



**GUIDANCE MATERIAL FOR
Future Air Navigation Systems (FANS)**

Approved by



.....
**(Chula Sukmanop)
Acting Director General
The Civil Aviation Authority of Thailand**

Date: 19 September 2016
Revision No :1

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The Civil Aviation Authority of Thailand

FUTURE AIR NAVIGATION SYSTEMS

Revision:

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Date:

19 September 2016

ISSUE APPROVAL

This Guidance Material (GM) contains the standards, policies, procedures and guidelines concerning the Thai Air Operator Requirement (AOCR) and is published for use by The Civil Aviation Authority of Thailand (CAAT) personnel delegated with the responsibility of certifying Air Operators shall comply with all provisions in this GM during the certification process

In addition, this GM contains instruction in respect of certification to be eligible to conduct by Air Operators for guidance to reach the CAAT requirement.

Amendments to this GM will be notified through www.caat.or.th.

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REVISION HIGHLIGHTS

Revision No:	1	Date:	19 September 2016
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Chapter/Section	Description of Change
All	New issue
All	Change name from DCA to CAAT

PART 1: CPDLC/ADS

1. PURPOSE

This Guidance Material (GM) provides guidance for the operation of Thailand 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. APPLICABILITY

This guidance material applies to all Thailand 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 GM 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 CAAT. It should be noted that beyond the Thailand FIR, operators shall comply with the Thailand Civil Aviation Regulations and other foreign State's regulations, whichever is more restrictive.

3. REFERENCES

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.
- (f) Global Operational Data Link Document. Available from:
http://www.icao.int/APAC/Documents/edocs/GOLD_2Edition.pdf

4. DEFINITION

Aeronautical fixed telecommunication network (AFTN). A worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics. (ICAO)

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

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). (ICAO)

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. (ICAO)

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. (ICAO)

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.

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

Dynamic airborne re-route procedure (DARP). The procedure for executing a re-route clearance initiated by a request from AOC.

Next data authority. The ground system so designated by the current data authority through which an onward transfer of communications and control can take place. (ICAO)

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. (ICAO)

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Required communication performance (RCP) specification. A set of requirements for air traffic service provision, aircraft capability, and operations needed to support performance-based communication within a defined airspace.

Note 1.— See ICAO Doc 9869 and Appendix B of this document for RCP specifications.

Note 2.— The term RCP, currently defined by ICAO as “a statement of performance requirements for operational communication in support of specific ATM functions”, is used in this document to align the concept of PBC with the concept of PBN. The term RCP is now used in the context of a specification that is applicable to the prescription of airspace requirements, qualification of ATS provision, aircraft capability, and operational use, including post-implementation monitoring (e.g. RCP 240 refers to the criteria for various components of the operational system to ensure an acceptable intervention capability for the controller is maintained).

5. INTRODUCTION

5.1 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).

5.2 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.

5.3 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 GM for PBN for amplification.

5.4 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.

6. APPLICATION

6.1 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 CAAT 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.

6.2 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.

6.3 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 CAAT 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.

7. AIRWORTHINESS REQUIREMENTS

7.1 General

The components of a FANS capable aircraft are normally already in the case of new generation aircraft. However, the operator must provide the CAAT 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.

7.2 Equipment

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

- (a) Compatible SATCOM
- (b) Compatible ACARS
- (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.

7.3 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, as specified by the CAAT, unless recorded by the FDR. Operators must submit the aircraft CVR capabilities in respect to data link communications.

7.4 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.

7.5 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.

7.6 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.

8. COMMUNICATION SYSTEM REQUIREMENTS

8.1 Requirements

Operators shall provide an operational control system 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.

8.2 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 - ACARS);
 - (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).

9. OPERATIONAL REQUIREMENTS

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

- (a) Use of GPS.
- (b) Use of CPDLC.
- (c) Use of RNP for airspace management.
- (d) RNAV/RNP approach procedures.
- (e) Enhanced FMS functions.
- (f) Use of ADS.

10. DOCUMENTATION

10.1 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 (If applicable).
- (e) Minimum Equipment List (MEL).

10.2 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:

10.2.1 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.

10.2.2 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.

10.2.3 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.

10.2.4 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.

10.3 Operations Manual Procedures

The Operations Manual should contain procedures on:

- (a) Cockpit preparation;
- (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;

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- (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.

10.4 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.

10.5 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.

10.6 Aircraft Manuals

The Aircraft Manuals must reflect the actual equipment.

