Civil Aviation Authority of Singapore

Manual of Standards - Aeronautical Information Services

Version 2.5: 4 November 2021

Published by

Civil Aviation Authority of Singapore

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TABLE OF CONTENTS

Amendment Records iii

Foreword vi

Definitions and Abbreviations vii

Chapter 1 Introduction 1-1

Chapter 2 Operation Requirement 2-1

2.1 General AIS Operation Requirement 2-1

2.2 Quality Management System 2-4

2.3 Operations Manual 2-6

Chapter 3 Safety Management System 3-1

3.1 Introduction 3-1

3.2 SMS Framework 3-1

(a) Safety Policy and Objectives 3-1

(b) Safety Risk Management 3-2

(c) Safety Assurance 3-2

(d) Safety Promotion 3-3

Chapter 4 Training and Personnel Requirement 4-1

4.1 Training Requirement 4-1

4.2 Personnel Requirement 4-1

Chapter 5 Aeronautical Information Publication 5-1

5.1 AIP Requirement 5-1

5.2 AIP Amendment 5-1

5.3 AIP Supplement 5-2

5.4 Electronic AIP (eAIP) 5-2

Chapter 6 NOTAM 6-1

6.1 General NOTAM Requirement 6-1

6.2 Specific NOTAM Requirement 6-5

6.3 Distribution of NOTAM 6-6

Chapter 7 Pre-flight And Post-flight Information System 7-1

7.1 Pre-flight Information 7-1

7.2 Automated Pre-flight Information System 7-1

7.3 Post-flight Information 7-2

Chapter 8 Aeronautical Information Regulation and Control 8-1

Chapter 9 Aeronautical Information Circular 9-1

Chapter 10 Documentation and Records 10-1

10.1 Documents and Records to be Maintained 10-1

10.2 Document Control 10-1

Chapter 11 Digital Data Sets 11-1

11.1 Digital data sets 11-1

11.2 Terrain and obstacle data sets 11-1

11.3 Terrain data sets 11-4

11.4 Obstacle data sets 11-5

11.5 AIP data set 11-5

11.6 Aerodrome mapping data sets 11-5

11.7 Instrument flight procedures data sets 11-6

11.8 Data set updates 11-6

Chapter 12 Aeronautical Chart 12-1

AMENDMENT RECORDS

The amendments listed below have been incorporated into this copy of the Manual of Standards – Aeronautical Information Services.

Amendment no.	Version no.	Subject	Source	Sections affected	Entered by (Date)	Approved by (Date)	Effective date
-	1.0	Original version	ICAO Annex 4 incorporating Amendment 54 ICAO Annex 15 incorporating Amendment 34	All	Ong Chuan Bin (1 Oct 2009)	Loo Chee Beng (1 Oct 2009)	1 Oct 2009
1	1.1	List of effective pages (deleted) Foreword Station declination Use of Units of Measurement Human Factors Operations Manual Aeronautical Charts	ICAO Annex 4 incorporating Amendment 55 ICAO Annex 15 incorporating Amendment 35 Arising from AAR Div's continual review of MOS-AIS	- iv vi 1.6 2.1.4 2.3.1, 2.3.2 12.2, 12.3, 12.4	Eng Chew Say (27 Apr 2010)	Loo Chee Beng (27 Apr 2010)	27 Apr 2010

Amendment no.	Version no.	Subject	Source	Sections affected	Entered by (Date)	Approved by (Date)	Effective date
2	2.0	Quality system to be ISO 9000 compliance	Ministerial Direction No 1/2010 Arising from AAR Div's continual review of MOS-AIS	2.2	AAR Div (3 Aug 2010)	Chief Executive (3 Aug 2010)	3 Aug 2010
3	2.1	Foreward Table of Contents Use of Automation Human Factors considerations Metadata Quality Management System Electronic AIP (eAIP) Automated Pre-flight Information System Aeronautical data	CAAS (ANS) (Amendment) Directions 2011 ICAO Annex 4 incorporating Amendment 56 ICAO Annex 15 incorporating Amendment 36 Arising from AAR Div's continual review of MOS-AIS	vi i 2.1.4 2.1.5 2.1.6 2.2 5.4 7.2 12.8	AAR Div (18 Nov 2010)	Authority (12 January 2011)	12 January 2011

Amendment no.	Version no.	Subject	Source	Sections affected	Entered by (Date)	Approved by (Date)	Effective date
4	2.2	Table of Content Forward Definitions Abbreviations Introduction AIS Operation Requirement Use of Automation Metadata Quality Management System Safety Management System Training Requirement Aeronautical Information Publication NOTAM Pre-flight and Post-flight Information Service AIRAC AIC	Arising from AAR Div's continual review of MOS-AIS ICAO Annex 4 incorporating Amendment 57 ICAO Annex 15 incorporating Amendment 37 ICAO Annex 19	ii vi vii to ix x 1.5, 1.9 2.1.1, 2.1.2 2.1.4 to 2.1.6 2.1.8, 2.1.9 2.2 3.1, 3.2 4.1 5.2 to 5.4 6.3 7.1 to 7.3 8.3 9.2	AAR Div (10 April 2014)	Authority (25 June 2014)	4 July 2014

Amendment no.	Version no.	Subject	Source	Sections affected	Entered by (Date)	Approved by (Date)	Effective date
		Electronic Terrain and Obstacle Data Aerodrome Terrain and Obstacle Chart – ICAO (Electronic)		11.1 to 11.5 12.9			
5	2.3	Table of Content Definitions Introduction General AIS Operation Requirement Quality Management System AIP Requirement General NOTAM Requirement Pre-flight Information Post-flight Information Aeronautical Information Regulation and Control	Arising from: AAR Div's continual review of MOS-AIS ICAO Annex 4 incorporating Amendment 60 ICAO Annex 15 incorporating Amendment 40 PANS-AIM (Doc 10066)	i vii to xviii 1.2(h) 2.1.1 to 2.1.2.3, 2.1.4, 2.1.6, 2.1.8, 2.1.10 to 2.1.15 2.2.1 to 2.2.3 2.2.5 to 2.2.13 5.1.1 6.1.2 to 6.1.3 7.1.2 to 7.1.4 7.3.1 7.3.1 8.1, 8.2, 8.4 to 8.6	AAR Div (3 April 2018)	Authority (18 October 2018)	8 November 2018

Amendment no.	Version no.	Subject	Source	Sections affected	Entered by (Date)	Approved by (Date)	Effective date
		Aeronautical Information Circular Documents and Records to be Maintained Digital data sets Aeronautical Charts		9.1, 9.3, 9.4 10.1.1 11.1 to 11.8.4 12.1 to 12.3, 12.7, 12.8			
6	2.4	NOTAM	Arising from: ICAO Annex 15 incorporating Amendment 41	6.1.3	AAR Div (25 August 2020)	Authority (30 September 2020)	5 November 2020
7	2.5	Enhanced global reporting format for assessing and reporting runway surface conditions (GRF)	Arising from: ICAO Annex 15 incorporating Amendment 42	xvii xix	AAR Div (2 November 2021)	Authority (27 October 2021)	4 November 2021

FOREWORD

Pursuant to paragraph 5 of the Ministerial Direction No. 1/2010 [as amended by the CAAS (ANS) (Amendment) Directions 2011], this Manual of Standards – Aeronautical Information Services is issued by CAAS specifying the national standards, requirements and procedures pertaining to the provision of aeronautical information services by the air navigation service provider within the Singapore Flight Information Region.

The standards in this Manual are based on those stipulated in Annexes 4 and 15 (entitled “Aeronautical Charts” and “Aeronautical Information Services”) to the Convention on International Civil Aviation [as in force and amended from time to time by the Council of the International Civil Aviation Organisation (ICAO)] and other relevant ICAO documents, and with such modifications as may be determined by CAAS to be applicable in Singapore.

Readers should forward advice of errors, inconsistencies or suggestions for improvement to this Manual to the addressee stipulated below.

Director (Aerodrome and Air Navigation Services Regulation)
Civil Aviation Authority of Singapore
PO Box 1, Singapore Changi Airport
Singapore 918141

DEFINITIONS AND ABBREVIATIONS

Definitions

Aerodrome
A defined area on land (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

Aerodrome mapping data (AMD)
Data collected for the purpose of compiling aerodrome mapping information. The Aerodrome mapping data are collected for purposes that include the improvement of the user's situational awareness, surface navigation operations, training, charting and planning.

