



CIVIL AVIATION ADVISORY PUBLICATION

CAAP 13

FANS

OPERATION USING THE FUTURE AIR NAVIGATION SYSTEMS (FANS) INCLUDING THE USE OF CPDLC AND ADS

1. PURPOSE

This Civil Advisory Publication (CAAP) provides guidance material for the operation of Yemen registered aircraft operating worldwide using the Future Air Navigation Systems (FANS) technology and utilizing data link and satellite communications, GNSS navigation and automatic surveillance systems.

2. STATUS OF THIS CAAP

This is issue 01 of CAAP 13 – FANS dated January, 2019. It will remain current until withdrawn or superseded. As some of this information includes Yemen legislative requirements, compliance is required wherever the word “shall” is used in this document.

3. APPLICABILITY

This guidance material applies to all Yemen operators when operating in designated airspace or routes promulgated in the particular State’s AIP, where the use of data link communications and/or ADS is permitted. Whilst random routing is part of FANS, this is a separate issue as it may be conducted without data link capability and is available to all operators with RNAV accuracy capability. Therefore this CAAP is not applicable to random routing only. Those operators requesting to operate on random routes without using data link (CPDLC and ADS) should apply separately to the CAMA. It should be noted that beyond the Sana’a FIR, operators shall comply with the Yemen Civil Aviation Regulations and other foreign State’s regulations, whichever is more restrictive.

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5. REFERENCES

5.1 General

The primary reference for the FANS operational authorization is the ICAO guidance material on CNS/ATM operations in the Asia/Pacific Region. The references are:

- (a) ICAO Guidance Material on CNS/ATM Operations in the Asia/Pacific Region.
- (b) FAA Advisory Circular AC 120-70 - Initial Air Carrier Operational Approval for Use of Digital Communications Systems.
- (c) ICAO Doc 4444 - Procedures for Air Navigation Services – Rules of the Air and Air Traffic Services.
- (d) ICAO Doc, 7030 - Regional Supplementary Procedures.
- (e) ICAO Doc. 9758-AN/966 - Human Factor Considerations In The Data Link Environment.

5.2 Legislation

The following references apply to data link communications or random routing;

- (a) YCAR Part III, paragraph 2.20.7.1 - Position reporting using data link communications.
- (b) YCAR Part III, paragraph 2.22.3 - Accuracy of data link.

- (c) YCAR Part III, paragraph 2.23.3.2 - ADS threshold values
- (d) YCAR Part III, paragraph 2.23.2.2 - Addition of random routing.
- (e) YCAR Part III, paragraph 2.23.6.3 - Position reporting using data link communications.
- (f) YCAR Part V, Chapter 1 paragraph 7.5.4 (b) (6) - Recording of digital communications with ATS on CVR

6. INTRODUCTION

6.1 General

Future Air Navigation Systems (FANS) is an advanced system of Communication, Navigation, Surveillance, Air Traffic Management (CNS/ATM) utilizing data link and satellite communications, navigation and surveillance systems, taking into account validated operational experience with modern technology. Whenever FANS 1, FANS A or FANS 1/A is documented, it refers to manufacturer's programmes (FANS 1 = Boeing and FANS A = Airbus).

6.2 Communications

One of the key features of the CNS based ATM system is the availability of two-way data communications between the aircraft and the ATC system. The available means of communication between ground and air are VHF voice, HF voice, controller pilot data link communications (CPDLC) and satellite voice. CPDLC is a means of communications between controller and pilot using data link for ATC communications.

6.3 Navigation

The level of aircraft navigation capability required for FANS varies for the specific route and/or airspace but RNP 4 accuracy is the most common standard. Refer to CAAP 3 for amplification.

6.4 Surveillance

In the FANS environment, surveillance is also provided by automatic dependent surveillance (ADS). ADS allows an aircraft to send flight identification, position, predicted route and weather data addressed to a specific ATS unit at specified intervals, or on the occurrence of a specific event at the request of the ATS unit. It can replace voice position reporting in specific areas.