10.7 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

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- (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.

11. PROVING FLIGHTS

Prior to granting operational approval, the CAAT 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.

12. AUTHORIZATION

12.1 CAAT Authorization

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

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12.2 Foreign Authorization

Once authorized by the CAAT, 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 CAAT.

13. CONTINUING SURVEILLANCE

Operators should conduct their own continuing surveillance on the following areas, as they will be audited by the CAAT 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 (load sheet, 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.

14. 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 CAAT within 24 hours.



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ATTACHMENT A APPLICATION AND CHECK LIST FOR FANS: CPDLC/ADS APPROVAL

Please complete this form electronically or in block capitals

1. AIRCRAFT DETAILS		
Registration Number:		
Type Designation:		
Serial Number:		
2. APPLICANT DETAILS		
Operator:		
Nominated Coordinator:		
Telephone number:		
Email:		
3. REQUIRED DOCUMENTS	Reference (GM for)	Inspector
Instantaneous change notices	GM for FANS 10.1(a)	
Operating procedures	GM for FANS 10.1(b)	
Quick Reference Handbook	GM for FANS 10.1(c)	
Fault Reference Handbook	GM for FANS 10.1(d)	
Minimum Equipment List (MEL)	GM for FANS 10.1(e)	
Previous CPDCL Approval		
PBN Approval from CAAT	GM for FANS 6.1	
4. DECLARATION OF COMPLIANCE	Reference (GM for)	Inspector
Aircraft navigation equipment certification	GM for FANS 7.1	
Aircraft communication system certification	GM for FANS 8	
CVR for digital communications	GM for FANS 7.3	
Documentation	GM for FANS 10.1	
Flight Operations policy and procedures	GM for FANS 10.2, 10.3	
Dispatch policy and procedures	GM for FANS 10.7	
Training and qualification of flight crew	GM for FANS 10.5	
Training and qualification of dispatchers	GM for FANS 10.7	
Proving flights	GM for FANS 11	
Operational approval in Operations		
5. APPLICANTS DECLARATION		
Signature of Flight Operation Inspector:		Date:

PART 2: AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST (ADS-B) OPERATIONS AND OPERATIONAL AUTHORIZATION

1. INTRODUCTION

The intent of this GM (Guidance Material) is to facilitate operations using Automatic Dependent Surveillance-Broadcast (ADS-B) technology. This GM applies to all Thai aircraft and operators intending to use ADS-B. Thailand does not mandate ADS-B equipage at this time, however ADS-B ground infrastructure has been set up for implementation of ADS-B operations in Thailand airspace. Thailand plans to introduce ADS-B for the provision of Air Traffic Services, including ‘radar-like’ separation in a phased manner. The Automatic Dependent Surveillance Broadcast “(ADS-B) OUT” transmissions on 1090MHz Extended Squitter (1090ES) data link will be used for provision of ATS surveillance services to eligible aircraft within notified portions of Thai airspace(s). This GM provides the means to obtain operational authorization for aircraft and operators intending to use ADS-B in airspace notified for ADS-B operations.

2. OVERVIEW

ADS-B provides air traffic control (ATC) with a means of surveillance in designated airspace, which allows application of reduced separation standards for more efficient use of the airspace. Currently, ADS-B provides surveillance coverage in several regions of the world, including portions of Australia, Canada, and in the Asia-Pacific region. Additional International Civil Aviation Organization (ICAO) regions and Member States are expected to implement ADS-B in their airspace and/or on specific airways and routes in the future.

3. CERTIFICATION AND INSTALLATION OF ADS-B OUT EQUIPMENT

ADS-B OUT transmitting equipment should be of an approved type meeting the specifications contained in Annex 10 (Volume IV) to the convention on International Civil Aviation or that has been certified as meeting;

- a) The current version of FAA AC No. 20-165 – Airworthiness Approval of ADSB OUT Equipment for Operation in the National Airspace System (NAS)
- b) EASA AMC 20-24 Certification Considerations for the Enhanced ATS in Non- Radar Areas using ADS-B Surveillance (ADS-B-NRA) Application via 1090 MHz Extended Squitter dated 05 February 2008, or
- c) The equipment configuration standards in Appendix XI of Civil Aviation Order 20.18 of the Civil Aviation Safety Authority of Australia dated 23rd August 2012 and any amendment thereof.