Aerodrome mapping database (AMDB)
A collection of aerodrome mapping data organised and arranged as a structured data set.

Aeronautical Chart
A representation of a portion of the earth, its culture and relief, specifically designated to meet the requirements of air navigation.

Aeronautical Data
A representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing

Aeronautical fixed service (AFS*)*
A telecommunication service between specified fixed points provided primarily for the safety of air navigation and for the regular, efficient and economical operation of air services.

Aeronautical Information
Information resulting from the assembly, analysis and formatting of aeronautical data

Aeronautical information management
The dynamic, integrated management of aeronautical information through the provision and exchange of quality-assured digital aeronautical data in collaboration with all parties

Aeronautical information product
Aeronautical data and aeronautical information provided either as digital data sets or as a standardised presentation in paper or electronic media. Aeronautical information products are intended primarily to satisfy international requirements for the exchange of aeronautical information.

Aeronautical information products include:
- Aeronautical Information Publication (AIP), including Amendments and Supplements;
- Aeronautical Information Circulars (AIC);
- Aeronautical charts;
- NOTAM; and
- Digital data sets.

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

Aeronautical Information Circular
A notice containing information that does not qualify for the origination of a NOTAM or for inclusion in the AIP, but which relates to flight safety, air navigation, technical, administrative or legislative matters.

AIP Amendment
Permanent changes to the information contained in the AIP

AIP Supplement
Temporary changes to the information contained in the AIP which are provided by means of special pages

AIRAC
An acronym (aeronautical information regulation and control) signifying a system aimed at advance notification based on common effective dates, of circumstances that necessitate significant changes in operating practices.

Aeronautical Information Services
A service established within the defined area of coverage responsible for the provision of aeronautical data and aeronautical information necessary for the safety, regularity and efficiency of air navigation

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

Application
Manipulation and processing of data in support of user requirements (ISO 19104).

Area navigation (RNAV)
A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground- or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

Note.— Area navigation includes performance-based navigation as well as other operations that do not meet the definition of performance-based navigation

ASHTAM
A special series NOTAM notifying by means of a specific format change in activity of a volcano, a volcanic eruption and/or volcanic ash cloud that is of significance to aircraft operations.

Assemble
A process of merging data from multiple sources into a database and establishing a baseline for subsequent processing.

Note.— The assemble phase includes checking the data and ensuring that detected errors and omissions are rectified.

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

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

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

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

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

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

Automatic terminal information service (ATIS)
The automatic provision of current, routine information to arriving and departing aircraft throughout 24 hours or a specified portion thereof:Data link-automatic terminal information service (D-ATIS). The provision of ATIS via data link.Voice-automatic terminal information service (Voice-ATIS). The provision of ATIS by means of continuous and repetitive voice broadcasts.

Bare Earth
Surface of the Earth including bodies of water and permanent ice and snow, and excluding vegetation and man-made objects

Calendar
Discrete temporal reference system that provides the basis for defining temporal position to a resolution of one day (ISO 19108).

Canopy
Bare Earth supplemented by vegetation height.

Confidence level
The probability that the true value of a parameter is within a certain interval around the estimate of its value.

Note.— The interval is usually referred to as the accuracy of the estimate.

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

Culture
All man-made features constructed on the surface of the Earth, such as cities, railways and canals.

Cyclic Redundancy Check (CRC)
A mathematical algorithm applied to the digital expression of data that provides a level of assurance against loss or alteration of data

Danger area
An airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times.

Data accuracy
A degree of conformance between the estimated or measured value and the true value

Data completeness
The degree of confidence that all of the data needed to support the intended use is provided.

Data format
A structure of data elements, records and files arranged to meet standards, specifications or data quality requirements.

Data Integrity (assurance level)
A degree of assurance that an aeronautical data and its value has not been lost nor altered since the data origination or authorized amendment

Data product
Data set or data set series that conforms to a data product specification (ISO 19131).

Data product specification
Detailed description of a data set or data set series together with additional information that will enable it to be created, supplied to and used by another party (ISO 19131).

Data Quality
A degree or level of confidence that the data provided meets the requirements of the data user in terms of accuracy, resolution, integrity (or equivalent assurance level), traceability, timeliness, completeness and format.

Data resolution
A number of units or digits to which a measured or calculated value is expressed and used.

Data set
Identifiable collection of data (ISO 19101).

Data set series
Collection of data sets sharing the same product specification (ISO 19115).

Data timeliness
The degree of confidence that the data is applicable to the period of its intended use.

Data traceability
The degree that a system or a data product can provide a record of the changes made to that product and thereby enable an audit trail to be followed from the end-user to the originator.

Datum
Any quantity or set of quantities that may serve as a reference or basis for the calculation of other quantities (ISO 19104).

Digital Elevation Model (DEM)
The representation of terrain surface by continuous elevation values at all intersections of a defined grid, referenced to common datum.

Note.— Digital Terrain Model (DTM) is sometimes referred to as DEM.

Direct transit arrangements
Special arrangements approved by the public authorities concerned by which traffic which is pausing briefly in its passage through the Contracting State may remain under their direct control.

Ellipsoid height (Geodetic height)
The height related to the reference ellipsoid, measured along the ellipsoidal outer normal through the point in question.

Feature
Abstraction of real world phenomena (ISO 19101).

Feature attribute
Characteristic of a feature (ISO 19101).

Note.— A feature attribute has a name, a data type and a value domain associated with it.

Feature operation
Operation that every instance of a feature type may perform (ISO 19110).

Feature relationship
Relationship that links instances of one feature type with instances of the same or a different feature type (ISO 19101).

Feature type
Class of real world phenomena with common properties (ISO 19110).

Geodesic distance
The shortest distance between any two points on a mathematically defined ellipsoidal surface.

Geodetic datum
A minimum set of parameters required to define location and orientation of the local reference system with respect to the global reference system/frame.

Geoid
The equipotential surface in the gravity field of the Earth which coincides with the undisturbed mean sea level (MSL) extended continuously through the continents.

Note.— The geoid is irregular in shape because of local gravitational disturbances (wind tides, salinity, current, etc.) and the direction of gravity is perpendicular to the geoid at every point.

Geoid undulation
The distance of the geoid above (positive) or below (negative) the mathematical reference ellipsoid.

Note.— In respect to the World Geodetic System — 1984 (WGS-84) defined ellipsoid, the difference between the WGS-84 ellipsoidal height and orthometric height represents WGS-84 geoid undulation.

Gregorian calendar
Calendar in general use; first introduced in 1582 to define a year that more closely approximates the tropical year than the Julian calendar (ISO 19108).

Note.— In the Gregorian calendar, common years have 365 days and leap years 366 days divided into twelve sequential months.

Height
The vertical distance of a level, point or an object considered as a point, measured from a specific datum.

Human Factors Principles
Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance

Integrity classification (aeronautical data)
Classification based upon the potential risk resulting from the use of corrupted data. Aeronautical data is classified as:

a) routine data: there is a very low probability when using corrupted routine data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe;

b) essential data: there is a low probability when using corrupted essential data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe; and

c) critical data: there is a high probability when using corrupted critical data that the continued safe flight and landing of an aircraft would be severely at risk with the potential for catastrophe.

International airport
Any airport designated by the Contracting State in whose territory it is situated as an airport of entry and departure for international air traffic, where the formalities incident to customs, immigration, public health, animal and plant quarantine and similar procedures are carried out.

International NOTAM Office (NOF)
An office designated by a State for the exchange of NOTAM internationally

Logon address
A specified code used for data link logon to an ATS unit.

Manoeuvring area
That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons

Metadata
Data about data (as defined in ISO 19115)

Note.— A structured description of the content, quality, condition or other characteristics of data.

Minimum en-route altitude (MEA)
The altitude for an en-route segment that provides adequate reception of relevant navigation facilities and ATS communications, complies with the airspace structure and provides the required obstacle clearance.

Minimum obstacle clearance altitude (MOCA)
The minimum altitude for a defined segment of flight that provides the required obstacle clearance.

Movement area
That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and the apron(s).

Next intended user
The entity that receives the aeronautical data or information from the Aeronautical Information Service.

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

Obstacle
All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that:

a) are located on an area intended for the surface movement of aircraft;
b) extend above a defined surface intended to protect aircraft in flight; or
c) stand outside those defined surfaces and that have been assessed as being a hazard to air navigation.

