Australian Government
Civil Aviation Safety Authority

ADVISORY CIRCULAR
AC 91-06 v1.1

Performance-based communication and surveillance (PBCS)

Date	October 2021
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For Flight Operations Regulations commencing on 2 December 2021

Advisory circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Advisory circulars should always be read in conjunction with the relevant regulations.

Audience

This advisory circular (AC) applies to:

- aircraft operators and flight crew involved in flight operations in oceanic airspace
- persons involved in flight planning and operations
- persons engaged in regulatory compliance issues
- persons involved with avionics of long-haul aircraft.

Purpose

This AC explains the basic principles of PBCS and the way it relates to the flight planning and operations.

For further information

For further information, contact CASA's Flight Standards Branch (telephone 131 757).

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this AC are references to the *Civil Aviation Safety Regulations 1998 (CASR)*.

Status

This version of the AC is approved by the Branch Manager, Flight Standards.

Note: Changes made in the current version are annotated with change bars.

Version	Date	Details
v1.1	October 2021	This version only applies from 2 December 2021 as it is aligned with the commencement of Part 91 and the appropriate inclusion of requirements from Instrument CASA 33/18 within the Part 91 Manual of Standards. Instrument CASA 33/18 will be repealed on 2 December 2021. The changes in this version align the definitions and multiple sections of the AC with the requirements specified in the Part 91 MOS.
v1.0	May 2018	Initial version.

Contents

1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Acronym	Description
AC	advisory circular
ACARS	aircraft communication addressing and reporting system
ADS-C	Automatic Dependent Surveillance - Contract
ANSP	Air Navigation Service Provider
ATM	Air Traffic Management
ATC	Air Traffic Control
ATS	Air Traffic Service
CPDLC	Controller-Pilot Data Link Communications
CSP	Communication Service Provider
FOM	Figure of Merit
MEL	Minimum Equipment List
MOS	Manual of Standards
NAA	National Aviation Authority
PBCS	Performance-based Communication and Surveillance
PBC	Performance-based Communication
PBN	Performance-based Navigation
PBS	Performance-based Surveillance
PORT	Pilot Operational Response Time
RCP	Required Communication Performance
RNP	Required Navigation Performance
RSP	Required Surveillance Performance
SSP	Satellite Service Provider

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below. Where definitions from the Regulations have been reproduced for ease of reference, these are identified by grey shading. Should there be a discrepancy between a definition given in this AC and the Regulations, the definition in the Regulations prevails.

Term	Definition
ATS routes	A specified route designed for channelling the flow of traffic as necessary for the provision of air traffic services. Note 1:. The term ATS route is used to mean variously, airway, advisory route, controlled or uncontrolled route, arrival or departure route, etc. Note 2: An ATS route is defined by route specifications that include an ATS route designator, the track to or from significant points (waypoints), distance between significant points, reporting requirements and, as determined by the appropriate ATS authority, the lowest safe altitude.
FANS 1/A	A direct datalink communication between the pilot of an aircraft and ATC via FANS 1/A avionics and FANS 1/A ground end systems, based on EUROCAE ED-100A/RTCA DO-258A, or a later version as in force from time to time. Note: References to FANS 1/A are taken to include FANS 1/A+.
controller-pilot datalink communications (CPDLC)	The means of communication between ATC and a pilot, using datalink for ATC communications.
communication services provider (CSP)	Any public or private entity which, under a contract or agreement, provides communication services for general air traffic which may include services provided by a satellite service provider (SSP) or services provided by the CSP in its own capacity as an SSP.
FOM	An indication of the aircraft navigation system's ability to maintain position accuracy.
performance based-communication (PBC)	communication based on performance specifications applied to the provision of air traffic services.
performance based navigation (PBN)	area navigation based on performance requirements for aircraft operating: (a) along ATS routes; or (b) on an IAP; or (c) in designated airspace. Note 1: Performance requirements are expressed in navigation specifications (RNAV specification, and RNP specification) in terms of the accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular class of airspace. Note 2 ATS routes is a defined term: see the CASR Dictionary.
performance-based surveillance (PBS)	surveillance based on performance specifications applied to the provision of air traffic services.
RCP allocation	A portion of an RCP parameter, and is a time value assigned to a specific component of the communication system used for transferring messages between aircraft and ATC.
RCP availability	An RCP parameter that specifies the required probability that an operational