7. APPLICATION

7.1 Process

The application for FANS authorization must follow a systematic planning process to minimize the lead-time. Only operators with proven operational competency, training and documentation in RNP, B-RNAV and RVSM airspace can be considered by the CAMA for FANS. The application must reference a particular aircraft registration number, unless all of the operator's aircraft are of the same type and have exactly the same equipment and software version. The application must address all of the following sections on Airworthiness Requirements, Communications Systems Requirements, Operational Requirements, Documentation and training.

7.2 Requirements

The general requirements for airworthiness and operational approval

- are;
- (a) Aircraft navigation equipment certification.
 - (b) Aircraft communication system certification.
 - (c) CVR for digital communications.
 - (d) Documentation.
 - (e) Flight Operations policy and procedures.
 - (f) Dispatch policy and procedures.
 - (g) Training and qualification of flight crew and dispatchers.
 - (h) Proving flights.
 - (i) Operational approval in Operations Specifications/authorization.

7.3 Lead-Time

To determine lead-time, operators should take into

- account:
- (a) Aircraft modification.
 - (b) Document amendment.
 - (c) Training and qualification of flight crew and dispatchers..
 - (d) The regulatory process for the issue of CAMA airworthiness and operational approvals.

- (e) The need to contract with a data link service provider and to register with the authorized service provider.
- (f) The approval or acceptance of the regulatory authorities responsible for the airspace.

8. AIRWORTHINESS REQUIREMENTS

8.1 General

The components of a FANS capable aircraft are normally already in the case of new generation aircraft. However, the operator must provide the CAMA with all the aircraft navigation, communication and data equipment details for each aircraft registration and include the applicable software versions. The majority of this information should be contained in the Aircraft Flight Manual, AFM supplements or STCs.

8.2 Equipment

The following equipment may need to be specifically approved if it has been modified:

- (a) Compatible SATCOM
- (b) Compatible AYCARS
- (c) IDS with appropriate software version to support FANS.
- (d) Fully integrated dual GPS with appropriate software version.
- (e) FMC with appropriate features and software version.
- (f) CMC with appropriate software version.
- (g) Printer to support the FMC interface.
- (h) HF DL for polar and remote routes.

8.3 Flight Data Recording

It is presently a requirement that voice communications are recorded on the CVR. When voice communications are replaced by data link there must be a recording of that communication. YCAR Part V, Chapter 1, paragraph 7.5.4 (b) (6) requires the CVR to record digital communications with ATS, as specified by the CAMA, unless recorded by the FDR. Operators must submit the aircraft CVR capabilities in respect to data link communications.

8.4 Training

Operators must provide adequate digital communication maintenance training to ensure that their maintenance personnel or contract personnel at facilities not staffed by the operator are able to properly implement digital communications related maintenance programmes. This

training includes, but is not limited to, addressing installation, modification, correction of reported system discrepancies, use of test equipment, procedures, MEL relief, and return to service authorizations. The training procedures should address testing digital communications functions while not introducing hazards with respect to simulated message traffic with an air traffic facility. All training programmes must be documented.

8.5 Software Updates

Operators should assure that appropriate digital communications software updates are incorporated when necessary and that both air and ground systems are able to identify and properly respond to the installed level of digital communication capability. There must be a documented mechanism for software update procedures.

8.6 Return to Service Policies

Digital communications return to service policies must be established to ensure proper digital communications functions when an aircraft is returned to service after a digital communications failure or maintenance action. An operator should not release an aircraft to service where digital communication functionality is required unless appropriate verification has been established.

9. COMMUNICATION SYSTEM REQUIREMENTS

9.1 Requirements

Operators shall provide an operational control system in accordance with YCAR Part IV and this must include a data link ground processor and a company communications system. There should be direct communications between operational control and ATS for strategic flight planning and coordination purposes. Any data link or CPDLC should have proven system reliability, which is measurable.

9.2 Communication Sources

Operators shall provide access to communications sources that are appropriate to coordinate with their aircraft and the ATC system for the purpose of exercising operational control. These communications systems include:

- (a) Air/Ground Voice Communications, which may utilize one or more of the following:
 - (i) VHF;
 - (ii) HF direct communications;
 - (iii) HF communications relayed by an intermediate radio operator; or
 - (iv) SATVOICE.

(b) Air/Ground Data Link Communications, which may utilize one or more of the following:

- (i) VHF (dedicated or via a service provider network - AYCARS);
- (ii) SATCOM; or
- (iii) HF.

Note: There may be a MEL requirement for dual dissimilar data link communications equipment for polar and other routes.

(c) Ground/Ground Voice Communications, which may utilize one or more of the following:

- (i) Dedicated voice circuit; or
- (ii) Public Telecommunication Network, which may be considered for remote locations or where infrequent communications cannot justify the cost of dedicated circuits.

(d) Ground/Ground Data Link Communications, which may utilize one or more of the following:

- (i) Aeronautical Fixed Telecommunication Network (AFTN);
- (ii) Dedicated circuit; or
- (iii) Aeronautical Telecommunication Network (ATN).

10. OPERATIONAL REQUIREMENTS

To be eligible for FANS authorization from the CAMA, the following needs to be addressed by the operator:

- (a) Use of GPS (refer to CAAP 1).
- (b) Use of CPDLC.
- (c) Use of RNP for airspace management. (refer to CAAPs 2 and 3)
- (d) RNAV/RNP approach procedures (referenced to RNP).
- (e) Enhanced FMS functions.
- (f) Use of ADS.

11. DOCUMENTATION

11.1 Required Documentation

Operators should ensure that the following documents are in place to obtain Airworthiness and Flight Operational approval;

- (a) Instantaneous change notices.
- (b) Operating procedures.
- (c) Quick Reference Handbook.
- (d) Fault Reference Handbook.
- (e) Minimum Equipment List (MEL).

11.2 Operations Manual Policy

Operators must assess operational requirements, establish their operational policy and procedures and incorporate them in appropriate section of the Operations Manual. An example of Operations Manual policy may be:

11.2.1 Operational Issues

- (a) The differences between voice and data link environments.
- (b) The concept of “data authority” and “next data authority”.
- (c) The transfer of data authority (or address forwarding).
- (d) Flight crew handling rules for ATC uplink messages, including normal and urgent instructions.
- (e) ADS emergency triggering.
- (f) Reporting requirements.

11.2.2 Communications

- (a) Phraseology
- (b) Pre-formatted messages with new interpretations such as “Standby”, “Request Deferred”;
- (c) The differences between free text and preformatted messages.
- (d) The limitations of free text messages.

- (e) The limitations of preformatted messages
- (f) The need to close the loop between uplink and downlink messages.
- (g) Requesting amended route clearances.
- (h) The importance of ensuring that the correct downlink message for a given uplink scenario.
- (i) Out of sequence messages.

11.2.3 Technology

- (a) Sequence of actions to be taken in case of re-route operations.
- (b) Loading and viewing amended route clearances.
- (c) Executing amended route clearances.
- (d) Resolving duplicate waypoint issues.
- (e) “armable” downlinks.
- (f) The types of ADS contracts.
- (g) The type of information that is included in ADS reports.
- (h) The pilot actions, which can trigger an ADS report.

11.2.4 Human Factors.

- (a) the increased “head down time” for flight crew.
- (b) Flight deck HMI limitations and issues.
- (c) the time required for reading and interpreting uplink messages.
- (d) the time required for selecting , composing and sending downlink messages.
- (e) the need for maintaining a shared crew awareness of the progress of ATC data link communications.
- (f) situational awareness and the inability of pilots to monitor other data link transmissions in the area of operations.