Obstacle/terrain data collection surface
A defined surface intended for the purpose of collecting obstacle/terrain data.

Origination (Aeronautical data or aeronautical information)
The creation of the value associated with new data or information or the modification of the value of an existing data or information

Originator (Aeronautical data or aeronautical information)
An entity that is accountable for data or information origination and/or from which the AIS organisation receives aeronautical data and information.

Orthometric height
Height of a point related to the geoid, generally presented as an MSL elevation.

Performance-based communication (PBC)
Communication based on performance specifications applied to the provision of air traffic services.

Note.— An RCP specification includes communication performance requirements that are allocated to system components in terms of the communication to be provided and associated transaction time, continuity, availability, integrity, safety and functionality needed for the proposed operation in the context of a particular airspace concept.

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

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

Performance-based surveillance (PBS)
Surveillance based on performance specifications applied to the provision of air traffic services.

Note.— An RSP specification includes surveillance performance requirements that are allocated to system components in terms of the surveillance to be provided and associated data delivery time, continuity, availability, integrity, accuracy of the surveillance data, safety and functionality needed for the proposed operation in the context of a particular airspace concept.

Portrayal
Presentation of information to humans (ISO 19117).

Position (geographical)
Set of coordinates (latitude and longitude) referenced to the mathematical reference ellipsoid which define the position of a point on the surface of the Earth.

Post spacing
Angular or linear distance between two adjacent elevation points.

Precision
The smallest difference that can be reliably distinguished by a measurement process.

Note.— In reference to geodetic surveys, precision is a degree of refinement in performance of an operation or a degree of perfection in the instruments and methods used when taking measurements.

Pre-flight information bulletin (PIB)
A presentation of current NOTAM information of operational significance, prepared prior to flight.

Prohibited area
An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited.

Quality
Degree to which a set of inherent characteristics fulfils requirements (ISO 9000).N1.The term “quality” can be used with adjectives such as poor, good or excellent.N2.“Inherent”, as opposed to “assigned”, means existing in something, especially as a permanent characteristic.

Quality assurance
Part of quality management focused on providing confidence that quality requirements will be fulfilled (ISO 9000).

Quality control
Part of quality management focused on fulfilling quality requirements (ISO 9000).
Quality management
Coordinated activities to direct and control an organisation with regard to quality (ISO 9000).

Radio navigation service
A service providing guidance information or position data for the efficient and safe operation of aircraft supported by one or more radio navigation aids.

Required communication performance (RCP) specification

A set of requirements for air traffic service provision and associated ground equipment, aircraft capability, and operations needed to support performance-based communication.

Required surveillance performance (RSP) specification
A set of requirements for air traffic service provision and associated ground equipment, aircraft capability, and operations needed to support performance-based surveillance.

Requirement
Need or expectation that is stated, generally implied or obligatory (ISO 9000).

Resolution
A number of units or digits to which a measured or calculated value is expressed and used.

Restricted area
An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.

Route stage.
A route or portion of a route flown without an intermediate landing.

SNOWTAM
A special series NOTAM given in a standard format providing a surface condition report notifying the presence or cessation of hazardous conditions due to snow, ice, slush, frost, standing water or water associated with snow, slush, ice or frost on the movement area.

Station Declination
An alignment variation between the zero degree redial of a VOR and true north, determined at the time the VOR station is calibrated.

Terrain
The surface of the Earth containing naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, and excluding obstacles.

Traceability
Ability to trace the history, application or location of that which is under consideration (ISO 9000).

Note.— When considering product, traceability can relate to:

- the origin of materials and parts;
- the processing history; and
- the distribution and location of the product after delivery.

Validation
Confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled (ISO 9000).

Verification
Confirmation, through the provision of objective evidence, that specified requirements have been fulfilled (ISO 9000).

Note. The term “verified” is used to designate the corresponding status.

Abbreviations

AAR	Aerodrome and Air Navigation Services Regulation
AFS	Aeronautical Fixed Services
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AIS	Aeronautical Information Services
AIM	Aeronautical Information Management
ATC	Air Traffic Control
ATS	Air Traffic Service
ATM	Air Traffic Management
CRC	Cyclic Redundancy Check
ICAO	International Civil Aviation Organisation
NOF	International NOTAM Office
NOTAM	Notice to Airmen
SARPS	Standards and Recommended Practices
SMS	Safety Management System

Chapter 1 – Introduction

1.1 The Manual of Standards - Aeronautical Information Services, contains the standards, requirements and procedures pertaining to the planning and operation of aeronautical information services and the provision of aeronautical charts.

1.2 This Manual is based mainly on compliance with the following ICAO documents:

(a) ICAO Annex 4 – Aeronautical Charts;

(b) ICAO Annex 11 – Air Traffic Services;

(c) ICAO Annex 15 – Aeronautical Information Services;

(d) ICAO Annex 19 – Safety Management

(e) ICAO Doc 8126 – Aeronautical Information Services Manual;

(f) ICAO Doc 9859 – Safety Management Manual; and

(g) ICAO Doc 9674 – World Geodetic System – 1984 (WGS - 84) Manual; and

(h) ICAO Doc 10066 – Procedure for Air Navigation – Aeronautical Information Management (PANS- AIM)

1.3 Where there is a difference between a standard in this Manual and that of the above-mentioned ICAO documents, the standard in this Manual shall prevail.

1.4 Differences, where they exist, between the standards in this Manual and those contained in the ICAO Annexes shall be published in section GEN 1.7 of the Singapore AIP and also notified to ICAO.

1.5 (Reserved)

1.6 The AIS provider shall ensure that the units of measurement as specified in Manual of Standards – Units of Measurement to be used in Air and Ground Operations are used in the provision of aeronautical information services and aeronautical charts.

1.7 In addition to the Manual of Standards, the following may also be issued as and when required to supplement the Manual of Standards:

(a) Safety Directive – this is a mandatory requirement to be complied by the AIS provider. It is published for purposes of immediate promulgation of local standards and recommended practices in response to, but not limited to, amendments to ICAO Annexes. The Safety Directives will be incorporated into subsequent amendments of the Manual of Standards.

(b) Safety Publication – this is published for purposes of promulgating supplementary guidance materials to the standards and recommended practices in the Manual of Standards. The publications are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means, of complying with the Manual of Standards. Safety Publications may explain certain regulatory requirements by providing interpretive and explanatory materials.

(c) Information Circular – this is published for purposes of bringing to the attention of the AIS provider educational materials related to aviation safety. The publications could be initiated as a result of ICAO State letters which do not require immediate changes to local regulations, new safety initiatives or international best practices as identified by AAR Division. The AIS provider is encouraged to review and adopt the material if practicable. Where appropriate, the material in the publications may be incorporated into subsequent amendments of the Manual of Standards.

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1.8 When an AIS provider is not able to comply with any standards specified or referenced in this Manual, the AIS provider shall apply to AAR Division for exemption or deviation from the relevant standards. Applications shall be supported in writing with the reasons for such exemption or deviation including any safety assessment or other studies undertaken, and where appropriate, an indication of when compliance with the current standards can be expected.

1.9 Any exemption or deviation granted to an AIS provider shall also be recorded in the operations manual. The operations manual shall also contain the details of the exemption or deviation, such as the reason that the exemption or deviation was requested and any resultant limitations or conditions imposed.

Chapter 2 – Operation Requirement

2.1 General AIS Operation Requirement

2.1.1 The AIS provider shall ensure that aeronautical data and aeronautical information necessary for the safety, regularity and efficiency of air navigation is made available in a form in conformity with ICAO Annex 4, 15 and the specifications in ICAO PANS-AIM (Doc 10066), and suitable for the operational requirements of the ATM community, including:

(a) those involved in flight operations, including flight crews, flight planning and flight simulators; and

(b) the ATS units responsible for flight information service and the services responsible for pre-flight information.

Note. – A description of the ATM community is contained in the Global ATM Operational Concept (Doc 9854).

2.1.2 The AIS provider shall receive, collate or assemble, edit, format, publish/store and distribute aeronautical data and aeronautical information concerning the airspace in which Singapore has responsibility for air traffic services. Aeronautical data and aeronautical information shall be provided as aeronautical information products.

Note. – An Aeronautical Information Service may include origination functions.

2.1.2.1 The AIS provider shall provide aeronautical information in the form of aeronautical information products and associated services.

Note.— Specifications concerning the order of resolution of aeronautical data provided for each aeronautical information product are contained in the PANS-AIM (Doc 10066), Appendix 1.