Term	Definition
	communication transaction can be initiated.
RCP continuity	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.
RCP integrity	An RCP parameter that specifies the required probability that an operational communication transaction is completed with no undetected errors, expressed in acceptable rate of undetected errors per flight hour.
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 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. **Note:** RCP 240 means that the expiration time (ET) is 240 Seconds. In other words, 99.9 per cent of ATC-flight crew transactions are expected to be completed in less than 240 Seconds.
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 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. **Note:** RSP 180 means that the overdue delivery time (OT) is 180 Seconds. In other words, 99.9 per cent of aircraft position reports are expected to be delivered in less than 180 Seconds.
RSP allocation	A portion of an RSP parameter and is a time value assigned to a specific component of the communication system used for transferring surveillance reports from aircraft to ATC.
RSP availability	An RSP parameter that specifies the required probability that surveillance data can be provided.
RSP continuity	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.
RSP integrity	An RSP parameter that specifies the required probability that the surveillance data is delivered with no undetected error, expressed in acceptable rate of undetected errors per flight hour.

1.3 References

Regulations are available on the Federal Register of Legislation website https://www.legislation.gov.au/

Document	Title
ICAO Doc 9869	Performance-based Communication and Surveillance (PBCS) Manual
ICAO Doc 7030	Regional Supplementary Procedures
ICAO Annex 6	Operation of Aircraft, Parts I and II
ICAO Annex 11	Air Traffic Services
ICAO Doc 4444	Procedures for Air Navigation Services - Air Traffic Management (PANS - ATM)
Part 91 MOS	Part 91 (General Operating and Flight Rules) Manual of Standards
U.S. FAA AC 90-117	Data Link Communications
U.S. FAA AC 20-140	Guidelines for Design Approval of Aircraft Data Link Communication Systems Supporting Air Traffic Services (ATS)
U.S. FAA AC 91-70B	Oceanic and Remote Continental Airspace Operations

2 Introduction

2.1 Overview

2.1.1 Performance-based communication (PBC) and performance-based surveillance (PBS) constitute performance-based communication and surveillance (PBCS) and are similar, and complementary, to performance-based navigation (PBN). PBC and PBS involve the establishment of required communication performance (RCP) and required surveillance performance (RSP) specifications and imposing them on aeronautical communication and surveillance systems respectively.

2.1.2 RCP and RSP specifications are composed of certain performance-related parameters. An RCP specification is identified by a designator (e.g. RCP 240) which shows the maximum transaction time in seconds. Similarly, the RSP designator (e.g. RSP 180) indicates maximum data delivery time in seconds. Moreover, there are other performance parameters attached to each RCP and RSP designator which include continuity, availability and integrity.

2.1.3 The use of RCP and RSP is mainly intended for new and emerging technologies used in the provision of communication and surveillance services. To date only RCP 240 and RSP 180 have been operationally applied to controller-pilot data link communications (CPDLC) and automatic dependent surveillance - contract (ADS-C) considering their actual and achievable performance using FANS 1/A avionics and supporting communication infrastructure. Together with RNP 10, 4 or 2, RCP 240 and RSP 180 are being used as criteria for establishing certain longitudinal and lateral separation minima in oceanic airspace. The basic concepts of the performance specifications are described below.

2.2 RCP 240 concept

2.2.1 The concept of RCP 240, as applied to CPDLC, is shown in Figure 1. A transaction starts with the controller beginning to send a message to the aircraft and ends with when he/she receives the response. To meet the maximum transaction time of 240 seconds, there is a time allocation for each component of the communication system (including ATC and flight crew). For example, the pilot needs to read and respond to a message within 60 seconds.

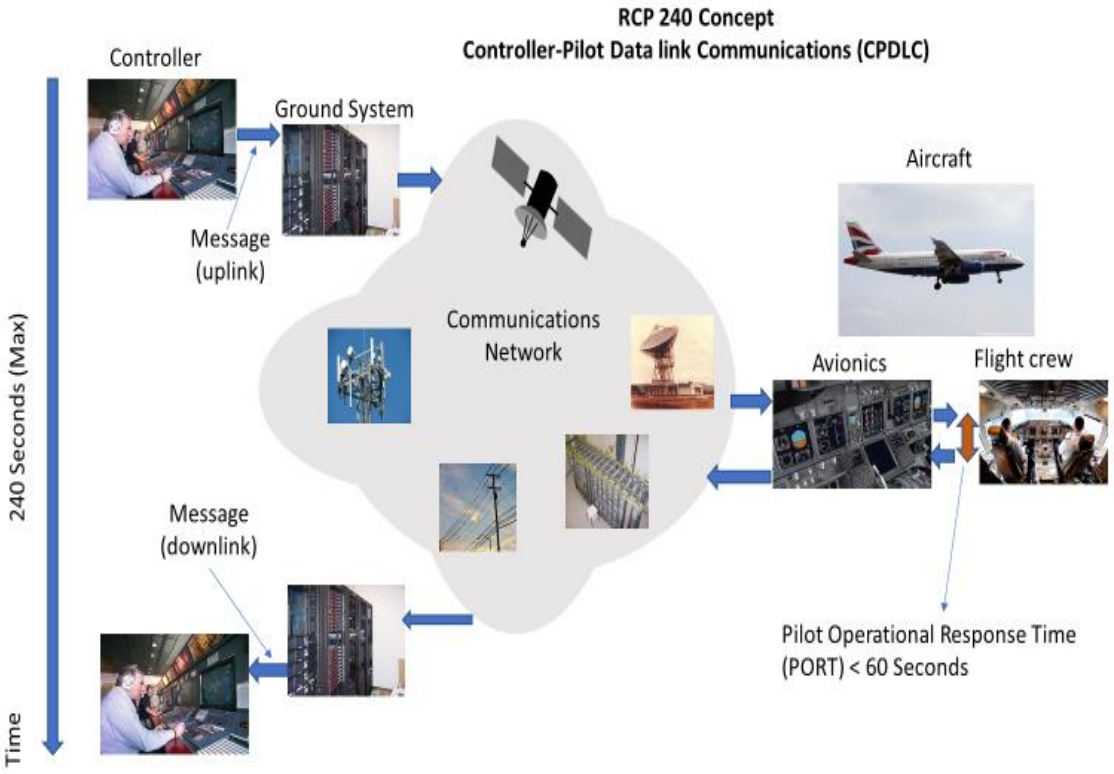

Figure 1 RCP 240 Concept
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2.2.2 RCP 240 maximum time allocations for various human and machine elements of the system are shown in Table 1. It should be noted that flight crew can only feel and assess their own performance (in terms of reading and responding to an ATC message within 60 seconds). Other time allocations and parameters of the RCP 240 are measured, tabulated and analysed by a data link monitoring system implemented by the air navigation service provider (ANSP) in airspace where it is prescribed. All parameters of RCP 240 are shown in Table 2.

Table 1 - RCP 240 Time Allocations (combined uplink and downlink - in seconds)

Controller	ATS Ground System	CSP/Network	Avionics	Flight Crew	Continuity
30	15	120	15	60	99.9%
30	10	100	10	60	95%

Note: The RCP allocation for the CSP are intended to aid the ANSP and the aircraft operator in the development of contracts and service agreements. Further information can be found in ICAO DOC 9869.

Table 2 - RCP 240 Parameters

Transaction Time (in seconds)	Continuity	Availability	Integrity
240 - Maximum	0.999	0.999	Malfunction: 10^{-5}per flight hour
210 - Nominal	0.95	(efficiency 0.9999 - see note)	

Note: The availability criteria are allocated entirely to CSP/Network and assume that the ATS unit's system is always available. Further information can be found in ICAO DOC 9869.

2.3 RSP 180 concept

2.3.1 The concept of RSP 180, as applied to ADS-C, is shown in Figure 2. Since ADS-C is an automatic data link application, it doesn't involve flight crew and the reports are automatically generated by avionics based on a contract with the ATS ground system. The process starts when a report is generated, and it finishes when it is displayed to the controller.

