

Advisory Circular

PERFORMANCE BASED COMMUNICATION AND SURVEILLANCE (PBCS)

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GENERAL

Advisory Circulars (ACs) are issued by the Director-General of Civil Aviation (DGCA) from time to time to provide practical guidance or certainty in respect of the statutory requirements for aviation safety. ACs contain information about standards, practices and procedures acceptable to CAAS. An AC may be used, in accordance with section 3C of the Air Navigation Act (Cap. 6) (ANA), to demonstrate compliance with a statutory requirement. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.

PURPOSE

This AC provides guidance to demonstrate compliance with the requirements regarding, and information related to an application for, an approval for operations with performance-based communications or surveillance in accordance with ANR-98.

APPLICABILITY

This AC is applicable to the operator seeking an approval for PBCS operations.

RELATED REGULATIONS

This AC relates specifically to Division 12 in Part 2 of ANR-98.

RELATED ADVISORY CIRCULARS

- AC 98-1-1 Application for an Approval to Conduct a Special Operation

CANCELLATION

This AC supersedes AC AOC-42.

EFFECTIVE DATE

This AC is effective from 1 October 2018.

OTHER REFERENCES

- AIP Supplement for Singapore, No.007/2018 Singapore FIR – Implementation of Performance-Based Communication and Surveillance (PBCS)
- ICAO Doc 9869 Performance-Based Communication and Surveillance (PBCS) Manual
- ICAO Doc 4444 Procedures for Air Navigation Services – Air Traffic Management
- ICAO PBCS Operational Authorisation Guide, January 2018 (version 1.0)
- RTCA DO-306/EUROCAE ED-122 Safety and performance standard for air traffic datalink services in oceanic and remote airspace (Oceanic SPR Standard)
- FAA AC 20-140C Guidelines for design approval of aircraft data link communication systems supporting air traffic services (ATS)
- FAA AC 90-117 Data link communications

1 DEFINITIONS

Required Communication Performance (RCP) is a means by which a specification defines performance requirements associated to a communication transaction.

Required Surveillance Performance (RSP) is a means by which a specification defines performance requirements associated to the delivery of surveillance data.

Future air navigation system (FANS 1/A) is the common industry name for the communication / surveillance system that incorporates CPDLC, ADS-C and PBCS.

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

Automatic dependent surveillance – contract (ADS-C) is 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 the conditions ADS-C reports would be initiated, and what data would be contained in the report.

2 INTRODUCTION

2.1 PBCS has been implemented in some areas where reduced oceanic separation standards are applied since 29 March 2018, 0000UTC. One or more of the separation minima as shown in **Table 1** may be used in the following airspace at the time of publication of this AC:

- PAC FIRs: Anchorage, Auckland, Brisbane, Fukuoka, Nadi, Oakland, Port Moresby, Tahiti
- NAT FIRs: Gander, Shanwick, Reykjavik, New York, Santa Maria
- Asia: Some routes over Bay of Bengal and South China Sea

Dimension of Separation	Separation Minima	Required Surveillance Performance (RSP) Requirement	Required Communication Performance (RCP) Requirement	Associated Navigation Requirement
Lateral	42.6 km (23 NM)*	180	240	RNP2 or RNP4
Performance-based Longitudinal	5 minutes	180	240	RNP2 or RNP4 or RNP10
Performance-based Longitudinal	55.5 km (30 NM)	180	240	RNP2 or RNP4
Performance-based Longitudinal	93 km (50 NM)	180	240	RNP4 or RNP10
* Also applicable to existing and future applications of 30NM lateral separation minima				

Table 1. Separation Minima that Require PBCS Approval

2.2 An operator has to obtain a PBCS operational approval from CAAS to operate using the separation minima in **Table 1**.

3 PRE-REQUISITES FOR PBCS OPERATIONAL APPROVAL.

Airworthiness Requirements

3.1 The RCP and RSP specifications in airspace where procedural separation could be applied is as shown in **Table 2**. Other RCP specifications may be added, pending the introduction of new ATM operations or the use of new communication or surveillance technologies.