11.3 Operations Manual Procedures

The Operations Manual should contain procedures on:

- (a) Cockpit preparation;

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- (b) AFN logon;
- (c) CPDLC procedures;
- (d) ATC/crew/dispatch initiated re-route;
- (e) Required time of arrival;
- (f) Company operational control (FMC route and wind/temp data uplink);
- (g) Complimentary voice communications;
- (h) Navigation: GNSS (GPS if applicable);
- (i) Navigation: rules and procedures for RNP operations;
- (j) Surveillance (ADS);
- (k) DARP operation;
- (l) ACAS operation;
- (m) Weather deviation;
- (n) Non normal procedures of CPDLC, DARP, RNP;
- (o) Contingency procedures;
- (p) RNP airspace/large navigation errors;
- (q) Minimum Equipment List.

11.4 Route Manual

The Route Manual must reflect the route and airspace requirements as documented in the AIP of the FIR controlling State as well as the applicable regional procedures stated in ICAO Regional Supplementary Procedures Doc. 7030.

11.5 Training Manual - Pilots

The Training Manual must reflect the training given, and the qualification, on equipment, procedures and operational requirements. In particular, consideration must be given to the training syllabus, training devices, training material and training staff. Whilst the provision of CPDLC and FMS MCDU (or similar equipment) in an aircraft simulator or training device is desirable, it is not a prerequisite for the operator to have this capability. However, the training must be representative of a particular aircraft type and include any digital communications system differences.

The training given and the flight crew training objectives must ensure that a pilot can demonstrate:

- (a) a satisfactory knowledge of:
 - (i) CNS/ATM concepts, terminology and architecture;
 - (ii) CNS/ATM components – GNSS, CPDLC, ADS, operational control data link, ATN, RNP, ATM;
 - (iii) CNS/ATM procedures appropriate to approach and departure phases of flight;
 - (iv) CPDLC procedures – means of communications, pre-flight phase, AFN logon, exchange of CPDLC messages, transfer of connection, disconnection, abnormal cases, use of complementary voice communication;
 - (v) Human factor considerations in the data link environment (refer to ICAO Doc. 9758-AN/966);
 - (vi) Aircraft equipment requirements;
 - (vii) Principles of airborne CNS/ATM equipment;
 - (viii) Appropriate CNS/ATM operating procedures for typical navigation tasks;
 - (ix) Contingency weather deviation procedures – sequence of actions when no ATC clearance is available;
 - (x) RNP contingency procedures – one RNP capable LRNS, inability to navigate to the specified RNP, loss of all LRNS;
- (b) the ability to satisfactorily perform the following operational tasks:
 - (i) Flight plan preparation for a flight using CNS/ATM operational procedures, including any special requirements for communications, navigation, surveillance or crew;
 - (ii) Pre-flight check for CNS/ATM operation;
 - (iii) Use of FMS MCDU (or similar equipment) – CNS/ATM function;
 - (iv) AFN logon;
 - (v) Operation of ADS
 - (vi) CPDLC – exchange of CPDLC messages, FIR boundary procedure, disconnection;
 - (vii) Operation of operational control data link;

- (viii) Operation of SATCOM;
- (ix) Operation of GPS;
- (x) Perform contingency procedures associated with degradation of RNP;
- (xi) Operation of the Required Time of arrival (RTA) function;
- (xii) Identification of deterioration of navigation performance, cross checking procedure to identify navigation errors;
- (xiii) DARP operations;
- (xiv) Use of CPDLC under emergency or abnormal situations;
- (xv) Non-normal procedures – CPDLC connection and disconnection;
- (xvi) Appropriate interaction between two pilots in a data link environment;
- (xvii) Use of voice – HF, SATVOICE.

11.6 Aircraft Manuals

The Aircraft Manuals must reflect the actual equipment.