2.1.2.2 Aeronautical information provided in a standardized presentation shall include the AIP, AIP Amendments, AIP Supplements, AICs, NOTAMs and Aeronautical Charts.

Note 1.— Detailed specifications about AIP, AIP Amendments, AIP Supplements, AICs and NOTAMs are contained in the PANS-AIM (Doc 10066).

Note 2.— Cases where digital data sets may replace the corresponding elements of the standardized presentation are detailed in the PANS-AIM (Doc 10066).

2.1.2.3 The scope of the aeronautical data and aeronautical information to be received and managed by the AIS provider shall include at least the following sub-domains based on the specifications in PANS-AIM (Doc 10066):

(a) Singapore regulations, rules and procedures required for civil aviation;
(b) aerodromes;
(c) airspace;
(d) ATS routes;
(e) instrument flight procedures;
(f) radio navigation aids/systems;
(g) obstacles;
(h) terrain; and
(i) geographical information

2.1.3 The AIS provider shall ensure that published geographical coordinates indicating latitude and longitude are expressed in terms of the World Geodetic System – 1984 (WGS-84) geodetic reference datum as in ICAO Doc 9674 - World Geodetic System – 1984 (WGS-84) Manual.

2.1.4 Automation shall be applied in order to ensure the quality, efficiency and cost-effectiveness of aeronautical information services.

Note.— Guidance for the development of databases and the establishment of data exchange services may be found in the ICAO Aeronautical Information Services Manual (Doc 8126).

2.1.5 Where aeronautical data and aeronautical information are provided in multiple formats, processes shall be implemented to ensure data and information consistency between formats.

2.1.6 In order to meet the data quality requirements, automation shall:

(a) enable digital aeronautical data exchange between the parties involved in the data processing chain; and

(b) use aeronautical information exchange models and data exchange models designed to be globally interoperable.

Note.1 — Guidance on the globally interoperable aeronautical information and data exchange models may be found in the ICAO Aeronautical Information Services Manual (Doc 8126).

Note.2 — Specifications concerning the globally interoperable aeronautical information and data exchange models are contained in the PANS-AIM (Doc 10066).

2.1.7 The AIS provider shall ensure that the organisation of the aeronautical information services as well as the design, contents, processing and distribution of aeronautical data and aeronautical information shall take into consideration ATS routes principles which facilitate their optimum utilization. Due consideration shall be given to the integrity of information where human interaction is required and mitigating steps taken where risks are identified.

2.1.8 Metadata as specified in ICAO PANS-AIM (Doc 10066) Chapter 4, shall be collected by the AIS provider for aeronautical data processes and exchange points. This metadata collection shall be applied throughout the aeronautical information data chain, from origination to distribution to the next intended user.

Note.— ISO Standard 19115 specifies requirements for geographic information metadata.

2.1.9 The metadata to be collected shall include, as a minimum:

(a) the name of the organisations or entities performing any action of originating, transmitting or manipulating the data;

(b) the action performed; and

(c) the date and time the action was performed.

2.1.10 The AIS provider shall establish formal arrangements with originators of aeronautical data and aeronautical information with their data originators for the timely and complete provision of aeronautical data and aeronautical information.

2.1.11 The AIS provider shall, wherever practicable, establish direct contact with other AIS providers in order to facilitate the international exchange of aeronautical data and aeronautical information.

2.1.12 The AIS provider shall provide, without charge and in the mutually-agreed form, the following aeronautical information products, upon request from the AIS of a Contracting State:

(a) AIP, including Amendments and Supplements;

(b) AIC;

(c) NOTAM; and

(d) Aeronautical Charts.

2.1.13 Aeronautical information products shall be distributed to authorized users who request them.

2.1.14 The AIS provider shall establish agreements with other Contracting States whose digital data sets of aeronautical data and aeronautical information are to be provided to the AIS provider for the provision of pre-flight service and to meet the need for in-flight information from the AIS of other States.

2.1.15 The procurement of aeronautical data and aeronautical information, including the elements of the aeronautical information products by other entities shall be subject to separate agreement between the AIS provider and entities.

2.2 Quality Management System

2.2.1 Quality management systems shall be implemented and maintained by an AIS provider, as specified in ICAO PANS-AIM (Doc 10066), Chapter 3, encompassing all functions of an aeronautical information service, as described in paragraph 2.1.2. The execution of such quality management systems shall be made demonstrable for each function stage.

Note.— Guidance material is contained in the ICAO Manual on the Quality Management System for Aeronautical Information Services (Doc 9839).

2.2.2 Quality management shall be applicable to the whole aeronautical information data chain from data origination to distribution to the next intended user, taking into consideration the intended use of data. A user feedback system shall be defined and implemented.

2.2.3 The quality management system implemented in paragraph 2.2.1 shall follow the International Organisation for Standardisation (ISO) 9000 series of quality assurance standards, and be certified by an accredited certification body.

2.2.4 The quality management system established by the AIS provider shall include the necessary policies, processes and procedures, including those for the use of metadata, to ensure and verify that aeronautical data is traceable throughout the aeronautical information data chain so as to allow any data anomalies or errors detected in use to be identified by root cause, corrected and communicated to affected users.

2.2.5 The quality management system established by the AIS provider shall provide users with the necessary assurance and confidence that the aeronautical data and aeronautical information satisfy the aeronautical data quality specifications for data accuracy, data resolution, data integrity, data traceability, data timeliness, data completeness and data format as specified in Annex 15, Chapter 3, paragraph 3.2.

2.2.6 Demonstration of compliance of the quality management system applied shall be by audit. If nonconformity is identified, initiating action to correct its cause shall be determined and taken without undue delay. All audit observations and remedial actions shall be evidenced and properly documented.

2.2.7 The AIS provider shall comply with the order of accuracy for aeronautical data in accordance with its intended use.

2.2.8 The AIS provider shall:

(a) ensure that digital data error detection techniques are utilised during the transmission and/or storage of aeronautical data and digital data sets.

(b) implement digital data error detection techniques as specified in PANS-AIM (Doc 10066) in order to maintain the data integrity levels for the provision of aeronautical data and information throughout the data process from origination to distribution to the next intended user; and

(c) ensure that data integrity is maintained for routine data, essential data and critical data as specified in Annex 15, Chapter 3.

2.2.9 The AIS provider shall ensure that the assessment of risks affecting the integrity of aeronautical data and aeronautical information is conducted when automated processes are implemented and mitigating steps are taken where risks are identified.

Note.— Risks of altering the integrity of data and information may be introduced by automated processes in case of unexpected systems behaviours.

2.2.10 The AIS provider shall implement policies and procedures for material to be issued by data originators, as part of an aeronautical information product to be thoroughly checked before it is submitted to the AIS provider, in order to ensure that all necessary information has been included and that it is correct in detail.

2.2.11 The AIS provider shall establish verification and validation procedures which ensure that upon receipt of aeronautical data and aeronautical information, quality requirements are met.

2.2.12 The AIS provider shall ensure that any aeronautical information product which has been granted copyright protection by the originating State and provided to the AIS provider shall only be made available to a third party on the condition that the third party is made aware that the product is copyright protected and provided that it is appropriately annotated that the product is subject to copyright by the originating State.

2.2.13 The AIS provider shall ensure that aeronautical information and aeronautical data that is provided to the AIS provider for the provision of pre-flight service and to meet the need for in-flight information from the AIS of other States shall not provide digital data sets of the providing State to any third party without the consent of the providing State.

2.3 Operations Manual

2.3.1 The AIS provider shall submit an operations manual to AAR Division. The information presented in the operations manual shall serve to demonstrate how the AIS provider will comply with the requirements of this Manual. It also serves as a reference document agreed between the AIS provider and AAR Division with respect to the standards, conditions and level of service to be maintained for the provision of aeronautical information services.

2.3.2 The contents of the operations manual shall contain:

(a) the information required of the AIS provider as mentioned in this Manual;

(b) an organization chart of the AIS provider that shows the position of each personnel and the name, qualification, experience, duties and responsibilities of personnel who are responsible for ensuring the compliance of the organization with the requirements in sub-paragraph (a);

(c) an operation plan for the aeronautical information services; and

(d) information on the compliance of the aeronautical information services with the applicable requirements of ICAO Annex 4 and 15 and this Manual of Standards – Aeronautical Information Services.