RCP/RSP Specification	RCP/RSP Transaction Time (seconds)	RCP/RSP Continuity (probability)	RCP/RSP Availability (probability)	RCP/RSP Integrity (acceptable rate/flight hour)
RCP 240	240	0.999	0.999 0.9999 (efficiency) (see Note 2)	10 ⁻⁵
RCP 400	400	0.999	0.999	10 ⁻⁵
RSP 180	180	0.999	0.999 0.9999 (efficiency) (see Note 2)	Figure of Merit (FOM) = navigation specification (see Note 3) Time at position accuracy = +/-1s Data integrity(malfunction) = 10 ⁻⁵
RSP 400	400	0.999	0.999	FOM = Navigation specification (see Note 3) Time at position accuracy = +/-30s Data integrity(malfunction) = 10 ⁻⁵

Table 2. RCP and RSP specifications in airspace for procedural separation

Note 1: Further information and rationale for the criteria provided in these specifications are contained in RTCA DO-306/EUROCAE ED-122.

Note 2: 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 and RSP 180, 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.

Note 3: The navigation figure of merit (FOM) is specified based on the navigation criteria associated with this specification. For example, if RNP 4 is prescribed, the FOM level would need to be 4 or higher for ADS-C surveillance services.

3.2 The operator is to demonstrate that the aircraft system is capable of meeting the applicable RCP and RSP specifications prescribed for the intended operations. The aircraft system is to meet the continuity, availability and integrity requirements as described in ICAO Document 9869 as follows:

- (a) Continuity: The aircraft system, when operating with a representative ATS provision (i.e. simulation or real ground system), is capable of meeting the operational RCP/RSP time and continuity criteria.
- (b) Availability: The aircraft system meets the RCP/RSP availability criteria. RCP/RSP availability is typically shown by evaluation of equipment failure and the number of similar components installed on the aircraft.
- (c) Integrity: The aircraft meets the RCP/RSP integrity criteria and associated safety requirements. RCP/RSP integrity is typically shown by analysis, design, system architecture, and evaluations of human-machine interaction.

3.3 The AOC holder may provide the following documents as a demonstration of compliance with the RCP and RSP specifications:

- (a) Type Certificate (TC);
- (b) Supplemental Type Certificate (STC);
- (c) Aircraft Flight Manual (AFM), AFM supplement; or
- (d) A Statement of Compliance (SoC) from the TC holder, STC holder or the entity that owns the design approval for their data link installation.

Note 1: For a FANS 1/A CPDLC and ADS-C aircraft system, RTCA DO-306/EUROCAE ED-122, Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace, is equivalent to RCP 240, RCP 400, RSP 180 and RSP 400 specifications. For an Aeronautical Telecommunications Network (ATN) Baseline 1 (B1) or FANS 1/A CPDLC aircraft system, RTCA DO-290/ED-120, Safety and Performance Requirements Standard for Air Traffic Data Link Services in Continental Airspace, provides performance criteria for the European Region.

Note 2: FAA AC20-140A or later satisfies the requirement for RCP240, RCP400, RSP 180 and RSP 400.

3.4 If the operator is unable to provide the documents (a) to (d), the operator may provide a detailed submission validating that the aircraft's current system meets the applicable RCP and RSP specifications as stated in paragraph 9.2. One possible approach is to seek the aircraft or equipment manufacturer to provide the substantiation.

3.5 The operator is to ensure that any items related to PBCS capability are specified in the Minimum Equipment List (MEL).

3.6 The operator is to ensure that the aircraft system is properly maintained, including configuring user-modifiable software, such as those used to manage communication media and routing policies, to meet the appropriate RCP/RSP specifications.

