, Montréal, April 1996) recognized the absence of objective criteria to evaluate communication performance requirements. The objective criteria needed were a set of values for parameters which would be based on the operational requirements for communication systems in the various phases of flight. The panel agreed that there was an urgent need to assess the existing technical options of communication systems against such a set of parameter values. The term “required communication performance (RCP)” type was used to denote a set of values for these parameters.

When reviewing the report of AMCP/4 in 1997, the Air Navigation Commission (ANC) tasked the Automatic Dependent Surveillance Panel (ADSP) (renamed in 2000 as the Operational Data Link Panel — OPLINKP) to develop the operational concept of RCP.

In 2001, the OPLINKP completed the document entitled *Concept of Required Communication Performance*, and the ANC solicited comments thereon from ICAO Member States. The comments received indicated broad support for the RCP concept. In light of the comments received, in 2002 the ANC amended the OPLINKP work programme to develop a *Manual on Required Communications Performance (RCP)* (Doc 9869) and, as necessary, Standards and Recommended Practices (SARPs) and procedures relating to the use of RCP in the provision of air traffic services.

In 2003, the Eleventh Air Navigation Conference (AN-Conf/11) endorsed recommendations to:

- a) continue the development of SARPs, procedures and guidance material on RCP; and
- b) investigate areas for further work including: determine the relationship of the RCP concept to separation studies and interoperability; standardize RCP types and allocations; ensure the adequacy of air traffic service (ATS) functions and procedures for new CNS/ATM environments; and establish requirements for safety performance monitoring.

The first meeting of the OPLINKP (OPLINKP/1, Montréal, September 2005) agreed on the proposed amendments to include a provision for RCP in Annex 6 — *Operation of Aircraft*, Annex 11 — *Air Traffic Services, Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444), and the first edition of the *Manual on Required Communication Performance (RCP)* (Doc 9869).

In 2007, the ICAO North Atlantic (NAT) and Asia-Pacific (APAC) Regions began collaborating on the global issue of increased use and dependency of commercial communication services in the provision of air traffic services. The companies providing these services decided to eliminate certain components of the system for economic reasons that conflicted with the needs for aviation safety. The NAT and APAC Regions recognized that the issue should be examined at the global level, but due to urgency, also at the regional level, since communication is an integral part of regional implementation plans. Both regions held special meetings to address the issue.

By 2008, the NAT Systems Planning Group (SPG) concluded to develop an RCP Implementation Plan proposing to mandate RCP in the NAT Region by 2015. The NAT and APAC Regions also agreed to develop common guidance material, which became known as: the *Global Operational Data Link (GOLD) Manual* (Doc 10037), of which the second edition was published in April 2013; and the *Satellite Voice Guidance Material (SVGM)*, with the first edition published in July 2012.

In 2008, the ANC approved a work programme to reconvene the OPLINKP, and tasked the panel to update the *Manual on Required Communication Performance (RCP)* (Doc 9869) by taking into account significant advances by ICAO Member States and regions, in the areas of qualification and monitoring, commercial service contracts/agreements and operational approvals, thereby also avoiding the imposition of regional or State-specific criteria on aircraft operators and aircraft/avionics manufacturers.

In 2010, OPLINKP reconvened and agreed to develop an amendment to Doc 9869, renaming it to the *Performance-based Communication and Surveillance (PBCS) Manual*, and expanding its scope by incorporating parts of the GOLD and SVGM, and other material that was developed by the regions since 2007.

An RCP type, which had been used in the first edition to denote a set of values for specific parameters, is not used in the second edition. An RCP type provided a means for the AMCP to assess different technologies. However, a means was also needed to specify and allocate operational, functional, safety and performance criteria and ensure actual CNS/ATM system performance. As a result, the operational criteria and associated allocations are now included in globally accepted RCP specifications. In addition, the second edition of Doc 9869 includes required surveillance performance (RSP) specifications to provide the operational, functional, safety and performance criteria for surveillance capability.

The RCP and RSP specifications are described within the performance-based communication and surveillance (PBCS) framework, thereby providing the means to prescribe the appropriate RCP and RSP specifications and initially qualify different subsystems, as well as manage operational (end-to-end) system performance in continued operations.

The second meeting of the OPLINKP (OPLINKP/2, Montréal, October 2014) agreed on the proposed amendments to include provisions for PBCS in Annex 6, Annex 11, Annex 15, PANS-ATM (Doc 4444) and PANS-ABC (Doc 8400) and the second edition of Doc 9869.

The amendments to Annexes and PANS were adopted/approved by the Council with an applicability date of 10 November 2016 and a draft PBCS manual developed by the OPLINKP was updated aligning it with the final PBCS provisions in the Annexes and PANS.

SCOPE AND PURPOSE

This manual provides guidance and information concerning PBCS operations and is intended to facilitate the uniform application of the SARPs contained in Annex 6, Annex 11, Annex 15, PANS-ATM (Doc 4444), PANS-ABC (Doc 8400) and, when necessary, the *Regional Supplementary Procedures* (Doc 7030).

This guidance material is also intended to improve safety and maximize operational benefits by promoting the PBCS concept and its general application to diverse and emerging technologies for communication and surveillance supporting ATM operations. The PBCS concept provides a framework for managing communication and surveillance performance in accordance with globally accepted RCP and RSP specifications.

The RCP and RSP specifications included are intended initially for automatic dependent surveillance — contract (ADS-C), controller-pilot data link communications (CPDLC) and satellite voice (SATVOICE) communications supporting ATM operations in airspace, where procedural separations are being applied. However, the PBCS concept allows for new RCP and RSP specifications for other purposes. For example, the manual could be updated to include a new RSP specification that is intended for automatic dependent surveillance — broadcast (ADS-B) supporting an ATM operation.

This second edition, formerly the *Manual on Required Communication Performance (RCP)*, was restructured as follows:

- a) Background information, purpose of the manual and explanation of terms was moved from Chapter 1 to the “Foreword”.
- b) Chapter 1 was renamed from “Introduction” to “Performance-based communication and surveillance (PBCS) concept”. This chapter provides information on the PBCS concept, including differences with performance-based navigation (PBN); the relationship of the PBCS concept to State safety management responsibilities; the PBCS framework; RCP and RSP specifications supporting ATM operations; and developing, applying and complying with an RCP/RSP specification.
- c) Chapter 2 was renamed from “Overview of RCP” to “Developing an RCP/RSP specification”. This chapter provides guidance on developing an RCP/RSP specification, which includes operational criteria in terms of RCP/RSP times; RCP/RSP continuity; RCP/RSP availability; RCP/RSP integrity and associated functional and safety requirements; and allocations to different components of the system.
- d) Chapter 3 was renamed from “Determining an RCP type” to “Applying an RCP/RSP specification”. This chapter provides guidance on applying an RCP/RSP specification, which includes the prescription of the communication and surveillance capability supporting specific ATM operations in specific airspace, associated operational approvals, and post-implementation monitoring.
- e) Chapter 4 was renamed from “Prescribing an RCP type” to “Complying with an RCP/RSP specification”. This chapter provides guidance on establishing policies, procedures and criteria for State approvals and on complying with an RCP/RSP specification, which includes: initial compliance determination and State approvals for aircraft systems; air navigation services provider (ANSP) systems and aircraft operators; flight plan requirements; and continued operational compliance — PBCS monitoring programmes.
- f) Chapter 5, which was entitled “Complying with an RCP type”, was incorporated into the above-mentioned Chapter 4.
- g) Appendix A was renamed from “Glossary of terms” to “PBCS Implementation Plan — Checklist”. The glossary of terms was moved to the preliminary portion of the manual. Appendix A now includes guidance — and a checklist—that lists tasks and other aspects for consideration in the development of a local or regional PBCS implementation plan.

- h) Appendix B was renamed from “Checklist for RCP application” to “RCP specifications”. The checklist was replaced by a new checklist that is contained in Appendix A. Appendix B now contains a “merged” version of the RCP specifications taken from the regional guidance material (GOLD and SVGM), Appendix B in each document. These specifications are considered a requirement when they are prescribed or guidance if applied only to PBCS monitoring programmes.
- i) Appendix C was renamed from “Example of determining an RCP type” to “RSP specifications”. The example was deleted. Appendix C now contains a “merged” version of the RSP specifications taken from the regional guidance material (GOLD and SVGM), Appendix C in each document. These specifications are considered a requirement when they are prescribed or guidance if applied only to PBCS monitoring programmes.
- j) A new Appendix D, “Post-implementation monitoring and corrective action (CPDLC and ADS-C),” was added. Appendix D contains the guidance on post-implementation monitoring at ANSP, regional and inter-regional levels, taken from GOLD, Appendix D. The material was simplified and is structured differently from that provided in the GOLD.
- k) A new Appendix E, “Post-implementation monitoring and corrective action (SATVOICE),” was added. Appendix E contains the guidance on post-implementation monitoring at ANSP, regional and inter-regional levels, taken from the SVGM, Appendix D.

The following personnel and organizations should be familiar with relevant aspects of its contents: regulators, airspace planners, aircraft operators, flight operations officers/flight dispatchers, ANSPs, aeronautical stations, communication services providers (CSPs), satellite service providers (SSPs), radio operators, training organizations, regional/local monitoring entities, automation specialists and radio facilities, aircraft manufacturers and equipment suppliers.

The guidance supports the following activities:

- a) States’ roles and responsibilities in relation to the following:
 - 1) safety oversight of air navigation services;
 - 2) operational approval (e.g. flight crew training and qualifications); and
 - 3) design approval of aircraft data link systems;
- b) development of agreements and/or contractual arrangements between ANSPs and aircraft operators and their respective CSPs;
- c) development of operational procedures; and
- d) operational monitoring, analysis, and exchange of operational data among appropriate entities, such as regional monitoring entities, States, ANSPs, and CSPs.

FUTURE DEVELOPMENTS

In order to keep this manual relevant and accurate, suggestions for its improvement regarding format, content or presentation are welcome. Any such recommendation or suggestion will be examined and, if found suitable, will be included in regular updates to the manual. Regular revision will ensure that the manual remains both pertinent and accurate. Comments on this manual should be addressed to:

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PUBLICATIONS

(referred to in this manual)

International Civil Aviation Organization (ICAO)

Annex 1 — Personnel Licensing

Annex 4 — Aeronautical Charts

Annex 6 — Operation of Aircraft

Part I — International Commercial Air Transport — Aeroplanes

Part II — International General Aviation — Aeroplanes

Part III — International Operations — Helicopters

Annex 10 — Aeronautical Telecommunications

Volume II — Communication Procedures including those with PANS status

Volume III — Communication Systems

Annex 11 — Air Traffic Services

Annex 15 — Aeronautical Information Services

Annex 19 — Safety Management

Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444)

Procedures for Air Navigation Services — ICAO Abbreviations and Codes (PANS-ABC, Doc 8400)

Regional Supplementary Procedures (Regional SUPPs, Doc 7030)

Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services (Doc 8585)

Aircraft Type Designators (ICAO Doc 8643)

Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689)

Performance-based Navigation (PBN) Manual (Doc 9613)

Manual on a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574)

Operating Procedures and Practices for Regional Monitoring Agencies in Relation to the Use of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9937)

Global Operational Data Link (GOLD) Manual (Doc 10037)

Satellite Voice (SATVOICE) Operations Manual (Doc 10038)

Manual on Monitoring the Application of Performance-based Horizontal Separation Minima (Doc 10063)

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European Organisation for Civil Aviation Equipment (EUROCAE) and Radio Technical Commission for Aeronautics, Inc. (RTCA) documents

Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace (Oceanic SPR Standard, RTCA DO-306/EUROCAE ED-122)

Safety and Performance Standard for Air Traffic Data Link Services in Continental Airspace (Continental SPR Standard, RTCA DO-290/EUROCAE ED-120, Change 1 and Change 2)

Interoperability Requirements for ATS Applications Using ARINC 622 Data Communications (FANS 1/A INTEROP Standard, RTCA DO-258A/EUROCAE ED-100A)

Interoperability Requirements Standard for Aeronautical Telecommunication Network Baseline 1 (ATN B1 INTEROP Standard, RTCA DO-280B/EUROCAE ED-110B)

Future Air Navigation System 1/A — Aeronautical Telecommunication Network Interoperability Standard (FANS 1/A — ATN B1 INTEROP Standard, RTCA DO 305A/EUROCAE ED 154A)

Safety, Performance and Interoperability Requirements Document for In-Trail Procedure in Oceanic Airspace (RTCA DO 312/EUROCAE ED 159) and Supplement

GLOSSARY

DEFINITIONS

When the subsequent terms are used in this manual, they have the following meanings.