2.3.3 The operations manual may consist of a main manual covering the main areas that need to be addressed, as well as separate supporting documents and manuals.

2.3.4 The operations manual is an important document and shall be issued under the authority of the AIS provider. The AIS provider shall control the distribution of the operations manual and ensure that it is amended whenever necessary to maintain the accuracy of the information in the operations manual and to keep its contents up to date.

Chapter 3 – Safety Management System

3.1 Introduction

3.1.1 The AIS provider shall establish a Safety Management System (SMS).

3.2 SMS Framework

3.2.1 The SMS to be established shall comply with an SMS framework consisting of the following components:

(a) Safety Policy and Objectives

(i) Management commitment and responsibility

The SMS shall have a clear definition of the philosophy and fundamental approach the service provider will adopt for the management of safety within its organization. This includes setting the safety policies and how they relate to the operation and maintenance processes of the service provider. The policies shall also clearly encapsulate the senior management's commitment to improve safety in the organization as a top priority, with the provision of the necessary human and financial resources for its implementation. The safety policy shall be periodically reviewed to ensure it remains relevant.

(ii) Safety accountabilities

The SMS shall have clear lines of safety accountabilities within the organization, including a direct accountability for safety on the part of senior management. Safety accountabilities shall be documented and communicated throughout the organization.

(iii) Appointment of key safety personnel

The AIS provider shall appoint a safety manager to serve as the focal point and driving force for the implementation and maintenance of SMS activities. However, the safety manager should not be held solely responsible for safety. Specific safety activities and the functional or operational safety performance and outcome are the responsibility of the relevant operational or functional managers and staff.

(iv) SMS implementation plan

The AIS provider shall develop and maintain an SMS implementation plan that defines the organisation's approach towards the management of safety in a manner that meets the organisation's safety needs. The SMS implementation plan shall be endorsed by senior management of the organization.

(v) Documentation

A SMS manual shall be produced as part of the operations manual, as this is the key instrument for guiding and communicating the organisation's SMS approach and methodology to the whole organization. Guidance on the production of an SMS manual can be found in ICAO Doc 9859.

(b) Safety Risk Management

(i) Hazard identification

The AIS provider shall develop and maintain a formal process for effectively collecting, recording, acting on and generating feedback about hazards in operations, based on a combination of reactive, proactive and predictive methods of safety data collection.

(ii) Safety risk assessment and mitigation process

The AIS provider shall develop and maintain a formal risk management process that ensures analysis (in terms of probability and severity of occurrence), assessment (in terms of tolerability) and control (in terms of mitigation) of risks to an acceptable level.

(c) Safety Assurance

(i) Safety performance monitoring and measurement

(1) The AIS provider shall develop and maintain the means to verify the safety performance of the organization compared to the safety policy and objectives, and to validate the effectiveness of safety risks controls.

(2) The AIS provider shall establish the safety performance indicators and targets of its SMS and submit them to AAR Division for agreement. Details on the establishment of the safety performance indicators and targets can be found in ICAO Doc 9859.

(ii) Management of change

The AIS provider shall develop and maintain a formal process to identify changes within the organization which may affect established processes and services. A risk assessment shall be carried out before the implementation of such changes.

(iii) Continuous improvement of the SMS

The AIS provider shall develop and maintain a formal process to identify the causes of sub-standard performance of the SMS, determine the implications of sub-standard performance in operations, and eliminate or mitigate such causes, in order to ensure the continual improvement of the SMS.

(iv) Safety audit

Regular internal safety audits shall be conducted by the service provider to assure the effectiveness of its SMS. The safety audit shall be conducted by a team of trained auditors who are familiar with the operation of the aeronautical information service, but also independent and not involved with the day to day operation of the service. Records of such safety audits and corrective follow up actions shall be kept.

(d) Safety Promotion

(i) Training and education

The AIS provider shall develop and maintain a safety training programme to ensure that personnel are trained and competent to perform the SMS duties. The scope of the safety training shall be appropriate to each individual's involvement in the SMS.

(ii) Safety communication

The AIS provider shall communicate and promote the organisation's SMS processes and activities to its entire staff, to ensure that staff is fully aware of the SMS. The AIS provider shall develop and maintain formal means for safety communication to ensure that staff are fully aware why particular safety actions and procedures are introduced or changed.

Chapter 4 – Training and Personnel Requirement

4.1 Training Requirement

4.1.1 The AIS provider shall establish procedures to ensure that all its personnel, including cartographic technical staff, possess the skills and competencies required in the provision of aeronautical information services. The AIS provider shall develop an overall training policy and programme and detailed job descriptions for its staff. The training policy and programme shall lay down the training courses that different levels of staff have to undergo to perform their duties, including initial, recurrent and specialised training. The job description shall depict the job purpose, key responsibilities, and outcome to be achieved of each staff. Initial and periodic assessments shall be established that require personnel to demonstrate the required competencies.

4.1.2 The AIS provider shall ensure that its staff undergo a suitable period of supervised on-the-job training before being deployed for duties.

4.1.3 The AIS provider shall maintain individual training records for each of its staff, which shall include a training plan detailing the courses completed by each staff as well as the time-frame for attending future courses as required under his training plan.

4.1.4 The AIS provider shall conduct a yearly review of the training plan for each staff at the beginning of the year to identify any gaps in competency, changes in training requirement and prioritise the type of training required for the coming year.

4.2 Personnel Requirement

4.2.1 The AIS provider shall employ sufficient number of competent personnel to perform the operation of the service. The AIS provider shall provide in the operations manual an analysis of the number of personnel required to perform the aeronautical information service taking into account the duties and workload required.

Chapter 5 – Aeronautical Information Publication

5.1 AIP Requirement

5.1.1 The AIS provider shall publish an Aeronautical Information Publication (AIP) containing current information, data and aeronautical charts relating to the airspace in which Singapore has responsibility for air traffic services. The contents of the AIP shall be in accordance with Chapter 5 of Annex 15 and Chapter 5 of PANS-AIM (Doc 10066).

5.1.2 The AIS provider shall ensure that the AIP to be published is self-contained and includes:

(a) a statement of the competent authority responsible for the air navigation facilities, services or procedures covered by the AIP;

(b) the general condition under which the services or facilities are available for international use;

(c) a list of the significant differences with the ICAO SARPS that Singapore has filed with ICAO with regards to its own regulations and practices;

(d) a summary of any significant regulations and practices followed by Singapore where the ICAO SARPS allow alternative course of action.

5.1.3 The AIS provider shall establish a system to disseminate and make the AIP, AIP Amendment and AIP Supplement available to any person upon request.

5.2 AIP Amendment

5.2.1 The AIS provider shall ensure that permanent changes to the AIP are published as AIP Amendments. Each AIP Amendment shall be allocated a serial number, which shall be consecutive. Each AIP Amendment page, including the cover sheet, shall display a publication date. A brief indication of the subjects affected by the amendment shall be given on the AIP Amendment cover sheet.

5.2.2 The AIS provider shall establish and publish the publication dates for its AIP Amendments in the AIP

5.3 AIP Supplement

5.3.1 The AIS provider shall ensure that temporary changes of long duration (three months or longer) and information of short duration which contains extensive text and/or graphics are published as AIP Supplement.

5.3.2 Each AIP Supplement shall be allocated a serial number which shall be consecutive and based on the calendar year. AIP Supplement pages shall be kept in the AIP as long as all or some of their contents remain valid.

5.3.3 The AIS provider shall issue a checklist of valid AIP Supplements at intervals of not more than one month. This information shall be issued through the medium of the monthly plain language list of valid NOTAM required by paragraph 6.3.3.

5.4 Electronic AIP (eAIP)

5.4.1 The AIS provider shall publish the AIP, AIP Amendment, AIP Supplement and AIC in a format that allows for displaying on a computer screen and printing on paper.

Note 1. – This composite electronic document is named "Electronic AIP" (eAIP) and may be based on a format that allows for digital data exchange.

5.4.2 When provided, the information content of the eAIP and the structure of chapters, sections and sub-sections shall follow the content and structure of the paper AIP. The eAIP shall include files that allow for printing a paper AIP.

5.4.3 When provided, the eAIP shall be available on a physical distribution medium (CD, DVD, etc) and/or online on the Internet.

Chapter 6 – NOTAM

6.1 General NOTAM Requirement

6.1.1 The AIS provider shall promptly originate and issue a NOTAM whenever the information to be distributed is of a temporary nature and of short duration or when operationally significant permanent changes, or temporary changes of long duration are made at short notice, except for extensive text and/or graphics.