4. ADS-B SYSTEM DESCRIPTION

4.1 ADS-B System Architecture.

The ADS-B system architecture is composed of aircraft avionics and a ground infrastructure. Onboard avionics determine the position of the aircraft, typically by using the Global Navigation Satellite Systems (GNSS) and transmitting this and additional information about the aircraft to ground stations for use by ATC; to ADS-B equipped aircraft; and to other aviation service providers.

4.2 ADS-B Operating Frequencies.

The ADS-B system operates on two frequencies: 1090 or 978 megahertz (MHz).

- **1090 MHz Frequency.** The 1090 MHz frequency is associated with current Mode A, C, and S transponder operations. ADS-B information is included in Mode S transponders' Extended Squitter (ES) transmit messages, and referred to as 1090ES in this GM.
- **978 MHz Frequency.** ADS-B equipment operating on 978 MHz are referred to as Universal Access Transceivers (UAT) in this GM.

4.3 ADS-B Avionics Operating Modes.

ADS-B avionics can have the ability to both transmit and receive information.

- **ADS-B OUT.** The transmission of ADS-B information from aircraft is known as -B OUT.
- **ADS-B IN.** The receipt of ADS-B information by an aircraft is known as ADS-B IN.

5. OPERATING PROCEDURES

5.1 System Operation Familiarity.

All operators should use the applicable Airplane Flight Manual (AFM), Airplane Flight Manual Supplement (AFMS), Rotorcraft Flight Manual (RFM), Rotorcraft Flight Manual Supplement (RFMS), pilot's operating handbook (POH), or other required operating handbooks or manuals, to become familiar with the proper operation of the installed ADS-B system and any procedures expected of the user for indications of reduced performance or failures within the system.

5.2 Understanding Failure Indicators within the System.

Because many ADS-B system installations will be upgrades to existing transponders (Mode S), there may be limited ability to indicate ADS-B failures. Mode S transponders with ADS-B functionality may indicate a device failure (loss of transponder/ADS-B) and input failures (loss of position source, such as GNSS) with the same indicator light. Operators should refer to their AFM, AFMS, RFM, RFMS, POH, and other handbooks and manuals for information on the differences between device failures and function failures, and the implications and procedures associated with each failure type.

5.3 Transponder Operation and ADS-B Transmissions.

For ADS-B system installations integrated within a transponder that share control features, operators should be aware that disabling the transponder may also disable ADS-B transmissions, resulting in a loss of Secondary Surveillance Radar (SSR) services and Traffic Alert and Collision Avoidance System (TCAS)/TCAS II operation, if so equipped.

6. OPERATIONAL AUTHORIZATION TO CONDUCT ADS-B OPERATIONS

CAAT authorization is required for all Thai aircraft and operators to conduct ADS-B OUT operations in airspace designated for ADS-B operation. Commercial operators will be issued an Operations Specification (Ops Spec) and general aviation a “letter of authorization” (LOA) for ADS-B operational approval.

6.1 Initial Request for Authorization.

6.1.1 Thai operators seeking to conduct ADS-B OUT operations in ADS-B designated airspace must first contact the CAAT office to indicate their intent. When making the initial request, the operator should be prepared to provide the following:

- a) Documented compliance of applicable requirements;
- b) The proposed plan to conduct operations under the authorization; and
- c) The identification of the appropriate point(s) of contact (POC) for coordination during the CAAT authorization process.

6.1.2 At the time of the operator’s initial request, the CAAT will provide the operator with information for obtaining relevant guidance and documents, as well as the proper content and format of the documentation required when submitting the formal request.

6.2 Required Documentation for Submission of Formal Request.

6.2.1 Documentation Guidance.

The following paragraph provides general guidance on the documentation required for submission of a formal request for issuance of this authorization. At the discretion of Flight Standard Department, CAAT, additional information may be required based on any unique aspects of specific operations.

6.2.2 Letter of Request for Issuance of Authorization.

The operator must submit a letter of request to the Office of CAAT requesting issuance of the authorization. The letter of request should include statements indicating the following:

- a) Area(s) of intended operation;
- b) Type of aircraft (make, model, and series (M/M/S)) to be used in the operations, aircraft registration number/mark, serial number;
- c) Description of ADS-B OUT equipment to be used. Make, model, and part number of ADS-B transmitter and positioning source(s);

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- d) Revision of aircraft qualification documents (Airplane Flight Manual (AFM), pilot's operating handbook (POH), etc.);
- e) Establishment of applicable operational procedures and practices;
- f) Revision of applicable operations manuals and checklists;
- g) Revision of ADS-B OUT system maintenance procedures;
- h) Establishment of periodic maintenance for the ADS-B OUT system;
- i) Revision of minimum equipment list (MEL), if applicable;
- j) Revision of pilot training; and
- k) Revision of dispatcher training, if applicable.