Operations Requirements

- 3.7 For the PBCS application to be considered, an operator is to establish and document the following:
- (a) Normal and abnormal procedures, including contingency procedures
 - (b) Flight crew qualification and proficiency requirements
 - (c) Appropriate maintenance procedures to ensure continued airworthiness
 - (d) Training programme for relevant personnel consistent with the intended operations
 - (e) A performance monitoring process
 - (f) A process to address substandard separation minima performance
 - (g) A problem reporting process
 - (h) Data link communication problem reporting procedures to the FANS-Central Reporting Agency (CRA) to ensure effective identification, tracking, and follow-up of data link-related events and permits record-keeping of various problems and solutions.
 - (i) A contract/service agreement with Communication Service Provider (CSP) that includes:
 - Failure notifications (to operator and ANSPs)
 - Recording data link messages
 - CSP integrity
 - Compliance with CSP allocations for RCP/RSP
 - Adequate subnetwork coverage for the route flown

Training Requirements

- 3.8 The operator is to ensure that flight crew and other personnel (flight dispatchers and maintenance engineers) are proficient with the PBCS operations. The areas to be covered by training are provided in Appendix A.

4 APPLICATION SUBMISSION AND ASSESSMENT.

- 4.1 The operator is to submit the following to CAAS along with an application letter, for PBCS operational approval:
- (a) a completed Form CAAS-98-2-1 "Application for PBCS" (This form can be found on the CAAS Website.);
 - (b) Evidence of compliance with airworthiness requirements as specified in paragraphs 9.2 – 9.5;
 - (c) Equipment maintenance programme;
 - (d) Training of personnel including maintenance and operational personnel (including flight crew);
 - (e) Operating policy and procedures;
 - (f) Flight and dispatch crew training to include pilot knowledge of data link performance based communication and surveillance concepts and system procedures;
 - (g) MELs;
 - (h) Other operational issues; and
 - (i) PBCS Global Charter membership, if any.

The operator may refer to **Appendix B** for a checklist regarding the application of the PBCS operational approval. The operator could also refer to the ICAO PBCS Operational Authorisation Information Guide for more information.

- 4.2 CAAS' assessment for the PBCS operational approval will take into account the following aspects:
- (a) aircraft eligibility and airworthiness compliance (any limitations, assumptions or specific procedures considered in the framework of the airworthiness approval must be addressed);
 - (b) documentation and maintenance of operating procedures for the specific data link system(s) including use of message sets;
 - (c) means of ensuring compliance of contracted services, such as those with communication services providers (CSPs) with respect to PBCS operations;
 - (d) documentation and maintenance of procedures for participation in PBCS monitoring programmes including problem reporting;
 - (e) documentation and maintenance of policies and procedures to control configuration of aircraft system including software and communication subnetwork for managing media and routing;
 - (f) flight crew initial training /competency requirements and continuing qualification requirements;
 - (g) training requirements for other personnel (e.g. flight dispatchers and engineers).
- 4.3 CAAS may request to participate in the operator's training session or line operations to assess the operator's training competency.

5 GRANT OF OPERATIONAL APPROVAL.

- 5.1 Upon successful assessment of the PBCS application, CAAS may grant PBCS operational approval to the operator. The PBCS operational approval will be stated in the Operations Specifications.
- 5.2 After the operator has been granted PBCS operational approval, the operator with PBCS operational approval is to indicate its approval status for RCP/RSP capabilities in the ICAO flight plan as follows:
- (a) Item 10a - CPDLC descriptors (J1-J7); RCP capability "P1" or "P2"; and
 - (b) Item 10b - ADS-C descriptors (D1 or G1); and (c) Item 18 - "SUR/RSP180" or "SUR/RSP400" to show RSP capability.

Note: The operator is to note that when operating in FAA airspace, the FAA's oceanic automation system, Advanced Technologies & Oceanic Procedures (ATOP), will determine eligibility for use of performance-based separation minima based on detection of BOTH flight plan codes.