6.1.2 The AIS provider shall ensure that the NOTAM service to be established shall:

(a) designate a NOF for Singapore;

(b) operate the NOF on a 24-hour basis;

(c) establish agreements with other international NOTAM offices or between the NOTAM offices and multinational NOTAM Processing Units for the exchange of NOTAM;

(d) use appropriate telecommunication facilities to issue and receive NOTAM;

(e) issue a checklist of the NOTAMs that are currently in force, at intervals of not more than one month; and

(f) issue promptly NOTAM in a format in accordance with ICAO Annex 15 and the specifications for NOTAM in PANS-AIM (Doc 10066).

6.1.3 A NOTAM shall be originated and issued concerning the following information:

(a) establishment, closure or significant changes in operation of aerodrome(s) or runways;

(b) establishment, withdrawal and significant changes in operation of aeronautical services including by AGA, AIS, ATS, CNS, MET and SAR operations;

(c) establishment, withdrawal and significant changes in operational capability of radio navigation and air-ground communication services. This includes: interruption or return to operation, change of frequencies, change in notified hours of service, change of identification, change of orientation (directional aids), change of location, power increase or decrease amounting to 50 per cent or more, change in broadcast schedules or contents, or irregularity or unreliability of operation of any radio navigation and air-ground communication services or limitations of relay stations including operational impact, affected service, frequency and area;

(d) unavailability of back-up and secondary systems, having a direct operational impact;

(e) establishment, withdrawal or significant changes made to visual aids;

(f) interruption of or return to operation of major components of aerodrome lighting systems;

(g) establishment, withdrawal or significant changes made to procedures for air navigation services;

(h) occurrence or correction of major defects or impediments in the manoeuvring area;

(i) changes to and limitations on availability of fuel, oil and oxygen;

(j) major changes to search and rescue facilities and services available;

(k) establishment, withdrawal or return to operation of hazard beacons marking obstacles to air navigation;

(l) changes in regulations requiring immediate action, e.g. prohibited areas for SAR action;

(m) presence of hazards not otherwise promulgated which affect air navigation (including obstacles, military exercises, and operations, intentional and unintentional radio radio frequency interferences, rocket launches, displays, fireworks, sky lanterns, rocket debris, races and major parachuting events outside promulgated sites);

(ma) conflict zones which affect air navigation (to include information that is as specific as possible regarding the nature and extent of threats of that conflict and its consequences for civil aviation);

Note.— Guidance related to conflict zones is contained in the Risk Assessment Manual for Civil Aircraft Operations Over or Near Conflict Zones *(Doc 10084).*

(n) planned laser emissions, laser displays and search lights if pilots' night vision is likely to be impaired;

(o) erecting or removal of, or changes to, obstacles to air navigation in the take-off/climb, missed approach, approach areas and runway strip;

(p) establishment or discontinuance (including activation or deactivation) as applicable, or changes in the status of prohibited, restricted or danger areas;

(q) establishment or discontinuance of areas or routes or portions thereof where the possibility of interception exists and where the maintenance of guard on the VHF emergency frequency 121.5 MHz is required;

(r) allocation, cancellation or change of location indicators;

(s) changes in aerodrome rescue and fire fighting category provided as required in Annex 14, Volume I, Chapter 9, and Attachment A, Section 17 of Annex 14);

(t) presence or removal of, or significant changes in, hazardous conditions due to snow, slush, ice, radioactive material, toxic chemicals, volcanic ash deposition or water on the movement area;

(u) outbreaks of epidemics necessitating changes in notified requirements for inoculations and quarantine measures;

(v) observations or forecasts of space weather phenomena, the date and time of their occurrence, the flight levels where provided, and portions of the airspace which may be affected by the phenomena;

(w) an operationally significant change in volcanic activity, the location, date and time of volcanic eruptions and/or horizontal and vertical extent of volcanic ash cloud, including direction of movement, flight levels and routes or portions of routes which could be affected;

(x) release into the atmosphere of radioactive materials or toxic chemicals following a nuclear or chemical incident, the location, date and time of the incident, the flight levels and routes or portions thereof which could be affected and the direction of movement;

(y) establishment of operations of humanitarian relief missions, such as those undertaken under the auspices of the United Nations, together with procedures and/or limitations which affect air navigation; and

(z) implementation of short-term contingency measures in cases of disruption, or partial disruption, of air traffic services and related supporting services according to Annex 11 paragraph 2.31 and Attachment C to Annex 11.

6.1.4 The following information shall not be notified by NOTAM:

(a) routine maintenance work on aprons and taxiways which does not affect the safe movement of aircraft;

(b) runway marking work, when aircraft operations can safely be conducted on other available runways, or the equipment used can be removed when necessary;

(c) temporary obstructions in the vicinity of aerodromes that do not affect the safe operation of aircraft;

(d) partial failure of aerodrome lighting facilities where such failure does not directly affect aircraft operations;

(e) partial temporary failure of air-ground communications when suitable alternative frequencies are known to be available and are operative;

(f) the lack of apron marshalling services and road traffic control;

(g) the unserviceability of location, destination or other instruction signs on the aerodrome movement area;

(h) parachuting when in uncontrolled airspace under VFR (see MOS-AIS Paragraph 6.1.3 m), when controlled, at promulgated sites or within danger or prohibited areas;

(i) training activities by ground units;

(j) unavailability of back-up and secondary systems if these do not have an operational impact;

(k) limitations to airport facilities or general services with no operational impact;

(l) national regulations not affecting general aviation;

(m) announcement or warnings about possible/potential limitations, without any operational impact;

(n) general reminders on already published information;

(o) availability of equipment for ground units without containing information on the operational impact for airspace and facility users;

(p) information about laser emissions without any operational impact and fireworks below minimum flying heights;

(q) closure of movement area parts in connection with planned work locally coordinated of duration of less than one hour;

(r) closure, changes, unavailability in operation of aerodrome(s) outside the aerodrome(s) operational hours;

(s) other non-operational information of a similar temporary nature.

Note.— Information which relates to an aerodrome and its vicinity and does not affect its operational status may be distributed locally during pre-flight or in-flight briefing or other local contact with flight crew member.

6.2 Specific NOTAM Requirement

6.2.1 The AIS provider shall ensure that:

(a) each NOTAM issued is allocated a series identified by a letter and a four-digit number followed by a stroke and a two-digit number for the year. The four-digit number shall be consecutive and based on the calendar year;

(b) each NOTAM issued is brief, deal with only one subject, and be compiled so that its meaning is clear without reference to another document;

(c) if a NOTAM contains information that requires an amendment to the AIP or an AIP Supplement, the NOTAM shall contain a cross reference to the affected AIP text or AIP Supplement;

(d) if a NOTAM is issued which cancels or supersedes a previous NOTAM, the serial number of the previous NOTAM shall be specified;

(e) if an error is detected in a NOTAM, a replacement NOTAM which cancels the original shall be issued;

6.3 Distribution of NOTAM

6.3.1 The AIS provider shall ensure that each NOTAM is distributed on the basis of a request and where possible be distributed as a single telecommunication message.

6.3.2 The AIS provider shall ensure that whenever practicable, the AFS is employed for NOTAM distribution. A predetermined distribution system for NOTAM transmitted on the AFS shall be used, subject to agreement established with other international NOTAM offices.

Chapter 7 – Pre-flight and Post-flight Information Service

7.1 Pre-flight Information

7.1.1 The AIS provider shall make available to flight operations personnel, including flight crews at aerodromes of departure in Singapore, aeronautical information that is essential for the safety, regularity and efficiency of air navigation.

7.1.2 The aeronautical information to be provided for pre-flight information shall include:

(a) Information of operational significance from the relevant elements of the aeronautical Information products

(b) a summary of valid NOTAM of operational significance and other information of an urgent character, in the form of plain-language pre-flight information bulletins (PIB);

7.1.3 An AIS shall, in addition, obtain aeronautical data and aeronautical information to enable it to provide pre-flight information service and to meet the need for in-flight information:

(a) from the AIS of other States;

(b) from other sources that may be available.

7.1.4 Aeronautical data and aeronautical information obtained under MOS-AIS, paragraph 7.1.3(a) shall, when distributed, be clearly identified as having the authority of the originating State.