6.3 Compliance Documentation.

Operators must submit documentation that demonstrates compliance with European Aviation Safety Agency (EASA) Acceptable Means of Compliance (AMC) 20-24, Certification Considerations for the Enhanced ATS in Non-Radar Areas using ADS-B Surveillance (ADS-B-NRA) Application via 1090 MHz Extended Squitter, dated February 5, 2008, or documents as in Para 3 above. Documentation should include:

6.3.1 Aircraft Qualification Documentation. Documentation from the aircraft manufacturer stating in the AFM/AFMS, POH that the proposed aircraft complies with EASA AMC 20-24 (or applicable documents in Para 3) Deviations, as stated in EASA AMC 20-24, must be included or referenced.

6.3.2 Operational Procedures and Practices. As applicable, company manuals must address the special characteristics of the proposed area(s) of operation.

6.3.3 Operations Manuals and Checklists. The AFM, Airplane Flight Manual Supplement (AFMS), Aircraft Operating Manual (AOM), Flight Operations Manual (FOM), POH, and associated checklists, as applicable to the specific operator, must include information to be used for the specific operation requested and be carried on the aircraft. The operations manual (or equivalent) should include a system description, operational and contingency procedures, and training elements for use of the ADS-B NRA application. Operations manuals should indicate that Direct Controller Pilot Communications (DCPC) must be available at all times (e.g., very high frequency (VHF), Controller-Pilot Data Link Communication (CPDLC), etc.). Operations manuals and checklists should indicate that when there is not an independent flight deck control selection between the ADS-B OUT on/off function and the ATC transponder on/off function, the crew must be fully aware that disabling the ADS-B function will also disable transponder and Traffic Alert and Collision Avoidance System (TCAS) functions.

6.3.4 Maintenance Procedures. The operator must submit documentation indicating the proposed maintenance procedures that address the instructions for continued airworthiness (ICA) provided by the manufacturer of the installed ADS-B equipment. Maintenance procedures must include a periodic verification check of aircraft-derived data used by the ADS-B system. Maintenance procedures must also include periodic verification (using suitable ramp test equipment or other acceptable means) that the correct ICAO 24bit address assigned to each aircraft is being transmitted by the ADS-B system.

6.3.5 Establishment of Periodic Checks of the ADS-B OUT System. The operator should provide documentation that indicates that periodic checks for the installed ADS-B OUT system are established.

6.3.6 Revision of MEL. The operator must submit documentation for proposed MEL (if used) revisions that address appropriate dispatch procedures of the aircraft with the ADS-B OUT system inoperative or partially inoperative.

6.3.7 Flight Crew Training. Pilots conducting operations under this authorization must be trained in the use and limitations of the installed ADS-B system, unless one of the crewmembers is an ADS-B trained trainer, as appropriate. Operators must submit documentation that details the method and content of the pilot training to be conducted. Pilot training must address the following:

- a) ADS-B operating procedures;
- b) Flight planning;
- c) MEL procedures;
- d) Human factors;
- e) ADS-B phraseology applicable to specific regions of operation;
- f) ADS-B system operation, including normal/abnormal procedures;
- g) Correct entry of ICAO aircraft ID as applicable to the flight;
- h) Operational procedures regarding the transmission of the generic emergency code (i.e., 7700) in cases when the flight crew actually selected a discrete emergency code (e.g., 7500, 7600);
- i) Handling of data source errors (e.g., discrepancies between navigation data sources); and
- j) Incident reporting procedures.

Note: General aviation operators must submit a statement that the operator's pilots have knowledge of current air traffic ADS-B directives for the intended areas of en route operation and will comply with applicable regulations.

6.3.8 Dispatcher/Flight Follower Training. Operators must submit a detailed description of the proposed dispatcher/flight follower (if required/used) training to be conducted. Dispatcher/flight follower training must address the following:

- a) Dispatch of aircraft with the ADS-B system unserviceable or partially unserviceable.
- b) Flight planning, fuel loading, and route change procedures associated with ADS-B operations.
- c) ADS-B ICAO region-specific requirements.