- 5.3 The operator, when planning to operate in airspace where RCP/RSP specifications are prescribed for certain services such as reduced separation, is to ensure that the planned use of communication and surveillance capabilities for the flight are in accordance with regulations, policies and procedures in control areas for the flight as published in the AIP or other State publications.

APPENDIX A TRAINING ON DATA LINK AND PBCS OPERATIONS

Note: A separate training program is not required if data link communication is integrated in the current training program. However, the operator should ensure that the existing training programme incorporates a basic PBCS concept and requirements for flight crew and other personnel that have direct impact on overall data link performance required for the provisions of air traffic services (e.g. reduced separation).

1 Flight Crew

- (a) Data link communications system theory (relevant to operational use)
- (b) AFM and AFM Supplement limitations
- (c) Normal pilot response to data link communication messages
- (d) Message elements in the message set used in each environment
- (e) Required Communication Performance (RCP)/Required Surveillance Performance (RSP) specifications and their performance requirements
- (f) Implementation of performance-based reduced separation with associated RCP/RSP specifications or other possible performance requirements associated with their routes
- (g) Other ATM operations involving data link communication services
- (h) Both normal and non-normal (contingency) procedures
- (i) Data link communication failure/problem and reporting

Note 1: If flight crew has already trained on data link operations, additional training only on PBCS is required, addressing a basic concept and requirements that have direct impact on overall data link performance required for provisions of air traffic services (e.g. reduced separation).

Note 2: Training may be provided through training material and other means that simulate the functionality.

2 Dispatchers/Flight Operations Officers

- (a) Proper use of data link and PBCS flight plan designators;
- (b) air traffic service provider's separation criteria and procedures relevant to RCP/RSP specifications;
- (c) MEL remarks or exceptions based on data link communications;
- (d) Procedures for transitioning to voice communication and other contingency procedures related to the operation in the event of abnormal behavior of the data link communication;
- (e) Coordination with the ATS unit related to or following a special data link communication exceptional event (e.g. log-on or connection failures); and
- (f) Contingency procedures to transition to a different separation standard when data link communication fails.

3. Engineering and maintenance personnel

- (a) Data link communication equipment including its installation, maintenance and modification
- (b) MEL relief and Procedures for return to service authorisations
- (c) Correction of reported non-performance of data link system

Note: Operators unsure of required maintenance procedures for data link communication-related equipment should contact field service representatives of their aircraft manufacturer.

APPENDIX B OPERATIONAL AUTHORISATION CHECKLIST

Applicable type of Aircraft or Aircraft Registration Number: _____

Applicable RCP/RSP: RCP240 RCP400 RSP180 RSP400

1 Aircraft eligibility: Select one of the following conditions applicable on aircraft or fleet type and provide required document(s).

Check	Type of compliance statement	Required documents
<input type="checkbox"/>	RCP/RSP compliance statement in AFM/TC/other supplemental documents	Documents on RCP/RSP compliance
<input type="checkbox"/>	Alternate compliance statement by aircraft manufacture	Other documents that include compliance statement Supplemental operator document (if applicable)
<input type="checkbox"/>	All other means of compliance	All documents supporting the other means of compliance

Note1: Compliance statement should include applicable sub network (VDLM0/A, VDL M2, HFDL, Inmarsat, Iridium).

Note2: Applicable RCP/RSP specifications would be incorporated into relevant compliance documents.

Note3: Other means of compliance would be by performance data and other considerable requirement by State of Registry or State of the Operator to meet the other components of RCP/RSP specifications (e.g. integrity, availability, safety, and alerting requirement described on Doc 9869).