7.2 Automated Pre-flight Information System

7.2.1 The AIS provider shall ensure that the automated pre-flight information system for the supply of aeronautical data and aeronautical information for self-briefing, flight planning and flight information service:

(a) provide for continuous and timely updating of the system database and monitoring of the validity and quality of the aeronautical data stored;

(b) permit access by operations personnel, including flight crew members and other aeronautical users through suitable telecommunications means;

(c) ensure provision, in paper copy form, of the aeronautical data and aeronautical information accessed, as required;

(d) use access and interrogation procedures based on abbreviated plain language and ICAO location indicators, as appropriate; and

(e) provide rapid response to a user request for information.

7.3 Post-flight Information

7.3.1 The AIS provider shall ensure that arrangements shall be made to receive at Singapore aerodromes, information concerning the state and operation of air navigation facilities and the presence of wildlife hazard noted by aircrews and shall ensure that such information is made available for such distribution as the circumstances necessitate.

Chapter 8 – Aeronautical Information Regulation and Control

8.1 The AIS provider shall publish under the AIRAC system, i.e. basing establishment, withdrawal or significant changes upon a series of common effective dates at intervals of 28 days, including 8 November 2018, information concerning the following circumstances:

(a) Limits (horizontal and vertical), regulations and procedures applicable to:

1. flight information regions;
2. control areas;
3. control zones;
4. advisory areas;
5. ATS routes;
6. permanent danger, prohibited and restricted areas (including type and periods of activity when known) and ADIZ;
7. permanent areas or routes or portions thereof where the possibility of interception exists.

(b) Positions, frequencies, call signs, identifiers, known irregularities and maintenance periods of radio navigation aids, and communication and surveillance facilities.

(c) Holding and approach procedures, arrival and departure procedures, noise abatement procedures and any other pertinent ATS procedures.

(d) Transition levels, transition altitudes and minimum sector altitudes.

(e) Meteorological facilities (including broadcasts) and procedures.

(f) Runways and stopways.

(g) Taxiways and aprons.

(h) Aerodrome ground operating procedures (including low visibility procedures).

(i) Approach and runway lighting.

(j) Singapore Aerodromes operating minima when published.

8.2 The information under the AIRAC system shall be made available by the AIS provider so as to reach recipients at least 28 days in advance of the effective date. The information published under the AIRAC system shall not be changed further for at least another 28 days after the effective date, unless the circumstance notified is of a temporary nature and would not persist for the full period.

8.3 The AIS provider shall publish, on a yearly basis, an AIC listing the AIRAC effective dates, publication dates and latest dates on which the raw data must reach AIS in order for an AIRAC AIP Supplement to be published and reach recipients at least 28 days in advance of the effective date

8.4 When information has not been submitted by the AIRAC date, a NIL notification shall be distributed not later than one cycle before the AIRAC effective date concerned.

8.5 The AIS provider shall ensure that implementation dates other than AIRAC effective dates shall not be used for pre-planned operationally significant changes requiring cartographic work and/or for updating of navigation databases.

8.6 When an AIP Amendment or an AIP Supplement is published in accordance with AIRAC procedures, a “Trigger” NOTAM shall be originated based on specifications in PANS-AIM (10066)

Chapter 9 – Aeronautical Information Circular

9.1 The AIS provider shall originate an AIC whenever it is necessary to promulgate aeronautical information which does not qualify for inclusion in the AIP or NOTAM. An AIC shall be used to provide:

(a) a long-term forecast of any major change in legislation, regulations, procedures or facilities; or

(b) information of a purely explanatory or advisory nature liable to affect flight safety; or

(c) information or notification of an explanatory or advisory nature concerning technical, legislative or purely administrative matters.

9.2 Each AIC shall be allocated a serial number which should be consecutive and based on the calendar year.

9.3 A checklist of currently valid AIC shall be issued at least once a year.

9.4 The validity of AIC currently in force shall be reviewed at least once a year.

Chapter 10 – Documentation and Records

10.1 Documents and Records to be Maintained

10.1.1 The AIS provider shall maintain all documents and records which are necessary for the operation of the service. Copies of these documents shall also be made available to personnel where needed. These documents shall include but not limited to:

(a) the Manual of Standards – Aeronautical Information Services;

(b) the AIS provider's operations manual;

(c) ICAO Annexes 4 and 15, Doc 8126, Doc 9859, Doc 10066 and other relevant ICAO documents;

(d) records of all incoming and outgoing aeronautical information to be identified by serial number and date;

(e) records of each person who is authorised to check, edit and publish aeronautical information;

(f) records of quality and safety audit reports;

(g) records of reporting, investigation and correction of error;

(h) records of job description, training programme and plan of each staff.

10.2 Document Control

10.2.1 The AIS provider shall establish a process for the authorization and amendment of the documents stipulated in paragraph 10.1.1 to ensure that they are constantly updated. The AIS provider shall establish a system to ensure that:

(a) the currency of the documents can be readily determined;

(b) amendments to the documents are controlled in accordance with established quality management principles; and

(c) only current versions of documents are available.

10.2.2 The AIS provider shall ensure that where documents are held as computer based records and where paper copies of computer based records are made, they are subjected to the same control as paper documents.

Chapter 11 – Digital data sets

11.1 Digital data sets

11.1.1 Digital data shall be in the form of the following data sets:

(a) terrain data sets;

(b) obstacle data sets;

(c) AIP data set;

(d) aerodrome mapping data sets; and

(e) instrument flight procedure data sets.

11.1.2 Specifications concerning the content of the digital data sets shall be based on the requirements in PANS-AIM (Doc 10066).

11.1.3 Each data set shall be provided to the next intended user together with at least the minimum set of metadata based on the specifications in Annex15 and PANS-AIM (Doc 10066) that ensures traceability.

11.1.4 A checklist of valid data sets shall be regularly provided.

11.2 Terrain and obstacle data sets

11.2.1 The coverage areas for sets of terrain and obstacle data shall be specified as:

Area 1: the entire territory of Singapore;

Area 2: within the vicinity of an aerodrome, sub-divided as follows;

Area 2a: a rectangular area around a runway that comprises the runway strip plus any clearway that exists.

Note.— See ICAO Annex 14, Volume I, Chapter 3 for dimensions for runway strip.

Area 2b: an area extending from the ends of Area 2a in the direction of departure, with a length of 10 km and a splay of 15 per cent to each side;

Area 2c: an area extending outside Area 2a and Area 2b at a distance of not more than 10 km from the boundary of Area 2a; and

Area 2d: an area outside the Areas 2a, 2b and 2c up to a distance of 45 km from the aerodrome reference point, or to an existing TMA boundary, whichever is nearest;

Area 3: the area bordering an aerodrome movement area that extends horizontally from the edge of a runway to 90 m from the runway centre line and 50 m from the edge of all other parts of the aerodrome movement area.

Area 4: the area extending 900 m prior to the runway threshold and 60 m each side of the extended runway centre line in the direction of the approach on a precision approach runway, Category II or III.

11.2.2 Terrain data shall be provided for Area 1. The obstacle data shall be provided for obstacles in Area 1 whose height is 100 m or higher above ground.

11.2.3 Obstacle data shall be provided for all obstacles within Area 2 that are assessed as being a hazard to air navigation.

11.2.4 Terrain data shall be provided for:

(a) Area 2a;

(b) The take-off flight path area;

(c) An area bounded by the lateral extents of the aerodrome obstacle limitation surfaces;

(d) Area 3; and

(e) Terrain data shall be provided for Area 4 for all runways where precision approach Category II or III operations have been established and where detailed terrain information is required by operators to enable them to assess the effect of terrain on decision height determination by use of radio altimeters.

Note.— Area 4 terrain data and Area 2 obstacle data are normally sufficient to support the production of the Precision Approach Terrain Chart — ICAO. When more detailed obstacle data is required for Area 4, this may be provided in accordance with the Area 4 obstacle data requirements specified in ICAO PANS-AIM (Doc 10066), Appendix 6, Table A6-2. Guidance on appropriate obstacles for this chart is given in the ICAO Aeronautical Chart Manual (Doc 8697).

11.2.4.1 Additional terrain data shall be provided within Area 2 as follows:

(a) in the area extending to 10 km from the ARP; and

(b) within the area between 10 km and the TMA boundary or 45-km radius (whichever is smaller) where terrain penetrates a horizontal terrain data collection surface specified as 120 m above the lowest runway elevation.

11.2.5 Obstacle data shall be provided for:

11.2.5.1 **Area 2a:**

(a) For those obstacles that penetrate an obstacle data collection surface outlined by a rectangular area around a runway that comprises the runway strip plus any clearway that exists. The Area 2a obstacle collection surface shall have height of 3 m above the nearest runway elevation measured along the runway centre line, and for those portions related to a clearway, if one exists, at the elevation of the nearest runway end;

(b) Objects in the take-off flight path area which project above a plane surface having a 1.2 per cent slope and having a common origin with the take-off flight path area; and

(c) penetrations of the aerodrome obstacle limitation surfaces.

Note.— Take-off flight path areas are specified in ICAO Annex 4, 3.8.2. Aerodrome obstacle limitation surfaces are specified in ICAO Annex 14, Volume 1, Chapter 4.

11.2.5.2 **Areas 2b, 2c and 2d**: for obstacles that penetrate the relevant obstacle data collection surface specified as follows:

(a) Area 2b: an area extending from the ends of Area 2a in the direction of departure, with a length of 10 km and a splay of 15% to each side. The Area 2b obstacle collection surface has a 1.2% slope extending from the ends of Area 2a at the elevation of the runway end in the direction of departure, with a length of 10 km and a splay of 15% to each side;

(b) Area 2c: an area extending outside Area 2a and Area 2b at a distance of not more than 10 km from the boundary of Area 2a. The Area 2c obstacle collection surface has a 1.2% slope extending outside Area 2a and Area 2b at a distance of not more than 10 km from the boundary of Area 2a. The initial elevation of Area 2c shall be the elevation of the point of Area 2a at which it commences; and

(c) Area 2d: an area outside the Areas 2a, 2b and 2c up to a distance of 45 km from the aerodrome reference point, or to an existing TMA boundary, whichever is nearest. The Area 2d obstacle collection surface has a height of 100 m above ground;

except that data need not be collected for obstacles less than a height of 3 m above ground in Area 2b and less than a height of 15 m above ground in Area 2c.

11.2.5.3 **Area 3**: for obstacles that penetrate the relevant obstacle data collection surface extending a half-metre (0.5 m) above the horizontal plane passing through the nearest point on the aerodrome movement area.

11.2.5.4 **Area 4**: for all runways where precision approach Category II or III operations have been established.

11.3 Terrain data set

11.3.1 Terrain data sets shall contain digital representation of the terrain surface in the form of continuous elevation values at all intersections (points) of a defined grid, referenced to common datum.

11.3.2 Sets of Terrain data shall include spatial (position and elevation), thematic and temporal aspects for the surface of the Earth containing naturally occurring features such as mountains, hills, ridges, valleys, bodies of water, permanent ice and snow, and excluding obstacles. Depending on the acquisition method used, this shall represent the continuous surface that exists at the bare Earth, the top of the canopy or something in-between, also known as “first reflective surface”.

11.3.3 In terrain data sets, only one feature type, i.e. terrain, shall be provided. Feature attributes describing terrain shall be those listed in PANS-AIM (Doc 10066) Appendix 6, Table A6-1. The terrain feature attributes listed in Appendix 6, Table A6-1 represent the minimum set of terrain attributes, and those annotated as mandatory shall be recorded in the terrain data set.

11.3.4 Terrain data for each area shall conform to the applicable numerical requirements in PANS-AIM (Doc 10066) Appendix 1.

11.4 Obstacle data set

11.4.1 Obstacle data sets shall contain the digital representation of the vertical and horizontal extent of obstacles. Obstacles data shall not be included in terrain data sets. Obstacle data elements are features that shall be represented in the data sets by points, lines or polygons.

11.4.2 In an obstacle data set, all defined obstacle feature types shall be provided and each of them shall be described according to the list of mandatory attributes provided in ICAO PANS-AIM (Doc 10066), Appendix 6, Table A6-2.

Note.— By definition, obstacles can be fixed (permanent or temporary) or mobile. Specific attributes associated with mobile (feature operations) and temporary types of obstacles are annotated in ICAO PANS-AIM (Doc 10066). Appendix 6, Table A6-2, as optional attributes. If these types of obstacles are to be provided in the data set, appropriate attributes describing such obstacles are also required.

11.4.3 Obstacle data for each area shall conform to the applicable numerical requirements in ICAO PANS-AIM (Doc 10066), Appendix 1.

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11.5 AIP data set

11.5.1 An AIP data set shall be provided covering the extent of information as provided in the AIP.

11.5.2 Where it is not possible to provide a complete AIP data set, the data subset(s) that are available shall be provided.

11.5.3 The AIP data set shall contain the digital representation of aeronautical information of lasting character (permanent information and long duration temporary changes) essential to air navigation.

11.6 Aerodrome mapping data sets

11.6.1 Aerodrome mapping data sets shall contain the digital representation of aerodrome features. Aerodrome features shall consist of attributes and geometries, which are characterized as points, lines or polygons.

11.6.2 Aerodrome mapping data sets shall be made available.

11.7 Instrument flight procedure data sets

11.7.1 Instrument flight procedure data sets shall contain the digital representation of instrument flight procedures.

11.7.2 Instrument flight procedures data sets shall be made available for aerodromes regularly used by international civil aviation.

11.8 Data set updates

11.8.1 Data sets shall be amended or reissued at such regular intervals as may be necessary to keep them up to date.

11.8.2 Permanent changes and temporary changes of long duration (three months or longer) made available as digital data shall be issued in the form of a complete data set or a sub-set that includes only the differences from the previously issued complete data set.

11.8.3 When made available as a completely re-issued data set, the differences from the previously issued complete data set shall be indicated.

11.8.4 Updates to AIP and the digital data sets shall be synchronized.

Chapter 12 – Aeronautical Charts

12.1 The AIS provider shall ensure that all aeronautical charts which are produced in Singapore are in conformity with ICAO Annex 4 and Annex 15.

12.2 The AIS provider shall publish the following aeronautical charts which are applicable in Singapore:

(a) World Aeronautical Chart – ICAO

(b) Aerodrome Chart – ICAO

(c) Aerodrome Obstacle Chart – ICAO Type A

(d) Aerodrome Obstacle Chart – ICAO Type B

(e) Precision Approach Terrain Chart – ICAO

(f) Enroute Chart – ICAO

(g) Area Chart – ICAO

(h) Standard Departure Chart – Instrument (SID) – ICAO

(i) Standard Arrival Chart – Instrument (STAR) – ICAO

(j) Instrument Approach Chart – ICAO

(k) Visual Approach Chart – ICAO

(l) Aerodrome Ground Movement Chart – ICAO

(m) Aerodrome Terrain and Obstacle Chart – ICAO (Electronic)

(n) Aircraft Parking/Docking Chart – ICAO

(o) Aeronautical Chart – ICAO 1:500,000

(p) Aeronautical Navigation Chart – ICAO Small Scale

(q) Plotting Chart – ICAO chart

(r) ATC Surveillance Minimum Altitude Chart – ICAO

12.3 The chart resolution of aeronautical data shall be that as specified for a particular chart.

Note.— Specifications concerning the chart resolution for aeronautical data are contained in the PANS-AIM (Doc 10066), Appendix 1.

12.4 The AIS provider shall ensure that all aeronautical charts listed in 12.2 are readily available to users, including from other ICAO Contracting States. The AIS provider shall take all reasonable measures to ensure that the information it provides and the aeronautical charts made available are adequate and accurate and that they are maintained up-to-date by an adequate revision service.

12.5 The AIS provider shall ensure that each type of aeronautical chart provides information relevant to the function of the chart and its design shall observe human factors principles which facilitate its optimum use.

12.6 The AIS provider shall ensure that the presentation of information in the aeronautical charts is accurate, free from distortion and clutter, unambiguous, and readable under all normal operating conditions.

12.7 The AIS provider shall ensure that aeronautical data quality requirements related to the data integrity and charting resolution are in accordance with ICAO Annex 4 paragraph 2.17. The integrity of the data shall be maintained throughout the data process from origination to the next intended user. Aeronautical data integrity requirements shall be based upon the integrity classification provided in PANS-AIM (Doc 10066) Appendix 1.

12.8 Electronic aeronautical charts shall be provided based on digital databases and the use of geographic information systems.

12.9 With effect from 12 November 2015, the AIS provider shall make available Aerodrome Terrain and Obstacle Chart – ICAO (Electronic) for Singapore civil aerodromes as specified in ICAO Annex 4, Chapter 5.