7. CANADA-SPECIFIC REQUIREMENTS.

7.1 Transport Canada Requirements.

See the current edition of Transport Canada AC 700-009, Automatic Dependent Surveillance-Broadcast, Paragraph 6.2, Foreign Air Operators, for information related to the ADS-B requirements of foreign operators.

7.2 NAV CANADA Requirements.

See the current edition of Aeronautical Information Circular (AIC) 21/09, Air Traffic Flow Management in the Vicinity of Hudson Bay as a Result of Automatic Dependent Surveillance-Broadcast OUT Implementation, for information related to NAV CANADA ATC services supported by ADS-B.

8. AUSTRALIA-SPECIFIC REQUIREMENTS.

See the current editions of Australia AIC H09/11, Transition to Satellite Technology for Navigation and Surveillance; Australia Civil Aviation Safety Authority (CASA) Civil Aviation Order (CAO) 20.18, Aircraft Equipment—Basic Operational Requirements, regarding avionics requirements; and CAO 82.5, Condition on Air Operators' Certificates Authorizing Regular Public Transport Operations in High Capacity Aircraft, for information related to the ADS-B requirements of certificated foreign operators.

9. ASIA-PACIFIC-SPECIFIC REQUIREMENT.

Singapore issued AIC 14/10, Introduction to Automatic Dependent Surveillance Broadcast (ADS-B) OUT Service within Parts of the Singapore FIR, dated December 28, 2010, informing aircraft operators regarding the Civil Aviation Authority of Singapore's (CAAS) plan to implement ADS-B operations after 2013 within portions of the Singapore flight information region (FIR). See CAAS AIC 14/10 for specific airways that will require ADS-B within Singapore's FIR.

10. RELATED DOCUMENTS.

ICAO Regional Guidance. Regulatory guidance and general information for ADS-B OUT operations for specific ICAO regions can be found in the following publications:

- a) FAA Order 8900.1, Flight Standards Information Management Systems (FSIMS), Volume 3, Chapter 18, Section 3, Part A Operations Specifications—General, Operations Specifications/Management Specifications/Letter of Authorization A153, Automatic Dependent Surveillance-Broadcast (ADS-B) Operations Outside of U.S.-Designated Airspace, current edition;
- b) FAA Notice 8900.269 OpsSpec/MSpec/LOA A153 ADS-OUT Operations Outside of U.S.- Designated Airspace.

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- c) EASA AMC 20-24, Certification Considerations for the Enhanced ATS in Non-Radar Areas using ADS-B Surveillance (ADS-B-NRA) Application via 1090 MHz Extended Squitter, dated February 5, 2008;
- d) TCCA AC 700-009, Automatic Dependent Surveillance-Broadcast, current edition;
- e) NAV CANADA AIC 21/09, Air Traffic Flow Management in the Vicinity of Hudson Bay as a Result of Automatic Dependent Surveillance-Broadcast OUT Implementation, current edition;
- f) CASA CAO 20.18, Aircraft Equipment—Basic Operational Requirements, current edition;
- g) CASA CAO 82.5, Condition on Air Operators' Certificates Authorizing Regular Public Transport Operations in High Capacity Aircraft, current edition; and
- h) CAAS AIC 14/10, Introduction to Automatic Dependent Surveillance Broadcast (ADS-B) OUT Service within Parts of the Singapore FIR, current edition.



**ATTACHMENT B
APPLICATION AND CHECK LIST FOR ADS-B OUT OPERATIONAL APPROVAL**

Please complete the form in BLOCK CAPITALS using black or dark blue ink.
This form is designed to elicit all the required information from those operators requiring the ADS-B Out Operational Approval. Complete Section I, II and III and submit to the CAAT.

SECTION 1: OPERATOR DETAILS

Operator:

Contact Person Name:

Date:

Please note that a minimum of 30 days will normally be required to check and confirm the given information. If data is missing or omitted the process may take considerably longer.

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ATTACHMENT B

APPLICATION AND CHECK LIST FOR ADS-B OUT OPERATIONAL APPROVAL

Please complete the form in BLOCK CAPITALS using black or dark blue ink.

This form is designed to obtain all the required information from those operators requiring the ADS-B Out Operational Approval. Complete Section I, II and III and submit to the THE CIVIL AVIATION AUTHORITY OF THAILAND, 71 Soi Ngamduplee Rama Iv Road Bangkok 10120, THAILAND.

The assessment to the application of the Operational Approval is based on EASA Acceptance Means of Compliance AMC 20-24. Applicants are strongly advised to read the AMC 20-24 and 'Notes for Completion' at the end of this form.