2 Engineering: Provide the following document(s).

Check	Required Documents
<input type="checkbox"/>	Records of data link equipment installation and maintenance, which includes manufacturer/model and supporting documents (e.g AFM, Service Bulletins and Aircraft Service Changes (ASC), Supplemental Type Certificates (STCs) etc.) <i>Note 1. Data link equipment refers to FANS 1/A (Satellite, HF, VHF) and, if installed, ATN (VDL 2).</i> <i>Not 2. If the operator has already submitted above-mentioned documents for their data link approval, they may not be required to resubmit these documents.</i>
<input type="checkbox"/>	Documentation of current configuration (e.g. current avionics software load); aircraft modifications (if applicable, listing of all Aircraft Service Changes (ASC) specific to data link communications, Service Bulletins etc.) <i>Note: The operator should indicate whether aircraft modifications have affected the data link system. If the system was affected, the operator should confirm compliance with the associated applicable RCP/RSP specifications.</i>

<input type="checkbox"/>	Documentation of user modifiable software configuration and its control process <i>Note: User modifiable software would control communication media and routing policies to meet RCP/RSP specifications.</i>
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3 Operation: Provide the following document(s).

Check	Required Documents
<input type="checkbox"/>	Procedures and limitations applicable to the use of specific data link system(s) by aircraft type (e.g AFM, OEM checklist/guide or operations manual)
<input type="checkbox"/>	Procedures for pilots and other operational personnel that addresses the following: <ul style="list-style-type: none"> a) pre-flight planning requirements including MELs, eligible flight plan filing; b) actions to be taken in the data link operation, to include specific RCP/RSP required cases; c) actions to be taken for the loss of data link capability while in and prior to entering the airspace requiring specific RCP/RSP specifications; d) problem reporting to the local/regional PBCS monitoring agency (e.g. central reporting agency) e) specific regional requirements, if applicable.

4 CSP Compliance: Select and provide one of the following documents.

Check	Required Documents
<input type="checkbox"/>	Arrangements with each CSP (copies of contracts or other CSP compliance documents) to ensure the following is provided: <ul style="list-style-type: none"> a) failure notification; b) recording data link messages; c) CSP Integrity; d) compliance with CSP allocations for RCP/RSP specifications, and e) adequate subnetwork coverage for the route flown.
<input type="checkbox"/>	A record of registration to PBCS Charter (e.g a copy of PBCS Charter web page which includes the name of contracted CSP and the operator)

5 MEL/MMEL: Provide the following document(s).

Check	Required Documents
<input type="checkbox"/>	Minimum Equipment List (MEL) and/or Master Minimum Equipment List (MMEL) addressing all data communication equipment related to the operation that requires specific RCP/RSP requirements. <i>Note: The MEL should highlight the impact of losing an associated system/sub-system on data link operational capability.</i>

6 Flight Planning: Provide the following document(s).

Check	Required documents
<input type="checkbox"/>	Documentation ensuring that proper information indicating PBCS approved capabilities will be included in the ICAO flight plan

7 Performance monitoring: Provide the following document(s).

Check	Required documents
<input type="checkbox"/>	Process to participate in local or regional PBCS monitoring programmes (e.g registration on the websites of the appropriate monitoring agencies)
<input type="checkbox"/>	Procedures to report data link failures and/or problems such as log-on failure, disconnect, corrupted messages and excessive delay. The process should include contacting the appropriate monitoring agencies for your area of operation
<input type="checkbox"/>	Procedures to disclose operational data (data/system logs), including data from its CSPs/SSPs, in a timely manner, to the appropriate monitoring agencies, when requested for the purposes of investigating a reported problem
<input type="checkbox"/>	Procedures to investigate the cause of non-compliance with applicable RCP/RSP specifications, reported by the appropriate monitoring agencies and to take an action to resolve the reported non-compliance

8 Training: Provide the following document(s).

Note: For operator with valid approval for data link operation, only records of trainings on PBCS are needed.

Check	Required documents
<input type="checkbox"/>	Pilot training programme addressing the operational practices and procedures related to data link communication and PBCS operations (e.g., initial, upgrade, or recurrent training for pilots)
<input type="checkbox"/>	Training programme for dispatch and engineering personnel addressing the datalink communication and PBCS operations