11.7 Dispatch Manual

The Dispatch Manual must reflect the procedures, the training to be given, and the qualification required. The objective of the training must ensure that a dispatcher can demonstrate:

- (a) a satisfactory knowledge of:
 - (i) CNS/ATM concepts, terminology and architecture;
 - (ii) CPDLC: system description – usage and role in communications, procedures, AFN logon, exchange of CPDLC messages, transfer of connection, disconnection, abnormal cases, MEL;
 - (iii) SATVOICE: system description – usage and role in communications, procedures;
 - (iv) Complementary use of voice communications
 - (v) Operational data link communications with ATC;
 - (vi) World Geodetic System (WGS-84);
 - (vii) GNSS (GPS) system description – MEL

- (viii) RNP concepts, routes, airspace, approval, requirements, flight planning and operational procedures;
 - (ix) RNP contingency procedures – one RNP capable LRNS, inability to navigate to the specified RNP, loss of all LRNS;
 - (x) ADS system description – usage and role in ATM – operational procedures – MEL;
 - (xi) ATM: ATC flight plan, strategic coordination, flow control;
 - (xii) DARP operations – general, sequence, procedures, abnormal circumstances;
 - (xiii) Distress and urgency conditions and procedures.
- (b) the ability to satisfactorily perform the following operational tasks:
- (i) Flight plan preparation for a flight using CNS/ATM operational procedures, including any special requirements for navigation, surveillance or crew;
 - (ii) Flight crew briefing;
 - (iii) Flight watch;
 - (iv) DARP operations.
- (c) a satisfactory knowledge and operational performance regarding the route and airspace requirements as documented in the AIP of the FIR controlling State and the applicable regional procedures as stated in ICAO Regional Supplementary Procedures Doc. 7030.

12. PROVING FLIGHTS

Prior to granting operational approval, the CAMA shall verify the following has been satisfied;

- (a) The conduct operational trials of the procedures for the CNS/ATM operations;
- (b) Operator readiness by ensuring that;
 - (i) Operational policies and procedures are in place, and incorporated in the appropriate manuals;
 - (ii) The aircraft equipment and associated software is complete and certified;
 - (iii) Flight crew training and qualification is complete;
 - (iv) Dispatcher training and qualification is complete;
- (c) Communication system is operational.

13. AUTHORIZATION

13.1 CAMA Authorization

The FANS authorization will be part of the Operation Specifications issued to an air transport operator or as an addendum to the authorization issued under Civil Aviation Law, Article 6 for a private operator. There will be two separate authorizations; one for random routing and another for the use of CPDLC and ADS.

13.2 Foreign Authorization

Once authorized by the CAMA, the operator is required to obtain a separate authorization from the FIR controlling State responsible for the use of digital communications in their airspace. This authorization may be in the form of a letter or the amendment of the Operations Specifications issued to that operator by the foreign State (eg. FAA, CASA). The operator must submit copies of those authorizations to the CAMA.

14. CONTINUING SURVEILLANCE

Operators should conduct their own continuing surveillance on the following areas, as they will be audited by the CAMA in order to retain the authorization:

- (a) Checking the Mandatory Occurrence Reports for abnormality.
- (b) Checking Voyage Reports that can affect FANS.
- (c) Result or comments made during FANS proving flight or subsequent checks.
- (d) Assessment of Operation dispatch centre and flight watch team capabilities.
- (e) Use of CPDLC and ADS equipment.
- (f) Continuation training evaluation.
- (g) Expansion of data link applications (loadsheets, V speeds, mass & balance etc)
- (h) Cross-checking that operations are in accordance with the appropriate ICAO Regional Supplementary Procedures and/or Aeronautical Information Publication for that airspace.

15. REPORTING ACTION

Unsafe conditions or performance related to data link operations such as a data link event, which potentially could affect continued safe operations, must be reported to the FIR controlling State and to the CAMA within 24 hours.