Note.— Where an asterisk appears beside a term, the term has already been defined as such in Annexes and Procedures for Air Navigation Services (PANS).

Access number. The number used by the ATS unit, aeronautical station or aeronautical operational control (AOC) to access the network switch to contact an aircraft via SATVOICE.

***Active flight plan.** See flight plan.

Actual communication performance (ACP). The portion of communication transaction time that is monitored against the required communication monitored performance (RCMP) values provided by the RCP specification.

Actual surveillance performance (ASP). The portion of surveillance data delivery time that is monitored against the required surveillance monitored performance (RSMP) values provided by the RSP specification.

***Aeronautical Information Publication (AIP).** A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.

***Aeronautical mobile-satellite (route) service (AMS(R)S).** An aeronautical mobile-satellite service reserved for communications relating to safety and regularity of flights, primarily along national or international civil air routes.

Note.— AMS(R)S includes both voice and data. In this document, the use of AMS(R)S for voice communications is referred to as SATVOICE to reflect the operational use of the term in standard phraseology and messages.

***Aeronautical mobile service (AMS).** A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate; emergency position-indicating radio beacon stations may also participate in this service on designated distress and emergency frequencies.

***Aeronautical operational control (AOC).** Communication required for the exercise of authority over the initiation, continuation, diversion or termination of flight for safety, regularity and efficiency reasons.

***Aeronautical station.** A land station in the aeronautical mobile service. In certain instances, an aeronautical station may be located, for example, on board ship or on a platform at sea.

***Aeronautical telecommunication network (ATN).** A global internetwork architecture that allows ground, air-ground and avionic data subnetworks to exchange digital data for the safety of air navigation and for the regular, efficient and economic operation of air traffic services.

***Air traffic control (ATC) clearance.** Authorization for an aircraft to proceed under conditions specified by an air traffic control unit.

Note 1.— For convenience, the term “air traffic control clearance” is frequently abbreviated to “clearance” when used in appropriate contexts.

Note 2.— The abbreviated term “clearance” may be prefixed by the words “taxi”, “take-off”, “departure”, “en-route”, “approach” or “landing” to indicate the particular portion of flight to which the air traffic control clearance relates.

***Air traffic control (ATC) service.** A service provided for the purpose of:

- a) preventing collisions:
 - 1) between aircraft, and
 - 2) on the manoeuvring area between aircraft and obstructions; and
- b) expediting and maintaining an orderly flow of air traffic.

***Air traffic management (ATM).** The dynamic, integrated management of air traffic and airspace (including air traffic services, airspace management and air traffic flow management) — safely, economically and efficiently — through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions.

***Air traffic service (ATS).** A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).

***Air traffic services unit (ATS unit).** A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office.

***Aircraft.** Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

***Aircraft address.** A unique combination of 24 bits available for assignment to an aircraft for the purpose of air-ground communications, navigation and surveillance.

***Aircraft identification.** A group of letters, figures or a combination thereof which is either identical to, or the coded equivalent of, the aircraft call sign to be used in air-ground communications, and which is used to identify the aircraft in ground-ground air traffic services communications.

Note 1.— The aircraft identification does not exceed 7 characters and is either the aircraft registration or the ICAO designator for the aircraft operating agency followed by the flight identification.

Note 2.— ICAO designators for aircraft operating agencies are contained in Doc 8585.

Aircraft registration. A group of letters, figures or a combination thereof which is assigned by the State of Registry to identify the aircraft.

Note.— Also referred to as registration marking.

***Appropriate authority.**

- a) Regarding flight over the high seas: The relevant authority of the State of Registry.
- b) Regarding flight other than over the high seas: The relevant authority of the State having sovereignty over the territory being overflown.

***Area navigation (RNAV) specification.** See navigation specification.

ATC waypoint. A waypoint contained in Item 15 of the ICAO flight plan, or as amended by ATC.

Note.— A waypoint inserted by the flight crew for purposes of conducting flight operations such as points of no return are not ATC waypoints.

ATM operation. An individual operational component of air traffic management.

Note.— Examples of ATM operations include the application of separation between aircraft, the re-routing of aircraft, and the provision of flight information.

***ATS surveillance service.** Term used to indicate a service provided directly by means of an ATS surveillance system.

***ATS surveillance system.** A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft.

Note.— A comparable ground-based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.

***Automatic dependent surveillance — broadcast (ADS-B).** A means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position and additional data, as appropriate, in a broadcast mode via a data link.

***Automatic dependent surveillance — contract (ADS-C).** A means by which the terms of an ADS-C agreement will be exchanged between the ground system and the aircraft, via a data link, specifying under what conditions ADS-C reports would be initiated, and what data would be contained in the reports.

Note.— The abbreviated term “ADS-contract” is commonly used to refer to ADS event contract, ADS demand contract, ADS periodic contract or an emergency mode

***Call sign.** The designator used to identify aeronautical stations, including ATS units, and aircraft in radiotelephony communications.

Note.— See Annex 10, Volume II, 5.2.1.7 for Standards on defining call signs. For aircraft, the call sign is equivalent to the aircraft identification.

Caller line identification (CLI). A display of the identification of a caller to the recipient prior to answering the call.

Note.— For the purposes of ATS communications, caller line identification to the flight crew is a display of facility name or the facility designator for the aeronautical station or ATS unit. For the ground user, it is a display of the aircraft identification.

Communication services provider (CSP). Any public or private entity providing communication services for general air traffic. The services would include those provided by a satellite service provider (SSP) through a contract or agreement

Communication services. Aeronautical fixed and mobile services to enable ground-ground and/or air-ground communications for safety and regularity of flight.

Compulsory reporting point. An ATC waypoint for which a position report is required by the aircraft.

***Control area (CTA).** A controlled airspace extending upwards from a specified limit above the earth.

***Controller-pilot data link communications (CPDLC).** A means of communication between controller and pilot, using data link for ATC communications.

***CPDLC message.** Information exchanged between an airborne application and its ground counterpart. A CPDLC message consists of a single message element or a combination of message elements conveyed in a single transmission by the initiator.

***Current flight plan.** See flight plan.

***Data link initiation capability (DLIC).** A data link application that provides the ability to exchange addresses, names and version numbers necessary to initiate data link applications.

Diagnostic rhyme test (DRT). A test and scoring system for speech intelligibility using trained listeners to distinguish a standard set of word-pairs with initial consonants that sound somewhat similar. (ANSI/ASA S3.2-2009)

Note.— Speech intelligibility is a vital factor in aeronautical safety communications. The DRT is specifically designed to test intelligibility of speech using trained listeners to distinguish a standard set of word-pairs with initial consonants that sound somewhat similar (e.g. goat/coat). They are played word-pairs processed through a condition (e.g. codec) under test and the success rate is scored. Intelligibility is largely dependent on consonant recognition; vowel recognition is less important. The target users for aeronautical communications are, as for the DRT listening panels, trained listeners (pilots, air traffic controllers) who use standard phrases.

Downlink message (DM). A CPDLC message sent from an aircraft.

Figure of merit (FOM). An indication of the aircraft navigation system's ability to maintain position accuracy.

***Filed flight plan.** See flight plan.

***Flight crew member.** A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

Flight identification. A group of numbers, which is usually associated with an ICAO designator for an aircraft operating agency, to identify the aircraft in Item 7 of the flight plan.

***Flight information region (FIR).** An airspace of defined dimensions within which flight information service and alerting service are provided.

***Flight manual.** A manual, associated with the certificate of airworthiness, containing limitations within which the aircraft is to be considered airworthy, and instructions and information necessary to the flight crew members for the safe operation of the aircraft.

***Flight plan.** Specified information provided to air traffic services units, relative to an intended flight or portion of a flight of an aircraft.

A flight plan can take several forms, such as:

Current flight plan (CPL). The flight plan, including changes, if any, brought about by subsequent clearances. (ICAO)

Note 1.— When the word “message” is used as a suffix to this term, it denotes the content and format of the current flight plan data sent from one unit to another.

Filed flight plan (FPL). The flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes. (ICAO)

Note 2.— When the word “message” is used as a suffix to this term, it denotes the content and format of the filed flight plan data as transmitted.

Operational flight plan. The operator's plan for the safe conduct of the flight based on considerations of aeroplane performance, other operating limitations and relevant expected conditions on the route to be followed and at the aerodromes concerned. (ICAO)

Active flight plan. The operational flight plan which is controlling the aircraft's progress in terms of route, speed and altitude.

Free text message element. A message element used to convey information not conforming to any standardized message element in the CPDLC message set.

Grade of service. The probability of a call being blocked or delayed for more than a specified interval, with reference to the busy hour when the traffic intensity is the greatest.

Ground user. A term to refer to either the controller or the radio operator.

Lateral deviation event (LDE). A type of event that triggers an ADS-C report when the absolute value of the lateral distance between the aircraft's actual position and the aircraft's expected position on the active flight plan becomes greater than the lateral deviation threshold.

Level-range deviation event (LRDE). A type of event that triggers an ADS-C report when the aircraft's level is higher than the level ceiling or the aircraft's level is lower than the level floor.

Note.— Sometimes referred to as altitude range change event or altitude range event.

Long-range communication system (LRCS). A system that uses satellite relay, data link, high frequency, or another approved communication system which extends beyond line of sight.

***Master minimum equipment list (MMEL).** A list established for a particular aircraft type by the organization responsible for the type design with the approval of the State of Design containing items, one or more of which is permitted to be unserviceable at the commencement of a flight. The MMEL may be associated with special operating conditions, limitations or procedures.

Maximum accumulated unplanned outage time. A value that defines the acceptable accumulated duration of unplanned outages that exceed the unplanned outage duration limit in a specified time period.

Note.— Unplanned outages that are less than the unplanned outage duration limit are considered against the criterion for continuity.

Maximum number of unplanned outages. A value that defines the acceptable number of unplanned outages that exceed the unplanned outage duration limit in a specified time period.

Note.— Unplanned outages that are less than the unplanned outage duration limit are considered against the criterion for continuity.

***Minimum equipment list (MEL).** A list which provides for the operation of aircraft, subject to specified conditions, with particular equipment inoperative, prepared by an operator in conformity with, or more restrictive than, the MMEL established for the aircraft type.

***Navigation specification.** A set of aircraft and flight crew requirements needed to support performance-based navigation operations within a defined airspace. There are two kinds of navigation specifications:

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

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

Note 1.— The Performance-based Navigation (PBN) Manual (Doc 9613), Volume II, contains detailed guidance on navigation specifications.

Note 2.— The term RNP, previously defined as “a statement of the navigation performance necessary for operation within a defined airspace”, has been removed from this Annex as the concept of RNP has been overtaken by the concept of PBN. The term RNP is now solely used in the context of navigation specifications that require performance monitoring and alerting, e.g. RNP 4 refers to the aircraft and operating requirements, including a 4 NM lateral performance with on-board performance monitoring and alerting that are detailed in Doc 9613.

***NOTAM.** A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

Operational approval. An authorization which entitles an operator, owner or pilot-in-command to undertake or continue a flight operation. States may use the following methods to issue operational approvals:

Approval. An explicit action by the State of the Operator/State of Registry to authorize an application to undertake a proposal to modify a flight operation that has been submitted by, or on behalf of, an operator or owner. The approval attests to compliance with the applicable provisions.

Specific approval. An approval which is required to be documented in the operations specifications for commercial air transport operations or in the list of specific approvals for international general aviation operations.

Acceptance. A written or implicit acknowledgement of consensus by a State on a notification submitted by the operator. A State's approval is implicit if it does not issue a written response to the operator within a certain period of time following the submission of the notification.

Note.— General aviation approvals may take the form of criteria established by the State of Registry which must be met by an operator, owner or pilot-in-command to undertake or continue a flight operation.

Operational communication transaction. The process a human uses to initiate the transmission of an instruction, clearance, flight information, and/or request, and is completed when that human is confident that the transaction is complete.

***Operational flight plan.** See flight plan.

***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.

***Performance-based navigation (PBN).** Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

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

***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 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.

Personal identification number (PIN). A secret numeric password shared between a user and a system that can be used to authenticate the user to the system.

Note.— For the purposes of ATS communications, all PIN numbers are issued for the same purpose, as there is no PIN that grants higher priority or access than another. The priority of the call is determined by the dialling string and ground-initiated calling service used. Calling line identification (caller ID) is just a substitute for the radio operator not having to dial the PIN number for ground-initiated calls. When caller ID is implemented for the customer, then all calls made from the access numbers provided to the GES provider will not be prompted for a PIN when the call is placed to the aircraft. If the switch does not recognize the pre-defined caller ID list provided to the GES, then the caller will be prompted for the PIN code.

Pre-emption. The immediate and automatic seizure of resources allocated to a lower-priority call. A higher priority call will interrupt communication resources being used by a lower priority communication to establish a connection without any indication or delay.

Note.— If the intervening call is the same or lower, the current call will not be pre-empted and the intervening caller will get an indication that the line is not available. The effects of pre-emption can be minimized by multiple channels and conference calling, but not completely eliminated.

Priority level. An indication of call precedence for ground-to-air or air-to-ground calls. Priority level may be used to establish pre-emption.

***Procedural control.** Term used to indicate that information derived from an ATS surveillance system is not required for the provision of air traffic control service.

***Procedural separation.** The separation used when providing procedural control.

Public switched telephone network (PSTN). A network of the world's public circuit-switched telephone networks. It consists of telephone lines, fibre optic cables, microwave transmission links, cellular networks, communications satellites, and undersea telephone cables, all interconnected by switching centres, thus allowing any telephone in the world to communicate with any other.

Qualification. The process through which a State, approval authority and applicant ensure that a specific implementation complies with applicable requirements with a specified level of confidence.

Radio operator. A person authorized by the appropriate authority to relay a radiotelephony communication between the ATS unit and the flight crew.

RCP allocation. A portion of an RCP parameter value assigned to a specific component of the communication system.

Note.— The different components of the system may include, for example, the ATS unit, the CSP, the aircraft system and the flight crew. An RCP allocation may also be a portion of an RCP parameter value that is used for monitoring (e.g. RCMP).

RCP answer/call performance. An RCP allocation that specifies the maximum time for when the flight crew receives an indication of an incoming call to when the parties on the call have completed the communication.

RCP availability (A). An RCP parameter that specifies the required probability that an operational communication transaction can be initiated.

RCP availability — aircraft (A_{AIR}). An RCP allocation that specifies the required probability that the aircraft system is serviceable for the relevant communication capability.

RCP availability — CSP (A_{CSP}). An RCP allocation that specifies the required probability that the CSP systems are available to provide the required level of communication service, given the ATS unit's system is available.

RCP availability — service ($A_{SERVICE}$). An RCP allocation that specifies the required probability that the ATS unit's system and the CSP systems are available to provide the required level of communication service.

RCP continuity (C). An RCP parameter that specifies the minimum proportion of relevant operational communication transactions to be completed within the specified time, given that the service was available at the start of the transaction, where:

- a) the minimum proportion is either 95 per cent that is used for statistical monitoring, or a proportion (e.g. 99.9 per cent) that is associated with the time after which the initiator is required to revert to an alternative procedure; and
- b) the specified time represents the RCP transaction time or any allocation provided by the RCP specification.

Note.— For any given allocation of the RCP transaction time, the RCP continuity remains constant and is referred to as “C for [allocation]”, (e.g. C for RCMP, C for RCTP).

RCP initiator performance. An RCP allocation that specifies the maximum time for the controller to issue an ATC instruction and receive a response.

RCP integrity (I). An RCP parameter that specifies the required probability that an operational communication transaction is completed with no undetected errors.

Note.— While RCP integrity is defined in terms of the quality of the communication capability, the criterion is specified as a probability of malfunction on a per flight hour basis (e.g. 10^{-5}), consistent with RSP and RNAV/RNP specifications.

RCP parameter. A performance characteristic that provides the basis for developing an RCP specification. The RCP parameters include RCP transaction time, RCP continuity, RCP availability and RCP integrity.

RCP pilot operational response time (PORT). An RCP allocation that specifies the maximum time for the flight crew to recognize and respond to an ATC instruction.

RCP queue/connect performance. An RCP allocation that specifies the maximum time allocated to the radio operator/aeronautical station system to organize and place the call either via a manual or automated dialling sequence.

RCP transaction time. An RCP parameter that specifies the maximum time for the completion of a proportion of operational communication transactions after which the initiator should revert to an alternative procedure. Two values are specified:

- a) RCP nominal time (TT). The maximum nominal time within which 95 per cent of operational communication transactions is required to be completed; and
- b) RCP expiration time (ET). The maximum time for the completion of the operational communication transaction after which the initiator is required to revert to an alternative procedure.

RCTP_{AIR}. An RCP allocation that specifies the maximum portion of RCTP for the aircraft system.

RCTP_{AS}. An RCP allocation that specifies the maximum portion of RCTP for an aeronautical station's system for ground-ground communications with an ATS unit.

Note.— RCTP_{AS} includes two concurrent processes:

- a) *the aircraft and aeronautical station technically disconnect the call; which is assumed. Operationally, the call is disconnected when the flight crew and radio operator complete the call; and*
- b) *the aeronautical station sends the response to the ATS unit via the ground-ground network; the performance is denoted by RCTP_{AS}.*

RCTP_{ATSU}. An RCP allocation that specifies the maximum portion of RCTP for the ATS unit's system.

RCTP_{CSP}. An RCP allocation that specifies the maximum portion of RCTP for the network, including CSP.

RCTP_{G/A}. An RCP allocation that specifies the maximum portion of RCTP for the ground system, network and aircraft system to set up a ground-to-air call, as determined from when the last digit of the dialling sequence is finished to when the aircraft indicates an incoming call to the flight crew.

Required communication monitored performance (RCMP). An RCP allocation that specifies the maximum time against which ACP is assessed.

***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 communication technical performance (RCTP). An RCP allocation that specifies the maximum technical time for relevant parts of the ATS unit's system, aeronautical station's system, the network systems and the aircraft system, for which there is no human contribution to the communication transaction performance.

***Required navigation performance (RNP) specification.** See navigation specification.

Required surveillance monitored performance (RSMP). An RSP allocation that specifies the maximum time against which ASP is assessed.

***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.

Required surveillance technical performance (RSTP). An RSP allocation that specifies the maximum technical time for relevant parts of the ATS unit's system, aeronautical station's system, the network systems and the aircraft system, for which there is no human contribution to the surveillance data delivery performance.

RSP allocation. A portion of an RSP parameter value assigned to a specific component of the surveillance system.

Note.— The different components of the system may include, for example, the ATS unit, the CSP, the aircraft system and the flight crew. An RSP allocation may also be a portion of an RCP parameter value that is used for monitoring (e.g. RSMP).

RSP answer performance. An RSP allocation that specifies the maximum time for when the ground user receives an indication of an incoming call to when the ground user accepts the call.

RSP availability (A). An RSP parameter that specifies the required probability that surveillance data can be provided.

RSP availability — aircraft (A_{AIR}). An RSP allocation that specifies the required probability that the aircraft system is serviceable for the relevant surveillance service.

RSP availability — CSP (A_{CSP}). An RSP allocation that specifies the required probability that the CSP/SSP systems are available to provide the required level of communication supporting surveillance services, given the ATS unit's system is available.

RSP availability — service ($A_{SERVICE}$). An RSP allocation that specifies the required probability that the ATS unit's system and the CSP systems are available to provide the required level of surveillance service.

RSP call performance. An RSP allocation that specifies the maximum time for when the ground user accepts an incoming air-to-ground call to when the parties on the call have completed the communication.

RSP continuity (C). An RSP parameter that specifies the minimum proportion of relevant surveillance data to be delivered within the specified time, given that the service was available at the start of delivery, where:

- a) the minimum proportion is either 95 per cent that is used for statistical monitoring, or a proportion (e.g. 99.9 per cent) that is associated with the time after which the surveillance data is considered overdue; and
- b) the specified time represents the RSP data delivery time or any allocation provided by the RSP specification.

Note.— For any given allocation of the RSP data delivery time, the RSP continuity remains constant and is referred to as “C for [allocation]”, (e.g. for RSTP, C for RSTP_{CSP}).

RSP data delivery time. An RSP parameter that specifies the maximum time for a proportion of surveillance data deliveries from the time at which the aircraft reported its position to when the ATS unit receives the report. Two values are specified:

- a) RSP nominal delivery time (DT). The maximum nominal time within which 95 per cent of surveillance data deliveries are required to be successfully delivered; and
- b) RSP overdue delivery time (OT). The maximum time for the successful delivery of surveillance data after which time the initiator is required to revert to an alternative procedure.

RSP initiator performance. An RSP allocation that specifies the maximum time for the flight crew to prepare a position report, from the time the aircraft was over its compulsory reporting point to when the call is initiated.

RSP integrity (I). An RSP parameter that specifies the required probability that the surveillance data is delivered with no undetected error.

Note 1.— Surveillance integrity includes such factors as the accuracy of time, correlating the time at aircraft position, reporting interval, data latency, extrapolation and/or estimation of the data.

Note 2.— While RSP integrity is defined in terms of the quality of the surveillance capability, the criterion is specified as a probability of malfunction using a per flight hour basis (e.g. 10^{-5}), consistent with RCP and RNAV/RNP specifications.

RSP parameter. A performance characteristic that provides the basis for developing an RSP specification. The RSP parameters include RSP data delivery time, RSP continuity, RSP availability and RSP integrity.

RSTP_{A/G}. An RSP allocation that specifies the maximum portion of RSTP for the ground system, network and aircraft system to set up an air-to-ground call as determined from when the last digit of the dialling sequence is finished to when the ground system indicates an incoming call to the receiving party.

RSTP_{AIR}. An RSP allocation that specifies the maximum portion of RSTP for the aircraft system.

RSTP_{AS}. An RSP allocation that specifies the maximum portion of RSTP for the aeronautical station's system for ground-ground communications with an ATS unit.

Note.— RSTP_{AS} includes two concurrent processes:

- a) the aircraft and aeronautical station technically disconnect the call; which is assumed. Operationally, the call is disconnected when the flight crew and radio operator complete the call; and*
- b) the aeronautical station sends the surveillance data to the ATS unit via the ground-ground network; the performance is denoted by RSTP_{AS}.*

RSTP_{ATSU}. An RSP allocation that specifies the maximum portion of RSTP for the ATS unit's system.

RSTP_{CSP}. An RSP allocation that specifies the maximum portion of RSTP for the CSP.

Satellite service provider (SSP). An entity or group of entities that provide, via satellite, aeronautical fixed services and/or aeronautical mobile services at least from the signal in space to/from aircraft, to the attachment point of the ground earth station (GES) to the ground communication services network.

SATVOICE number. The number used to contact an aircraft or ground facility via SATVOICE.

Note.— The SATVOICE number takes different forms:

- a) after the access number has been dialled, the aircraft SATVOICE number is the ICAO aircraft address represented by an 8-digit octal code;*
- b) the ATS unit or aeronautical station SATVOICE number is a 6-digit short code or a PSTN direct dial number, which are published on aeronautical charts and in aeronautical information publications (AIPs or equivalent publications); and*
- c) AOC SATVOICE number is a PSTN direct dial number.*

Standard message element. Part of a message defined in the PANS-ATM (Doc 4444) in terms of display format, intended use and attributes.

***State of Design.** The State having jurisdiction over the organization responsible for the type design. (ICAO)

***State of Manufacture.** The State having jurisdiction over the organization responsible for the final assembly of the aircraft.

***State of Registry.** The State on whose register the aircraft is entered.

Note.— In the case of the registration of aircraft of an international operating agency on other than a national basis, the States constituting the agency are jointly and severally bound to assume the obligations which, under the Chicago Convention, attach to a State of Registry. See, in this regard, the Council Resolution of 14 December 1967 on Nationality and Registration of Aircraft Operated by International Operating Agencies which can be found in the Policy and Guidance Material on the Economic Regulation of International Air Transport (Doc 9587).

***State of the Operator.** The State in which the operator's principal place of business is located or, if there is no such place of business, the operator's permanent residence.

Surveillance data. Data pertaining to the identification of aircraft and/or obstructions for route conformance monitoring and safe and efficient conduct of flight.

Surveillance data delivery. The process for obtaining surveillance data.

Unplanned outage. An outage for which no advance notification was provided to the appropriate parties.

Unplanned outage duration limit. A value applied to a given airspace that defines the maximum time for the duration of an unplanned outage at which time there is an operational impact.

Unplanned outage notification delay. The time from when the unplanned outage begins to when the ATS unit receives notification of the unplanned outage.

Unplanned outage time. The time from when an unplanned outage begins to when the ATS unit receives notification that the service has been restored.

Uplink message (UM). A CPDLC message sent from a ground system.

Vertical rate change event (VRE). A type of event that triggers an ADS-C report when the aircraft's rate of climb or descent is greater than the vertical rate threshold.

Waypoint change event (WCE). A type of event that triggers an ADS-C report when there is a change in the next waypoint or the next plus 1 waypoint on the active flight plan.

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ABBREVIATIONS AND ACRONYMS

When the following abbreviations are used in this manual, they have the meanings indicated below.

Note.— Where an asterisk appears beside a term, the term has already been defined as such in Annexes and Procedures for Air Navigation Services (PANS).

ACARS	Aircraft Communication Addressing and Reporting System
ACL	ATS clearance (data link service)
ACM	ATS communications management (data link service)
ACP	Actual communication performance
ACTP	Actual communication technical performance
ADS	Automatic dependent surveillance (retained for reference with non-updated documents. This term would normally be used to refer to ADS-C)
*ADS-B	Automatic dependent surveillance – broadcast
*ADS-C	Automatic dependent surveillance – contract
AFN	ATS facilities notification
*AGL	Above ground level
*AIC	Aeronautical information circular
*AIP	Aeronautical information publication
AMC	ATS microphone check (data link service)
AMS	Aeronautical mobile service
*AMS(R)S	Aeronautical mobile-satellite (route) service
ANSP	Air navigation service provider
AOC	Aeronautical operational control
ASP	Actual surveillance performance
*ATC	Air traffic control
*ATM	Air traffic management
*ATN	Aeronautical telecommunication network
ATN B1	Aeronautical telecommunication network baseline 1 (RTCA DO 280B/EUROCAE ED 110B)

Note.— ATN B1 generally means that the data link system on an aircraft, the ATS unit's system, and communication service provision comply with the standard as adapted by EUROCONTROL Specification on Data Link Services (EUROCONTROL-SPEC-0116). ATN B1 consists of the following data link applications:

- a) context management (CM) for data link initiation capability (DLIC); and*
- b) limited CPDLC for ATS communications management (ACM), ATS clearance (ACL), and ATC microphone check (AMC).*

*ATS	Air traffic service
ATSU	ATS unit
C	Continuity
CLI	Caller line identification
CM	Context management (data link application)
*CNS	Communications, navigation and surveillance
*CNS/ATM	Communications, navigation and surveillance/air traffic management
COM	Communications
*CPDLC	Controller-pilot data link communications
*CPL	Current flight plan
CRC	Cyclic redundancy check

CSP	Communication services provider
*CTA	Control area
DCPC	Direct controller-pilot communications
*DLIC	Data link initiation capability
DM	Downlink message
DRT	Diagnostic rhyme test
DT	Delivery time
ET	Expiration time
FANS	Future air navigation systems
FANS 1/A	Future air navigation system – initial (RTCA DO 258A/EUROCAE ED 100A, or previous standards that defined the FANS 1/A capability)

Note.— FANS 1/A generally means that the data link system on an aircraft, the ATS unit's system, and communication service provision comply with the standard. In certain cases, specific reference is made to a particular type of FANS 1/A aircraft as follows:

- a) FANS 1/A+ means that the aircraft completely complies with Revision A of the standard, which includes message latency monitor; and*
- b) FANS 1/A ADS-C means that the aircraft complies with AFN and ADS-C applications, but does not include the CPDLC application.*

*FIR	Flight information region
FMS	Flight management system
FOM	Figure of merit
FPL	Filed flight plan
*GES	Ground earth station
GOLD	Global Operational Data Link (Manual)
*HF	High frequency (3-30 MHz)
LDE	Lateral deviation event
LRCS	Long-range communication system
LRDE	Level-range deviation event
MAS	Message assurance
*MEL	Minimum equipment list
*MMEL	Master minimum equipment list
ORT	Operational requirements table
OT	Overdue delivery time
OT	Operational continuity
*PANS-ATM	Procedures for Air Navigation Services — Air Traffic Management (Doc 4444)
PBC	Performance-based communication
PBCS	Performance-based communication and surveillance
PBN	Performance-based navigation
PBS	Performance-based surveillance
PIN	Personal identification number
PORT	Pilot operational response time
POS	Position report message
PSTN	Public switched telephone network
RCMP	Required communication monitored performance
RCP	Required communication performance
RCP A	RCP availability
RCP A _{AIR}	RCP availability — aircraft
RCP A _{CSP}	RCP availability — CSP
RCP A _{SERVICE}	RCP availability — service

RCP C	RCP continuity
RCP I	RCP integrity
RCTP	Required communication technical performance
RGS	Radio ground station
RNAV	Area navigation
RNP	Required navigation performance
RSMP	Required surveillance monitored performance
RSP	Required surveillance performance
RSP A	RSP availability
RSP A _{AIR}	RSP availability — aircraft
RSP A _{CSP}	RSP availability — CSP
RSP A _{SERVICE}	RSP availability — service
RSP C	RSP continuity
RSP I	RSP integrity
RSTP	Required surveillance technical performance
RTF	Radiotelephone
*SARPs	Standards and Recommended Practices
SATCOM	Satellite communications (used only when referring generally to both voice and data satellite communication)
SATVOICE	Satellite voice communications
SSP	Satellite service provider
TT	RCP transaction time
UM	Uplink message
VDL	VHF data link Mode 0/A or Mode 2
VDL M2	VHF data link Mode 2 subnetwork
*VHF	Very high frequency (30-300 MHz) (ICAO)
VRE	Vertical rate change event
WCE	Waypoint change event

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Chapter 1

PERFORMANCE-BASED COMMUNICATION AND SURVEILLANCE (PBCS) CONCEPT

1.1 GENERAL

1.1.1 The performance-based communication and surveillance (PBCS) concept provides objective operational criteria to evaluate different and emerging communication and surveillance technologies, intended for evolving air traffic management (ATM) operations. Once these criteria have been established and accepted, implementation of a specific ATM operation including its technical and human performance may be evaluated against these operational criteria to assess their viability. The PBCS concept and guidelines provided in this manual are applicable to any air traffic services (ATS) system change that is predicated on communication and/or surveillance performance.

1.1.2 The PBCS concept is aligned with that of performance-based navigation (PBN). While the PBN concept applies required navigation performance (RNP) and area navigation (RNAV) specifications to the navigation element, the PBCS concept applies required communication performance (RCP) and required surveillance performance (RSP) specifications to communication and surveillance elements, respectively. Each RCP/RSP specification includes allocated criteria among the components of the communication and surveillance systems involved.

1.1.3 Where beneficial, RCP, RNP/RNAV and RSP specifications are applied to communication, navigation and surveillance elements to ensure that the operational system and its components perform in accordance with the specifications. Figure 1-1 provides an overview of the performance-based communications, navigation, and surveillance (CNS)/ATM model, which characterizes the relationship of the performance-based specifications among CNS elements supporting an ATM operation.

Note 1.— While RCP and RSP specifications may be applied where beneficial, the PBCS concept is primarily intended for emerging technologies, and not traditional ones, such as HF voice communication or radar. As such, this edition has considered controller-pilot data link communications (CPDLC), automatic dependent surveillance — contract (ADS-C) and SATVOICE technologies, and may be revised to apply to other technologies, such as automatic dependent surveillance — broadcast (ADS-B), as experience is gained.

Note 2.— Similar to the PBN concept, security is beyond the scope of the PBCS concept. However, in some cases, the RCP and RSP specifications may include criteria to support mitigations from security threats. For example, the RCP and RSP specifications that may be applied to SATVOICE contain provisions for satellite service providers (SSPs) to oversee communication services providers (CSPs), in administering accounts to authorized subscribers with personal identification numbers (PIN) and priority level calling. Aircraft SATVOICE systems only route calls to the flight deck from authorized subscribers or alert the flight crew of the appropriate call priority for ATS communication.

1.1.4 There are some differences between the PBCS concept and PBN concept:

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

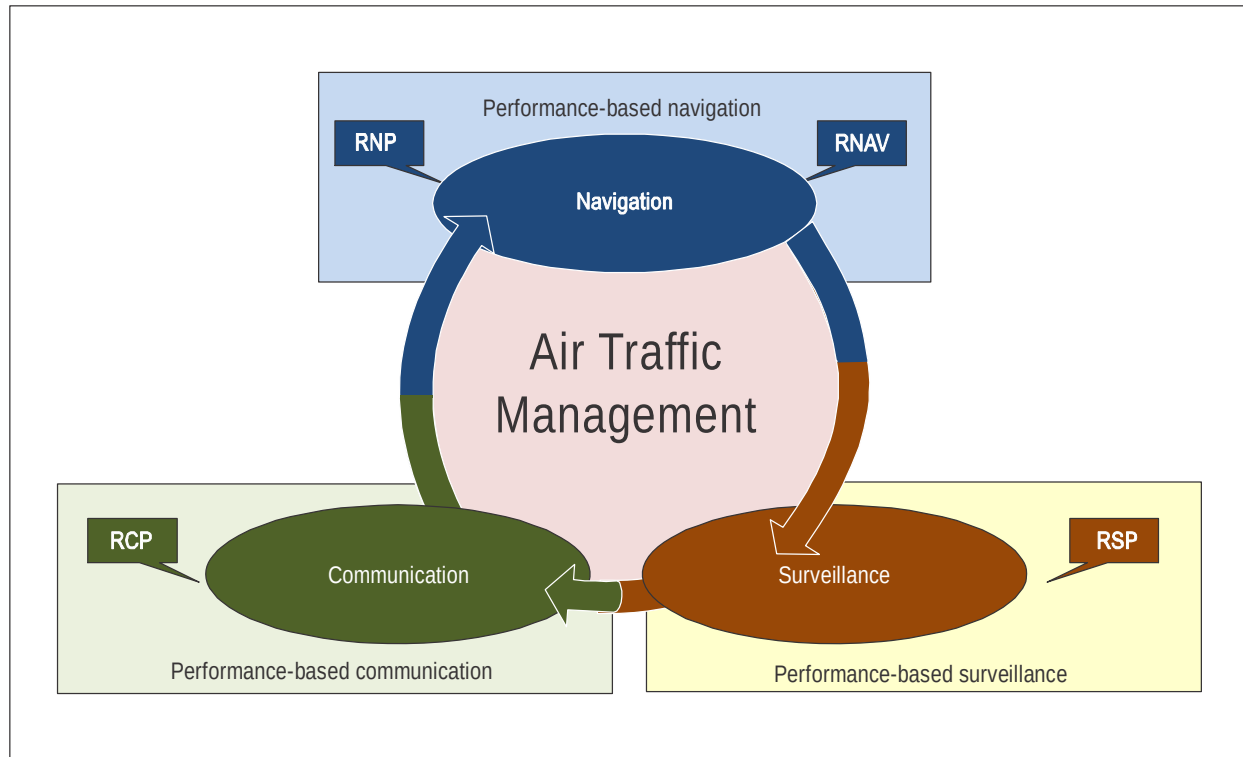


Figure 1-1. Performance-based CNS/ATM model

- b) the PBCS concept includes post-implementation monitoring programmes, on a local and regional basis, with global exchange of information; whereas 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).

1.2 THE PBCS FRAMEWORK

1.2.1 The PBCS concept provides a framework to apply RCP and RSP specifications to ensure acceptable levels of communication and surveillance capabilities and performance of an operational system. These specifications are applied using the following methods:

- prescription (in accordance with Annex 11, PANS-ATM, *Regional Supplementary Procedures* (Doc 7030) and/or the Aeronautical Information Publication (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 air traffic services (ATS) provision in a particular airspace;
- operational approval (in accordance with Annex 6) to file the flight plan RCP/RSP capabilities, including aircraft equipage where RCP and/or RSP specifications are prescribed for the communications and/or surveillance capabilities supporting the ATS provision; and

- c) local and regional monitoring programmes to assess actual communication and surveillance performance against RCP and RSP specifications, thereby determining corrective action, as applicable, for the appropriate entity.

Note.— Consistent with the PANS-ATM (Doc 4444), 4.4.1.4 and Appendix 2, Item 10, a communication or surveillance capability comprises the following elements: a) presence of relevant serviceable equipment on board the aircraft; b) equipment and capabilities commensurate with flight crew qualifications; and c) relevant approvals from the appropriate authority.

1.2.2 The consistent definition and use of communication and surveillance capabilities is needed to apply the PBCS concept on a global basis, in order for States, ANSPs and operators (or airspace users) to acquire its benefit.

1.2.3 The PBCS concept applies to communication and surveillance capability performance. It therefore affects the provision of air traffic services and the aircraft operator's use of the services, including associated aircraft equipage. The PBCS concept is also intended to characterize the communication and surveillance capability, as well as its performance, through RCP and RSP specifications and ensure that systems meet these specifications.

1.3 RELATIONSHIP WITH STATE SAFETY MANAGEMENT RESPONSIBILITIES

1.3.1 Annex 19 — *Safety Management* requires States to establish and maintain a State safety programme (SSP) to proactively manage safety that supports the continued improvement of safety performance. The PBCS concept supports States in managing the safety performance with an effective means of implementing the SSP and safety oversight system.

1.3.2 The RCP and RSP specifications, one of the key elements of the concept, prescribes the functional, safety and performance requirements for all components of communication and surveillance systems. These components include the provision of air traffic services, including contracted communication and surveillance services, the aircraft operator and the aircraft systems.

1.3.3 States can use the specifications to evaluate the initial and ongoing compliance of these systems. In addition, the specifications serve to ensure that the entities involved commit to managing and monitoring the safety performance of communication and surveillance systems, which contribute to achieving an acceptable level of safety performance for the State.

1.3.4 The PBCS monitoring programmes required as part of the concept will support hazard identification as well as safety risk assessment and management. It also supports exchange of safety information on both a regional and global basis.

1.3.5 In accordance with Annex 19, States are also required to ensure that the following service providers under their responsibility implement a safety management system (SMS) and manage their interfaces with other organizations that can contribute to the safety of their products or services:

- a) approved training organizations;
- b) aircraft operators or helicopters authorized to conduct international commercial air transport;
- c) organizations responsible for the type design or manufacture of aircraft, engines or propellers;
- d) air traffic services providers; and
- e) operators of certified aerodromes.

1.3.6 The importance of interface management for air traffic services providers and aircraft operators is highlighted in the PBCS concept. When communication and surveillance services are negotiated, as illustrated in Figure 1-2, the air traffic services provider and aircraft operators should establish proper mechanisms, such as administrative and legal arrangements. These mechanisms should ensure the initial and ongoing compliance, by the contracted CSP and SSP, with the functional, safety and performance requirements described in the RCP and RSP specifications.

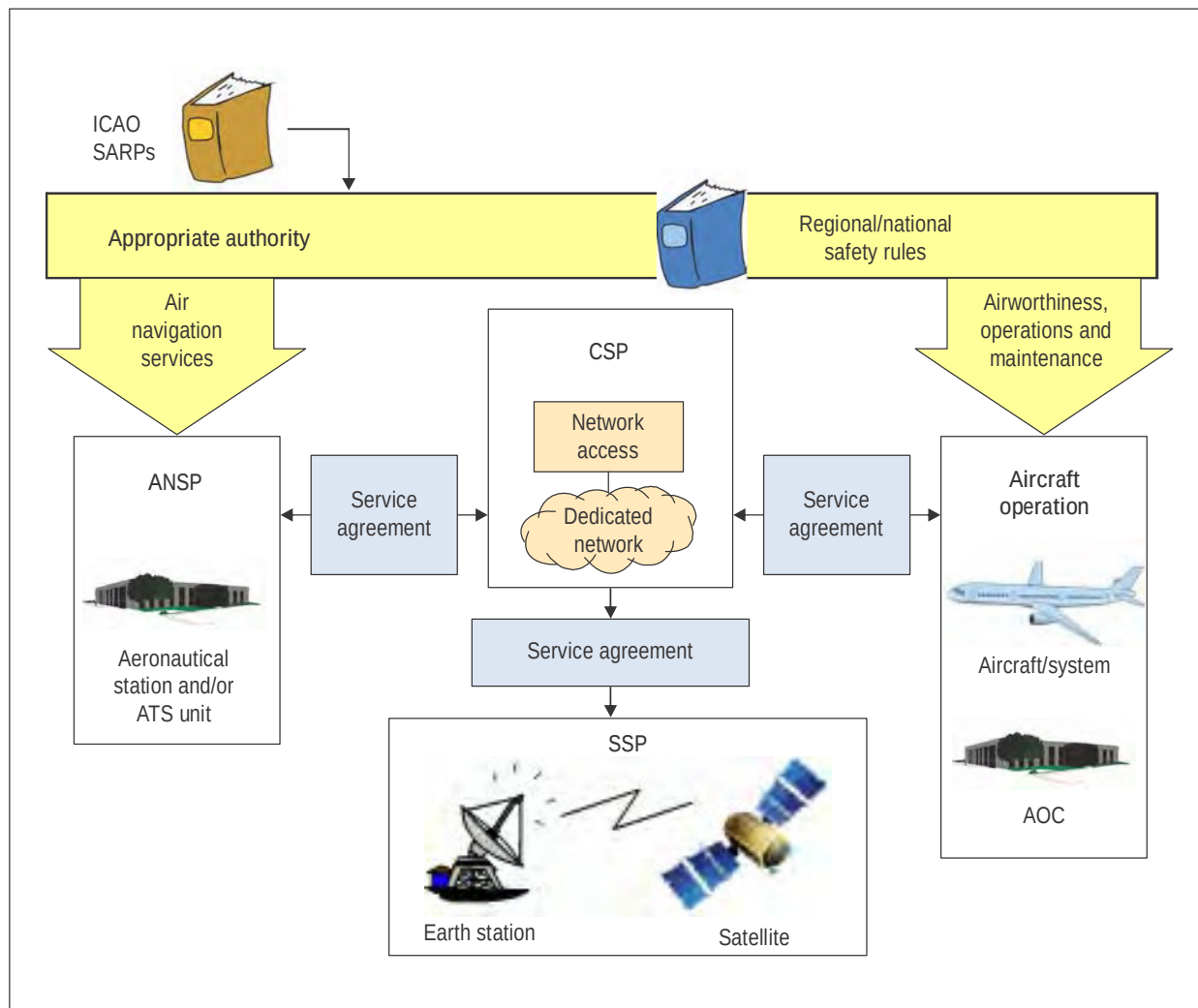


Figure 1-2. Example of contracted communication and surveillance services

1.4 RCP AND RSP SPECIFICATIONS SUPPORTING ATM OPERATIONS

1.4.1 To perform ATM operations within a performance-based airspace, functional, safety and performance criteria need to be specified for the applicable communication, navigation and/or surveillance (CNS) elements. RCP and RSP specifications, in conjunction with RNP/RNAV specifications, provide these criteria and are intended to facilitate the development of standards and procedures for ATM operations. This approach is essential to the evolution of operational concepts that use emerging technologies.

1.4.2 This manual , outlines considerations for assessing the risk of collision when determining separation minima within a target level of safety. When assessing the CNS criteria for a particular ATM operation, the risk of collision is affected by many factors such as navigation performance, route configuration, traffic density, surveillance, communication and air traffic control. Trade-offs in required performance among the CNS elements are therefore evaluated, and practical and technological constraints are taken into account to achieve the target level of safety.

1.4.3 This manual characterizes the relationship of communication and surveillance elements with the navigation element through the use of a communication and controller intervention buffer, referred to as tau (τ). Table 1-1 shows the relationship of the parameters of tau (τ) with RCP and RSP specifications, considering three different scenarios: normal communication and surveillance, non-normal communication (i.e. first communication transaction was not completed by a specified time) and non-normal surveillance (i.e. surveillance data was not delivered by a specified time and is now considered overdue).

Note.— Table 1-1 was derived from RTCA DO-306/EUROCAE ED-122, 5.2.3.2, Table 5-5.

Table 1-1. Relationship of tau (τ) with RCP and RSP specifications

<i>Communication and controller intervention buffer, τ, parameter (Appendix 5)</i>	<i>Normal communication and surveillance</i>	<i>Non-normal communication</i>	<i>Non-normal surveillance</i>
Not considered part of τ . The time for the system to deliver the surveillance data to the ATS unit.	Consideration for RSP specification.	Consideration for RCP specification.	Consideration for RSP specification.
The time for the controller to recognize the potential conflict and to devise an alternative means of separation (assumed to be achieved by a change of level in procedurally controlled airspace).	Not considered in RSP or RCP specification.	Not considered in RCP specification.	No time allocated for RSP specification. (Overdue position report.)
The time taken to communicate the instructions to the pilot via normal means of communication. In the case of an overdue position report, the time taken to obtain the report via normal means of surveillance.	Consideration for RCP specification.	Consideration for RCP specification.	Consideration for RSP specification. (Time after which the controller initiates first attempt to obtain overdue position report.)

<i>Communication and controller intervention buffer, τ, parameter (Appendix 5)</i>	<i>Normal communication and surveillance</i>	<i>Non-normal communication</i>	<i>Non-normal surveillance</i>
The time taken to communicate the instructions to the pilot via alternative means of communication. In the case of a first attempt to obtain overdue position report fails, the time taken for a second attempt via alternative means of surveillance.	Not applicable.	Consideration for RCP specification.	Consideration for RSP specification. (Time after which the controller initiates second attempt to obtain overdue position report. If no response received, the controller would have initiated communication with other aircraft.)
The time for the pilot to react and initiate an appropriate manoeuvre and the time for the aircraft to achieve a change of trajectory sufficient to ensure that a collision will be averted.	Not applicable.	Not applicable.	Not applicable.
Not considered part of τ . Communication time for the PORT and WILCO responses to the ATC instruction, which may be concurrent with manoeuvring the aircraft.	Consideration for RCP specification.	Consideration for RCP specification.	Not applicable.

1.4.4 An RCP/RSP specification provides values for operational parameters that, when applied within a PBCS framework, ensures confidence that the operational communication and surveillance capabilities will be conducted in an acceptably safe manner. These operational parameters include RCP transaction time, RSP surveillance data delivery time, RCP/RSP continuity, RCP/RSP availability and RCP/RSP integrity. An RCP/RSP specification includes functional, safety and performance requirements that are associated with each of the operational parameters.

1.4.5 In addition, an RCP/RSP specification includes allocated criteria to system components based on technological dependencies. These allocations are used to:

- a) assess the viability of different technologies in meeting operational requirements;
- b) approve the provision of air traffic services supported by communication and/or surveillance systems;
- c) determine the initiation of contingency procedures;
- d) design, implement and qualify communication and/or surveillance services;

- e) design, implement, qualify and approve aircraft type designs;
- f) approve aircraft operators for PBCS operations; and
- g) operationally monitor, detect and resolve non-compliant performance.

1.4.6 An RCP/RSP specification is globally harmonized and is applied to identical or similar ATM operations to reduce training requirements and errors resulting from confusion in operations across airspace boundaries. Global harmonization also facilitates the application of an RCP/RSP specification to components of the system that are global in nature, such as aeronautical mobile satellite services and ground-ground networks.

1.4.7 An RCP/RSP specification provides the basis to manage the performance of communication and surveillance capabilities. This is achieved by:

- a) developing an RCP/RSP specification for one or more communication and surveillance capabilities on a global basis; then
- b) applying an RCP/RSP specification related to one or more communication and surveillance system(s) within that airspace; and
- c) complying with a prescribed RCP/RSP specification through initial compliance of the different system components individually, and local and regional monitoring programmes, which include ongoing assessments of the actual performance of communication and surveillance systems and corrective action.

1.5 DEVELOPING AN RCP/RSP SPECIFICATION

1.5.1 ICAO, in coordination with industry partners (e.g. the Radio Technical Commission for Aeronautics, Inc. (RTCA) /the European Organisation for Civil Aviation Equipment (EUROCAE)), develops a new RCP/RSP specification or revises an existing RCP/RSP specification to provide a set of operational requirements for communication and surveillance capabilities that are adequate for a new ATM operation. ICAO may also revise an existing RCP/RSP specification to provide a new set of allocations to the communication or surveillance system components as new technologies emerge. These system components encompass the provision of air traffic services, including contracted communication and surveillance services, the aircraft operator and the aircraft systems. Figure 1-3 provides an overview RCP/RSP specification development.

1.5.2 The operational requirements provided by an RCP/RSP specification are based on an assessment of operational communication transactions and operational surveillance data delivery for a specific ATM operation, taking into account human interactions, procedures and environmental characteristics. These operational requirements address the functions, performance and safety of a complete system which comprises interoperable system components.

1.5.3 The operational requirements of an RCP/RSP specification are not based on technological dependencies, although it is assumed that compliance of communication and surveillance capabilities to prescribed interoperability standards, including those applicable to communication medium types that support the capabilities, is in place.

1.5.4 Allocations to system components, however, which are also provided in an RCP/RSP specification, take into account technological dependencies. Nevertheless, it is not intended to promote an unrestricted number of alternative communication technologies for one ATM operation. An RCP/RSP specification is intended to be flexible, to the greatest extent practicable, taking into account aircraft equipage and operator requirements, interoperability, cost and other practical considerations.

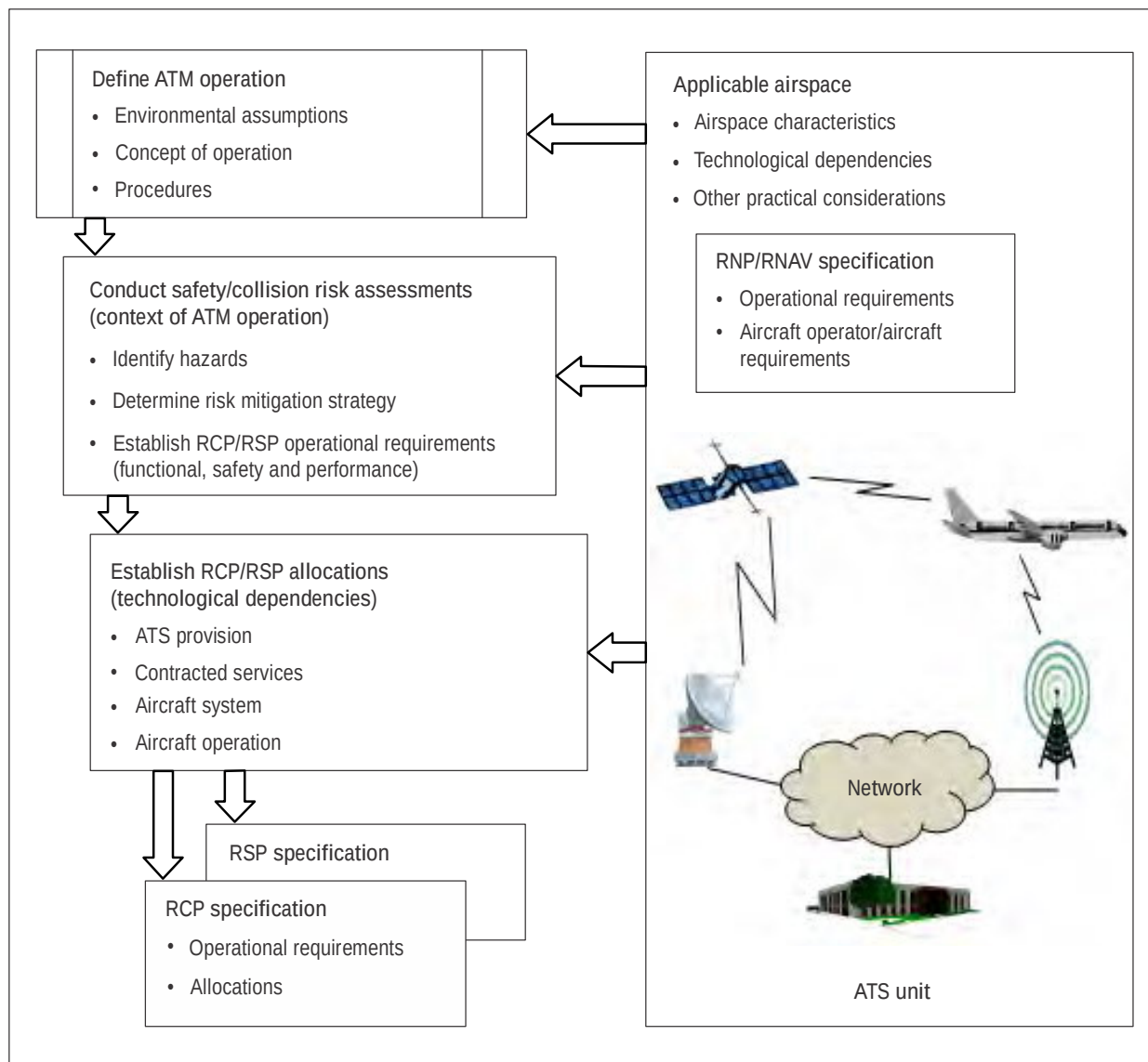


Figure 1-3. Overview RCP/RSP specification development

Note.— Chapter 3 provides guidance on developing an RCP/RSP specification, including how to revise existing specifications, criteria for new specifications, operational assessment in the development of new specifications and application to one or more ATM operations.

1.6 APPLYING AN RCP/RSP SPECIFICATION

1.6.1 ICAO identifies an RCP/RSP specification, as appropriate, to develop Standards and procedures for new ATM operations. States apply an RCP/RSP specification in support of applicable ATM operations. As such, the application of an RCP/RSP specification also requires safety oversight of air traffic services, operational approval, aircraft system design approval and post-implementation monitoring. Figure 1-4 provides an overview of an RCP/RSP specification application.

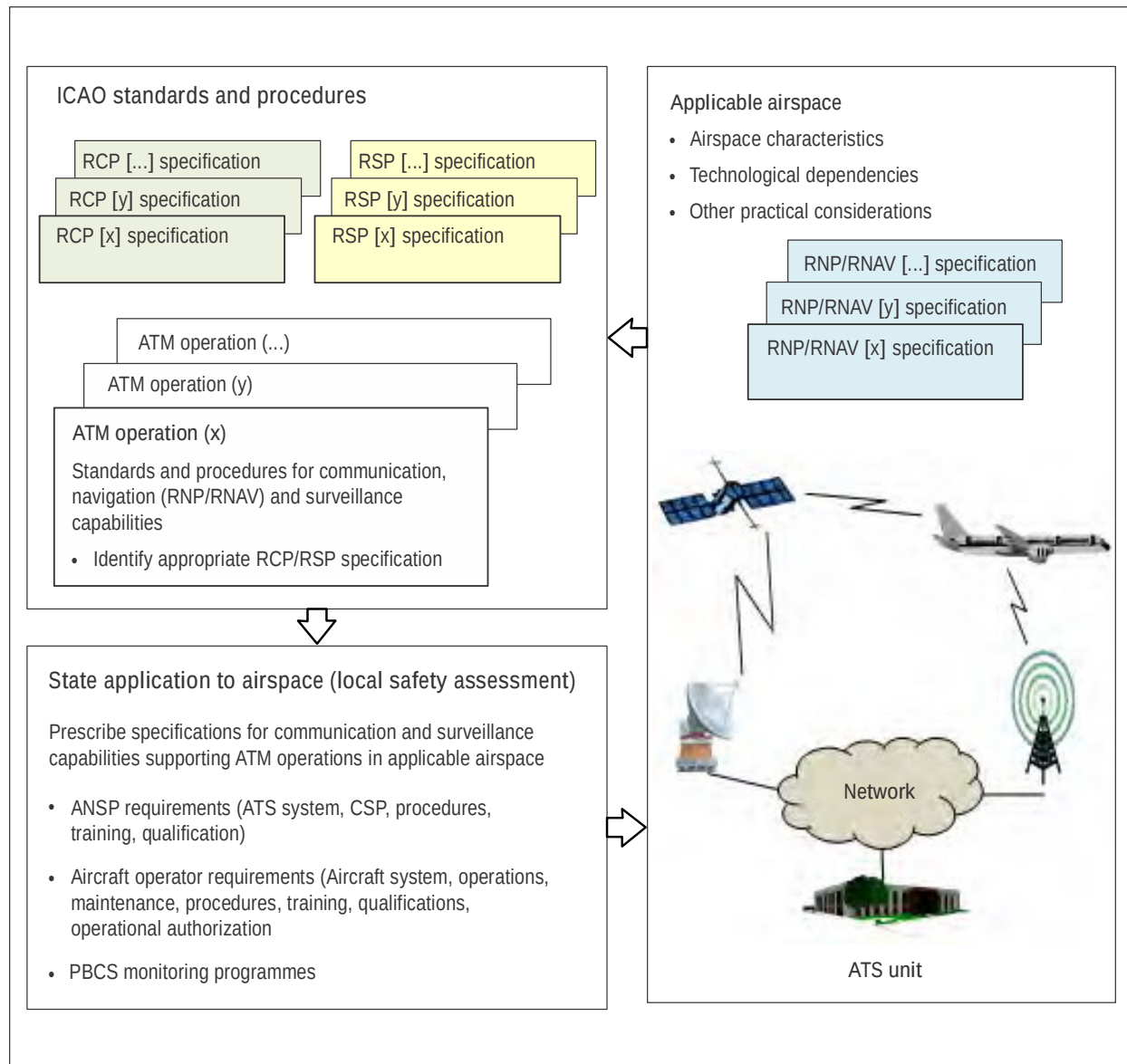


Figure 1-4. Overview of RCP/RSP specification application

1.6.2 States should prescribe an RCP and/or RSP specification based on the ATM operations that an ATS provider chooses to implement within that airspace. In cases where a safety-related change, including the implementation of a reduced separation minimum or a new procedure, is predicated on communication and surveillance performance, RCP and RSP specifications are prescribed. The approval of this change demonstrates that the criteria defined by the RCP and RSP specifications have been met.

1.6.3 When ATM operations within an airspace are predicated on communication and/or surveillance performance, the State prescribes RCP and RSP specifications for an airspace either locally or on the basis of a bilateral, multilateral or regional air navigation agreement, if applicable.

1.6.4 To perform certain ATM operations, States may require a combination of voice/data communication and surveillance capabilities applicable to the prescribed RCP and RSP specifications. Data communication and surveillance capabilities allow for the integration of operational capabilities in order to exchange information between an ATS unit's system and an aircraft system. Data communication and surveillance capabilities can also provide functional integration (e.g. loading CPDLC messages on the flight deck and ATS conformance monitoring using ADS-C reports) with the aircraft's system or an ATS unit's system.

1.6.5 RCP and RSP specifications can be applied to communication and surveillance capabilities in an airspace or to support an ATM operation. Examples of such applications include:

- a) a defined airspace (e.g. North Atlantic or Pacific Regions) for safety or to support application of a 5-minute or 55.5 km (30 NM) longitudinal separation minimum;
- b) a fixed ATS route (e.g. between Sydney, Australia, and Auckland, New Zealand);
- c) random track operations (e.g. between Hawaii and Japan); or
- d) a volume of airspace (e.g. a block altitude on a specified route).

1.6.6 When a State prescribes an RCP/RSP specification, the RCP/RSP specification indicates the requirements for communication and surveillance capabilities supporting the ATM operation, including procedures, aircraft equipage, airspace infrastructure, flight plan filing and post-implementation monitoring programmes.

1.6.7 The application of a given separation minimum within a volume of airspace may require that a single RCP and/or single RSP be specified. However, the State can prescribe multiple RCP and RSP specifications within a given airspace. For example, the State may prescribe one RCP specification, applicable to the normal means of communication appropriate for the controller's intervention capability to apply the separation minimum, and prescribe another RCP specification to a new communication technology that supports an alternative means of communication when the normal means of communication fails.

1.6.8 The State can prescribe different RCP and RSP specifications for different airspace depending on ATM operations. For example, an RCP specification applicable in terminal area airspace may differ from the RCP specification for en-route or oceanic airspace.

1.6.9 In cases where ATM operations are not predicated on communication or surveillance performance, it can be beneficial for the State to apply RCP and RSP specifications, if only to provide a basis for post-implementation monitoring programmes (i.e. the specifications are not prescribed).

Note.— Chapter 3 provides guidelines for applying RCP and RSP specifications to communication and surveillance capabilities.

1.7 COMPLYING WITH AN RCP/RSP SPECIFICATION

1.7.1 When the State prescribes an RCP/RSP specification for communication or surveillance capability, the ANSP and the aircraft operator should show that the provision of air traffic services and use of the service comply with the specifications to achieve and maintain the required communication and surveillance performance. Figure 1-5 provides an overview of RCP/RSP specification compliance.

1.7.2 Compliance with an RCP/RSP specification may be achieved in various ways: the State provides policies and guidance on acceptable means through which the ANSP and the aircraft operator show compliance with RCP and RSP specifications, both initially and in continued operations, to support approvals.

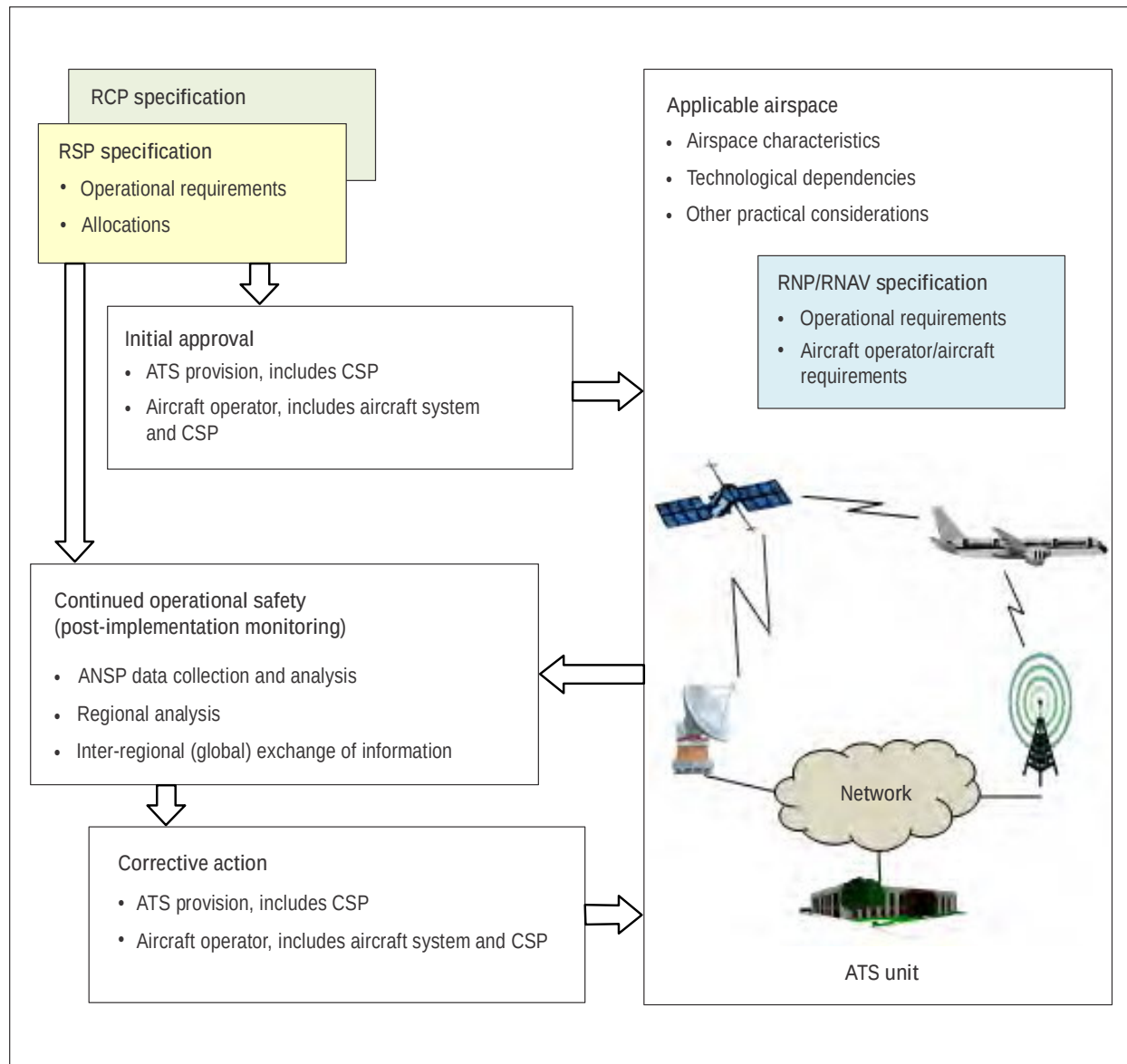


Figure 1-5. Overview of RCP/RSP specification compliance

1.7.3 The initial compliance with RCP and RSP specifications occur at different times for each system component; the processes for these approvals and the parties involved (described below) are both different. Generally, the initial compliance is determined as follows :

- a) the ANSP complies in accordance with applicable national regulations by demonstrating that the necessary procedures and training, systems, and related contracted services comply with the RCP and RSP specifications appropriate for the specified ATM operations and airspace; and
- b) the aircraft operator complies in accordance with applicable regulations from the State of the Operator or State of Registry by demonstrating that the necessary procedures and training, aircraft systems, maintenance and related contracted services comply with the RCP and RSP specifications

appropriate for specified aircraft types/systems in its fleet. For the aircraft system, the operator complies by presenting a certificate of approval obtained by the aircraft or equipment manufacturer from the State of Design or through bilateral or multilateral airworthiness agreements.

Note.— The State of the Operator would be applicable to commercial air transport operations (Annex 6, Part I and Part III, Section II). The State of Registry would be applicable to general aviation operations (Annex 6, Part II and Part III, Section III).

1.7.4 For continued operations, the ANSP establishes a local monitoring programme to collect and analyse operational data, ensuring that the infrastructure and the aircraft operators within its airspace continue to meet the appropriate RCP and RSP specifications. A regional monitoring programme may also be established to analyse performance at the regional level. Aircraft operators, CSPs, SSPs and other stakeholders participate in the ANSP monitoring programmes in accordance with operational approvals or service agreements.

1.7.5 The scope of local and regional monitoring programmes includes analyses on an operator basis, taking into account individual aircraft, aircraft types/systems and various infrastructure and technological dependencies (e.g. subnetwork types, subnetwork routing policies, frequencies), all of which are factors in evaluating communication or surveillance performance.

1.7.6 When a monitoring programme detects non-compliance, it is reported to the appropriate parties for corrective action.

Note.— Chapter 4 provides guidelines for complying with RCP and RSP specifications and reporting non-compliance to the appropriate parties.

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Chapter 2

DEVELOPING AN RCP/RSP SPECIFICATION

2.1 NEED ASSESSMENT FOR AN RCP/RSP SPECIFICATION

2.1.1 Figure 2-1 provides a synopsis for assessing the need for a required communication performance (RCP) /required surveillance performance (RSP) specification in a particular airspace. The potential need for an RCP/RSP specification is two-fold:

- a) the operational introduction of one or more new air traffic management (ATM) operations may prescribe an RCP/RSP specification (e.g. the introduction of reduced lateral and longitudinal separation minima or trajectory-based operations); and
- b) the introduction of a new communication media technology may require an evaluation against the existing RCP/RSP specification (e.g. the use of SwiftBroadband services over satellite communication (SATCOM)).

2.1.2 For some ATM operations, both controller-pilot data link communications (CPDLC) and automatic dependent surveillance — contract (ADS-C) applications are used as enablers. In most cases, both CPDLC and ADS-C applications use the same new technology; in such cases, the need for both the RCP and RSP specifications needs to be assessed.

2.1.3 An assessment of operational communication and surveillance services should consider the following:

- a) airspace characteristics (e.g. separation minima, spacing criteria and capacity limits);
- b) ATM operations (e.g. dynamic arrival procedure, crossing flight paths, or in-trail climb/descent procedure); and
- c) operational system performance (e.g. navigation, flight management, flight data processing, and decision support tools for the controller and the flight crew).

2.1.4 An RCP/RSP specification needs to be determined in the context of the relevant airspace characteristics, operational capabilities and system performance. Trade-offs can be, and are, made to take advantage of existing fleet equipment and air traffic services provisions. For example, if an operator/aircraft is eligible for RNP 4 operations when implementing a 50 NM longitudinal separation minimum, the interval for ADS-C periodic position reports is 32 minutes. If an operator/aircraft was only eligible for RNP 10 operations, the separation minimum can still be implemented, but the interval for ADS-C periodic position reports is 27 minutes, which increases the number of position reports and associated costs. The operator, however, would not incur any costs to upgrade to RNP 4 operations, since the service provisions would need to allow for variations in these performance trade-offs.

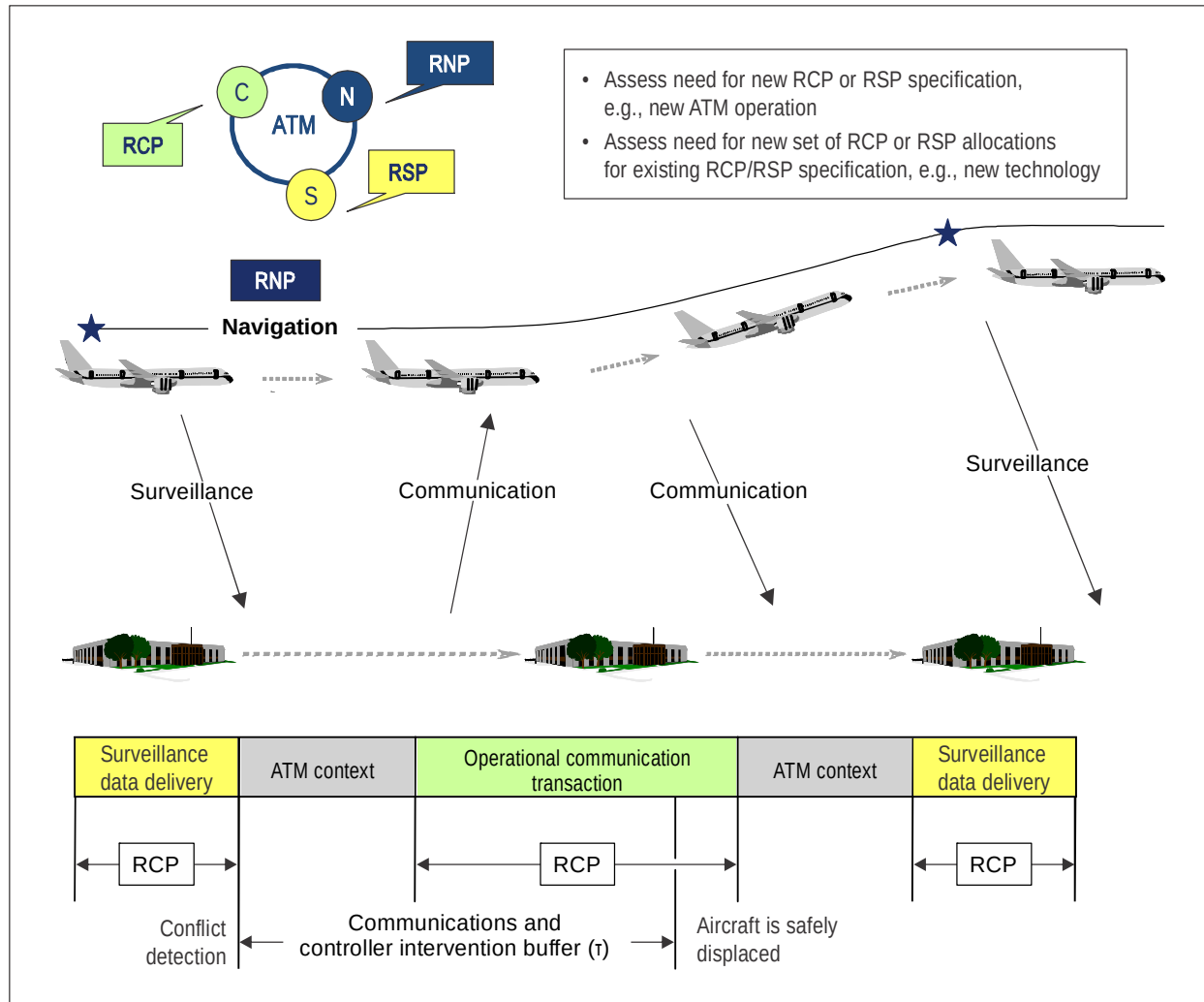


Figure 2-1. Operational context of communication and surveillance capability and performance

2.1.5 Given the airspace characteristics and other capabilities and performances, the RCP/RSP specification is used to characterize the communication and surveillance capabilities and performances that need to exist for the controller/system to first — detect an out-of-conformance, second — intervene and third — resolve a conflict. It should not be implied that all communication and surveillance capabilities need to meet the RCP/RSP specification. However, in addition to the RCP/RSP specification applicable to the intervention capability, other RCP and/or RSP specifications may be appropriate for specific operations that require different performance characteristics. For example, this dependency may be related to:

- functional differences in the means of communication or surveillance, such as between voice and data (i.e. providing interactive capability versus providing air-ground automation integration capability);
- an increase in communications due to an increase in airspace capacity (e.g. when increasing airspace capacity, the controller depends on a CPDLC and ADS-C to maintain an acceptable workload and suitable performance of the very high frequency (VHF) voice communication to intervene in time-critical situations); and

- c) a contingency procedure in the event that normal communication systems fail (e.g. when implementing a separation minimum predicated on communication and surveillance performances, the contingency procedure requires an alternative means of communication that enables the controller to establish communications with an aircraft after the normal means fail to obtain position information and intervene, as necessary).

2.1.6 In cases where an RCP/RSP specification is applied to a normal means of communication, it may be necessary to apply a different RCP/RSP specification to the alternative means of communication or surveillance. This different RCP/RSP specification may be appropriate when employing emerging technologies for the alternate means of communication or surveillance to ensure that it performs as expected.

2.2 RCP SPECIFICATIONS

2.2.1 General

2.2.1.1 The operational requirements of an RCP specification apply to the controller's communication and intervention capability. These requirements also define parameter values for operational (end-to-end) RCP transaction times, RCP continuity, RCP availability and RCP integrity, as well as their allocated values (e.g. required communication monitored performance (RCMP), required communication technical performance (RCTP) and, when applicable, human performance). An underlying assumption in the application of RCP is the compatibility and interoperability of the supporting system components, in accordance with interoperability standards.

2.2.1.2 An RCP specification is identified by a designator (e.g. RCP 240) to simplify the RCP designator naming convention and to make the RCP transaction time readily apparent to airspace planners, aircraft manufacturers and operators. The designator represents the maximum communication transaction time after which the initiator should revert to an alternative procedure (or RCP expiration time).

2.2.1.3 Figure 2-2 shows an RCP specification model for which the same operational (end-to-end) performance applies, but with two different sets of RCP allocations (CPDLC and SATVOICE). Although different communication technologies may lead to different allocated values, they still yield the same end-to-end result. The performance of the technical systems is known as the required communication technical performance (RCTP).

2.2.1.4 As is illustrated in Figure 2-2, using CPDLC, the communication transactions are allocated to the following components:

- a) controller (initiator) — composition of the instruction and recognition of the response; and
- b) required communication monitored performance (RCMP), which is further allocated to:
 - 1) pilot operational response time (PORT); and
 - 2) required communication technical performance (RCTP).

2.2.1.5 With CPDLC, the operational (end-to-end) communication transaction performance parameters apply to the actual performance associated with:

- a) the controller's human-machine interaction (HMI) design and procedures; and

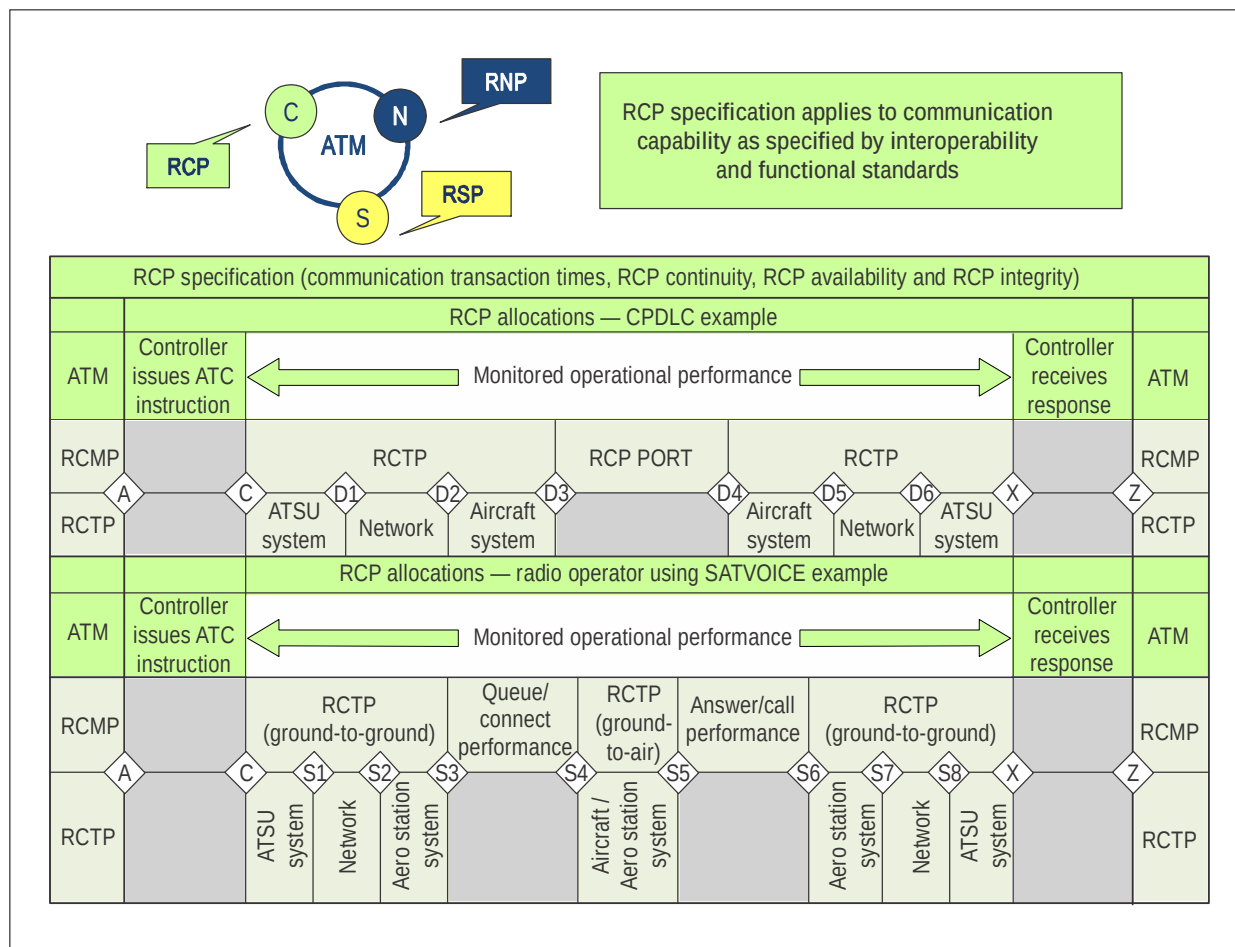


Figure 2-2. RCP specification model

- b) the communication transaction beginning when the controller sends the instruction to the aircraft, and ending when the controller receives an indication of the WILCO response (RCMP). RCMP is a pseudo end-to-end transaction time parameter against which the ACP is measured during post-implementation monitoring. The allocations allow for further assessment of:

- 1) actual communication technical performance (ACTP); and
- 2) pilot operational response time (PORT), which includes the flight crew's HMI design and procedures.

2.2.1.6 Since certain routine messages do not pertain directly to the controller intervention capability, a subset of communication transaction types, as defined in Appendix D for CPDLC and Appendix E for SATVOICE, are used to assess the critical system data transit delay.

2.2.1.7 An operational communication transaction is the process used by a human to send an instruction, a clearance, flight information, and/or a request, and is completed when that human is confident that the transaction is complete.

2.2.1.8 The contribution of the human toward communication performance can be significant, since they are a key player in this transfer of information between sender and receiver.

2.2.1.9 Additionally, data communication meeting the prescribed RCP specification can provide the capability to communicate clearances and instructions without the need for a voice read back.

2.2.1.10 The RCP specification should include the necessary operational, functional, safety and performance criteria, for example:

- a) a specific message set or phraseology, transaction types and intended use;
- b) the interactive capability of voice communication;
- c) the air-ground integration capability of data communication;
- d) times to indicate non-compliant performance and procedures when such indications occur;
- e) positive assurance of the flight crew's receipt of an instruction, clearance or request or the controller's receipt of a request/flight information; and
- f) party-line and/or broadcast capability, multiple recipients of the same instruction, clearance or information (e.g. such as transmitting and receiving on-guard frequencies).

2.2.1.11 The set of requirements for an RCP specification are based on the following parameters:

- a) *RCP transaction time*. The maximum time for the completion of the operational communication transaction after which the initiator should revert to an alternative procedure;
- b) *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;
- c) *RCP availability*. The required probability that an operational communication transaction can be initiated; and
- d) *RCP integrity*. The required probability that an operational communication transaction is completed with no undetected errors.

Note.— While RCP integrity is defined in terms of the quality of the communications capability, the criterion is specified as a probability of malfunction on a per flight hour basis (e.g. 10^{-5}), consistent with an RNAV/RNP specification.

2.2.1.12 Table 2-1 lists RCP specifications, also provided in Appendix B. Currently, the number of specifications is limited to two (RCP 240 and RCP 400) in airspace where procedural separation is applied. Other RCP specifications may be added, pending the introduction of new ATM operations or the use of new communication technologies.

2.2.1.13 RCP 240 may be applied to maintain the performance for normal means of communication, which supports controller intervention capability in procedurally controlled airspace, where the separation minimum applied is predicated on communication performance.

Table 2-1. RCP specifications

<i>RCP specification</i>	<i>RCP transaction time (seconds)</i>	<i>RCP continuity (probability)</i>	<i>RCP availability (probability)</i>	<i>RCP integrity (acceptable rate/flight hour)</i>
RCP 240	240	0.999	0.999 0.9999 (efficiency) (see Note 3)	10^{-5}
RCP 400	400	0.999	0.999	10^{-5}

Note 1.— The results of safety assessments and further information on RCP 240 and RCP 400 are contained in RTCA DO-306/EUROCAE ED-122. Additional RCP specifications will be validated by a safety assessment, data collection and/or other means prior to inclusion.

Note 2.— When a unit of measure other than the “per flight hour” is used to specify RCP specification values for integrity, the conversion process will need to be validated. For example, when data are analysed on a “per transaction” basis, or on a “per sector” basis, the average number of transactions per flight hour or the average number of flight hours per sector hour, respectively, will need to be validated for the specific implementation.

Note 3.— The values for availability are based on a safety assessment, taking into account assumptions about the environment, such as mitigating procedures for failed communication and contingencies. For RCP 240, an additional and more stringent value has been assigned, based on the operational effect of frequent losses of the service in providing an efficient and orderly flow of air traffic. Two values are used to determine corrective action when the service availability degrades below the assigned value. The corrective action may vary depending on whether the criterion is for safety or for efficiency.

2.2.1.14 RCP 400 may be applied to maintain the performance for emerging technology (e.g. satellite voice) used to provide normal means of communication supporting controller intervention capability in procedurally controlled airspace, where the separation minimum applied is based on position reporting at compulsory reporting points. RCP 400 may also be applied to maintain the performance required for emerging technologies used to provide alternative means of communication, that may be required in combination with the normal means of communication, to which RCP 240 is applied.

Note.— RCP specifications were derived from intervention capabilities used in collision risk modelling (Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689)), aircraft performance characteristics, conflict detection and resolution capability, Procedures for Air Navigation Services — Air Traffic Management (PANS-ATM, Doc 4444), RTCA/EUROCAE Standards, and other factors.

2.2.2 RCP transaction time and allocations

2.2.2.1 There may be multiple operational communication transactions that support an ATM operation. These transactions are therefore assessed to determine which is the most stringent. The value for the RCP transaction time is based on the time needed to complete the most stringent transaction for controller intervention.

2.2.2.2 The assessment would take into consideration the time needed to safely execute the contingency procedure and can include simulations, demonstrations, operational trials and analysis of empirical data applicable to the RCP communication transaction times for the ATM operation.