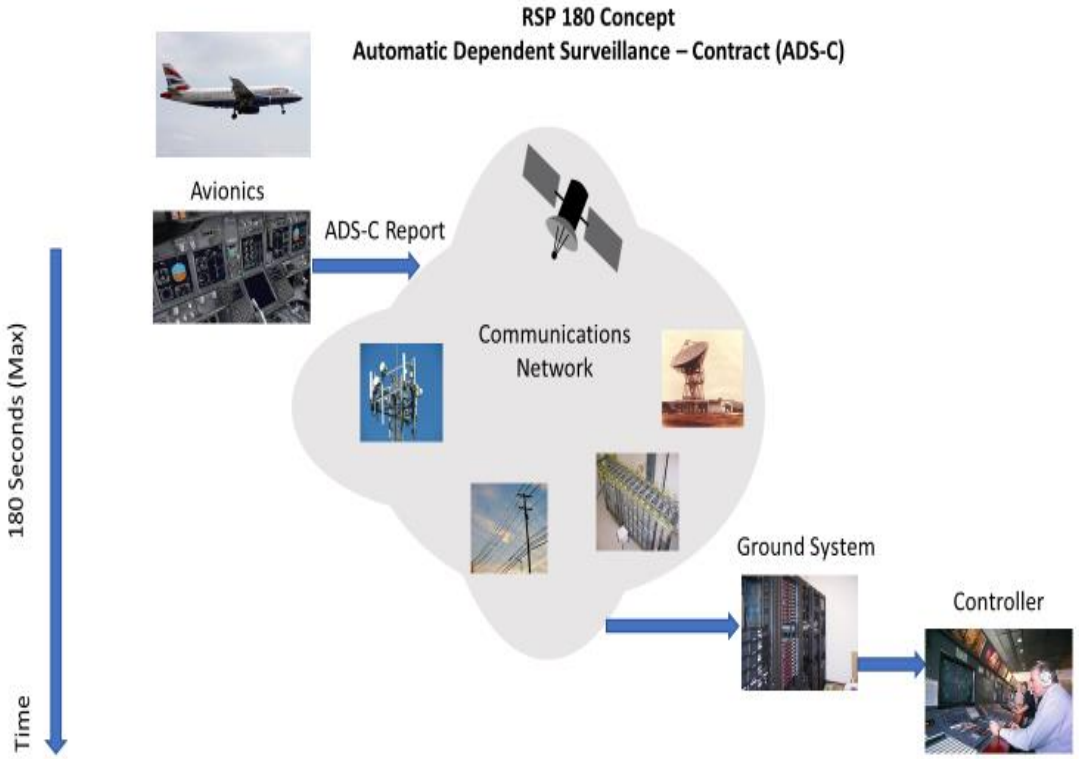

Figure 2 RSP 180 concept
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Maximum time allocations for various elements of the ADS-C system are shown in Table 3. Time allocations and parameters of RSP 180 that are shown in Table 4, are measured, tabulated and analysed by the ANSP in airspace where it is prescribed.

Table 3 - RSP 180 Time Allocations (downlink in Seconds)

Avionics	CSP/Network	ATS Ground System	Continuity
5 (Maximum)	170 (Maximum)	5 (Maximum)	99.9%
3 (Nominal)	84 (Nominal)	3 (Nominal)	95%

Note: The RSP allocations for the CSP are intended to aid the ANSP and the aircraft operator in the development of contracts and service agreements. Further information can be found in ICAO DOC 9869.

Table 4 - RSP 180 Parameters

Data Delivery Time (in Seconds)	Continuity	Availability	Integrity
180 (Maximum)	0.999	0.999	Navigation = FOM (based on Nav Spec) Time at Position Accuracy: +/- 1 sec (UTC) Data Integrity: Malfunction = 10^{-5} per flight hour
90 (Nominal)	0.95	0.9999 (efficiency - see note)	

Note: RTCA DO-306/EUROCAE ED-122 specifies an availability value based on a safety assessment of the operational effects of the loss of the service. The availability value herein is more stringent, based on an additional need to maintain orderly and efficient operations.

3 Application of PBCS

3.1 Criteria for separation minima

3.1.1 PBCS complements PBN for establishing a performance framework for CNS systems in support of specific ATM scenarios and operations. To date, the only operational application of PBCS has been the inclusion of RCP 240 and RSP 180 in the list of requirements for certain separation minima in oceanic airspace.

3.1.2 Specifically, according to *Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM*), Doc. 4444, the longitudinal separation minima for 50 NM and 30 NM require RNP 10, 4 or 2 respectively as well as RCP 240 and RSP 180 along with ADS-C and associated periodic reporting intervals.

3.1.3 Similarly, for lateral separation of 23 NM, in addition to RNP 4 or 2, RCP 240 and RSP 180 (with certain associated reporting requirements) are required.

3.1.4 In general, aircraft flying in the part of an airspace where PBCS has been prescribed, need to declare their RNP, RCP and RSP capabilities in their flight plans. Non-equipped, non-compliant or non-declaring (e.g. those lacking authorisations from State of registry/operator) aircraft may not be permitted to operate in the PBCS-part of the airspace which may be more favourable in term of flight efficiency.

4 Compliance with PBCS regulations

4.1 Authorisation for declaring PBCS Capabilities

4.1.1 Australian pilots and operators conducting flight operations in oceanic airspace need to be aware of PBCS-related regulations that are gradually being developed and applied by National Aviation Authorities (NAAs).

4.1.2 When it is determined that a certain flight operation involves PBCS, the pilot in command should ensure that:

a. the requirements of section 11.09 of the Part 91 MOS are met

Note: This ensures that:

i) aircraft is properly equipped

ii) aircraft documentation indicates a Statement of Compliance (SOC) with the subject requirements

iii) the equipment is operative for the flight

iv) information relevant to RCP 240 and RSP 180 is included in the Minimum Equipment List (MEL) where applicable

v) there is a proper agreement with the CSP (See Appendix A for a summary of CSP requirements).

b. descriptors for RCP 240 and RSP 180 are duly entered in the flight plan as per instructions by the NAA
c. the flight crew is aware of the ATC procedures in place for handling data link failures or non-compliance to prescribed RCP/RSP specification during flight
d. documentation is available to the flight crew containing the appropriate procedures.

Note: For pilots working for an operator holding a kind of operations certificate (Parts 119, 121, 131, 133, 135, 137, 138, 141 and 142), these procedures would normally be contained in the operator's exposition or operations manual.

4.1.3 Appendix B shows a summary of the requirements in the form of a compliance checklist for aircraft operators.

4.1.4 Similarly, foreign operators conducting flight operations in Australian-administered airspace, should be aware of applicable PBCS-related requirements as stipulated in the Aeronautical Information Publication (AIP) Australia and when required, ensure that:

a. the relevant aircraft is equipped with FANS 1/A avionics and conducts data link operations satisfactorily
b. they are authorised by the respective NAA to declare applicable RCP and RSP capabilities
c. descriptors for RCP 240 and RSP 180 are duly entered in the flight plan as indicated in the AIP
d. the flight crew are appropriately trained and are aware of the ATC procedures in place for handling data link failures or non-compliance to prescribed RCP/RSP specifications during flight
e. the aircraft operations manual contains the appropriate procedures.

Appendix A

A summary of CSP requirements for RCP 240 and RSP 180

The Communication Service Provider (CSP) agrees, or undertakes to make its best effort, to provide the following in the context of a data link communication agreement with the aircraft operator:

a. Sufficient and un-interrupted coverage and inter-operability with the ATS units over the entire route flown.
b. Notification (to respective ATS units and the operator) of any coverage and performance failures within 5 minutes.
c. Recording of data link messages for 30 Days and making them available to the NAA.
d. No modification or alteration of data link messages.
e. Network availability of 99.9% or better which translate into the following:
    i. Unplanned outage duration < 10 minutes
    ii. Maximum No. of unplanned outages (per year) < 48
    iii. Total accumulated unplanned outage time (per year) < 520 minutes.
f. The network allocated transaction times as follows:
    i. RCP 240:
        A. less than 120 seconds (combined uplink and downlink - for 99.9% of transactions)
        B. less than 100 seconds (combined uplink and downlink - for 95% of transactions).
    ii. RSP 180:
        A. less than 170 second (downlink - for 99.9% of reports)
        B. less than 90 seconds (downlink - for 95% of reports).

Appendix B

Compliance checklist for Australian operators intending to declare RCP 240 and RSP 180 capabilities during their operations

Requirement	Compliance			Remarks
	Yes	No	Unsure or N/A	
1. Aircraft is equipped with avionics supporting ADS-C and CPDLC applications over FANS 1/A (the equipment); and the equipment is operative for the flight.				
2. There are no Airservices Australia notifications of failure of the aircraft to meet operational criteria of RCP 240 and RSP 180				
3. SOC indicating that the aircraft system is approved for datalink communications using FANS 1/A avionics and the aircraft datalink system meets the aircraft-allocated requirements of the RCP 240 and RSP 180 specifications is shown in: a. the AFM, b. an OEM service letter or c. another document from the entity responsible for the design approval of the aircraft datalink communications equipment, or 2. a copy of the aircraft operator's written and dated request to the appropriate design authority for an SOC				
3. Relevant information included in the MEL where applicable.				
4. Agreement with the CSP (see Appendix A), or 5. if the agreement doesn't address matters in Appendix A, a copy of the relevant operator's written and dated request to the appropriate CSP for a revised agreement				
6. Flight crew and other relevant personnel are appropriately trained.				
7. Operations manual contains the applicable procedures.				
Overall Assessment				