SECTION I OPERATOR DETAILS

Operator: Applicant Name: Tel: Date: Please note that a minimum of 30 days will normally be required to check and confirm the given information. If data is missing or omitted the process may take considerably longer.

Operator Name:

Tel:

Date:

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SECTION II AIRCRAFT DETAILS (Use continuation sheet if necessary)										
Aircraft Registration	Aircraft Model	GNSS Receiver Model	GNSS Receiver P/N	GNSS Receiver SA Aware Yes/No	GNSS Receiver FDE Yes/No	ADS-B Transponder Model	ADS-B Transponder P/N	Airworthiness Compliance Standard		
								AMC 20-24	FAA AC 20-165	CASA CAO 20.18 App. XI

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SECTION III OPERATIONAL APPROVAL

1. Airworthiness Compliance Airworthiness Compliance to EASA AMC 20-24, The current version of FAA AC No. 20-165 or equipment configuration standards compliance to Appendix XI of CASA CAO 20.18 are acceptable. Submit copies of relevant sections from Aircraft Flight Manual or other supporting certification data.

Inspector Comment:

2. Operations Manuals and Training Give reference of flight operations training programme and operational procedures. Refer to EASA AMC 20-24 paragraph 10.3. Submit copies of relevant sections from Operations and Training Manuals.

Inspector Comment:

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3. Minimum Equipment List Give reference of relevant MEL. Refer to EASA AMC 20-24 paragraph 10.5. Submit copies of the relevant sections from the proposed or actual MEL where the operation is addressed.

Inspector Comment:

4. Continuing Airworthiness Give details of maintenance programme to ensure the systems meet requirements. Refer to EASA AMC 20-24 paragraph 11. Submit copies of the relevant sections from the proposed or actual Maintenance Schedules on the ABS-B systems.

Inspector Comment:

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SECTION I & II - OPERATOR AND AIRCRAFT DETAILS

Section II is for the Approval Database and Monitoring Programme.

As Selective Availability (SA) aware and Fault Detection and Exclusion (FDE) functionalities will improve accuracy and integrity to the position source of ADS-B, the forward fitment of these functionalities to new aircraft is highly recommended.

Below are the examples on completing Section II table.

SECTION II AIRCRAFT DETAILS (Use continuation sheet if necessary)

Aircraft Registration	Aircraft Model	GNSS Receiver Model	GNSS Receiver P/N	GNSS Receiver SA Aware Yes/No	GNSS Receiver FDE Yes/No	ADS-B Transponder Model	ADS-B Transponder P/N	Airworthiness Compliance Standard	
								AMC20-24	CAO 20.18 App. XI

Inspector Comment:

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SECTION III – OPERATIONAL APPROVAL

Paragraph 1 - The airworthiness compliance of EASA AMC20-24 is declared in the Aircraft Flight Manual, AFM supplement or other appropriate airworthiness documentation. If the aircraft does not have the equipment certification, alternatively compliance with Appendix XI of CASA CAO 20.18 specified requirements needs to be demonstrated.

ADS-B equipages compliance requirements can be referred to GM for ADS-B

Paragraph 2 -Appropriate flight operations training programme and operational procedures are established to ensure that pilots are knowledgeable about ADS-B operations and their onboard operational equipment.

The Operations Manual, preferably Section B, should include a system description, operational and contingency procedures and training elements for use of the ADS-B application.

Aircraft operators should ensure that flight crew are thoroughly familiar with all relevant aspects of ADS-B applications. Flight crew training should address the

- a) General understanding of ADS-B operating procedures;
- b) Specific ADS-B associated phraseology;
- c) General understanding of the ADS-B technique and technology;
- d) Characteristics and limitations of the flight deck human-machine interface, including an overview of ADS-B environment and system descriptions.

Inspector Comment:

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Paragraph 3 - The Minimum Equipment List needs to reflect the functional requirements of the ADS-B system, such as GPS/MMR and ATC transponder.

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Inspector Comment:

Paragraph 4 - The continuing airworthiness of ADS-B system must be assured. Existing maintenance programme or a proposed maintenance programme needs to be reviewed to ensure that it meets relevant requirements.

Maintenance tests should include a periodic verification check of aircraft derived data including the ICAO 24bit aircraft address using suitable ramp test equipment and periodicity for the check of the ADS-B transmitter should be established

Inspector Comment: Approved or Not Approved

Inspector's signature:

Name:

Date: