Civil Aviation Authority of Singapore

Manual of Standards - Aeronautical Information Services

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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
2	2.0	Quality system to be	Ministerial Direction No 1/2010 Arising from AAR		AAR Div (3 Aug 2010)	Chief Executive (3 Aug 2010)	3 Aug 2010

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		ISO 9000 compliance	Div's continual review of MOS-AIS	2.2			
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
4	2.2	Table of Content Forward Definitions Abbreviations Introduction	Arising from AAR Div's continual review of MOS-AIS ICAO Annex 4 incorporating Amendment 57	ii vi vii to ix x 1.5, 1.9	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
		AIS Operation Requirement	ICAO Annex 15 incorporating Amendment 37	2.1.1, 2.1.2			
		Use of Automation		2.1.4 to 2.1.6			
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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.

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DEFINITIONS AND ABBREVIATIONS

Definitions

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

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 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 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 published 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

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

Data Quality
A degree or level of confidence that the data provided meets the requirements of the data user in terms of accuracy, resolution and integrity

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

Integrated Aeronautical Information Package
A package in paper, or electronic media which consists of the following elements:
- AIP, including amendment service;
- Supplements to the AIP;
- NOTAM and PIB;
- AIC; and
- checklists and lists of valid NOTAM.

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

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

Metadata
Data about data (as defined in ISO 19115)

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

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

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

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.

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

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 or efficiency of air navigation is made available in a form in conformity with ICAO Annex 15 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 an Integrated Aeronautical Information Package.

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

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 introduced with the objective of improving the timeliness, 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.— Guidance on the aeronautical information and data exchange models may be found in the ICAO Aeronautical Information Services Manual (Doc 8126).

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 human factors 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 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 survey/origin 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.

2.2 Quality Management System

2.2.1 Quality management systems shall be implemented and maintained by an AIS provider encompassing all functions of an aeronautical information service, as described in paragraph 2.1.2.

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 should 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.

Note 1 – Quality management may be provided by a single quality management system or serial quality management systems.

Note 2, – Letters of agreement concerning data quality between originator and distributor and between distributor and next intended user may be used to manage the aeronautical information data chain.

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 approved organisation.

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 for accuracy, resolution and integrity as specified in paragraph 2.2.6 and that the data traceability requirements are met through the provision of appropriate metadata as specific in 2.1.8 of this Manual. The system shall also provide assurance of the applicability period of intended use of aeronautical information/data as well as that the agreed distribution dates will be met.

2.2.6 The AIS provider shall comply with the order of accuracy for aeronautical data and aeronautical information as specified in ICAO Annex 11, Chapter 2, paragraph 2.19 and Annex 14, Volumes I and II, Chapter 2. The order of publication resolution and data integrity of aeronautical data and aeronautical information shall comply with Annex 15, paragraph 3.3.2.1 and Appendices 1 and 7.

2.2.7 The AIS provider shall ensure that electronic aeronautical data sets, shall be protected by the inclusion in the data sets of a 32-bit cyclic redundancy check (CRC) implemented by the application dealing with the data sets.

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 4 and Appendix 1 of Annex 15.

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 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.

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.

6.3.3 The AIS provider shall ensure that a monthly plain language list of valid NOTAM, including indications of the latest AIP Amendments, AIC issued and a checklist of AIP Supplements is prepared with a minimum of delay and forwarded by the most expeditious means to recipients of the Integrated Aeronautical Information Package.

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) relevant elements of the Integrated Aeronautical Information Package

(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);

(c) relevant maps and charts;

(d) current information relating to the aerodrome of departure concerning the following:

(i) construction or maintenance work on or immediately adjacent to the manoeuvring area;
(ii) rough portions of any part of the manoeuvring area, whether marked or not;
(iii) presence and depth of water on runways and taxiways, including their effect on runway friction;
(iv) parked aircraft or other objects on or immediately next to taxiways;
(v) presence of other temporary hazards, including birds;
(vi) failure or irregular operation of part or all of the aerodrome lighting system and aerodrome power supply;
(vii) failure or irregular operation or changes in the operational status of air navigation facilities;

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 birds 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 the establishment, withdrawal of, and premeditated significant changes (including operational trials) to aeronautical information stipulated under Appendix 4 of ICAO Annex 15. Guidance material on the procedures applicable to the AIRAC system is found in ICAO Doc 8126 – AIS Manual.

8.2 The information under the AIRAC system shall be published in paper copy form and shall be distributed at least 42 days in advance of the effective date with the objective of reaching recipients at least 28 days in advance of the effective date. The information published 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 The AIS provider shall ensure that when updating contents covered by the AIRAC system on its aeronautical database, the effective date of data coincide with the established AIRAC effective date used for the publication of information in paper copy form.

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 originated whenever it is desirable to promulgate:

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

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

(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 AIC currently in force shall be issued at least once a year, with distribution as for the AIC.

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 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 internal 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 – Electronic Terrain and Obstacle Data

11.1 With effect from 12 November 2015, the AIS provider shall made available electronic terrain and obstacle data for Singapore and civil aerodromes as specified in this chapter.

11.2 Coverage areas and requirements for data provision

11.2.1 The coverage areas for sets of electronic 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.

Note.— See ICAO Annex 15 Appendix 8 for descriptions and graphical illustrations of the coverage areas.

11.2.2 Electronic terrain data shall be provided for Area 1. The obstacle data shall be provided for obstacles in Area 1 higher than 100 m above ground.

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

11.2.4 Electronic terrain data shall be provided for:

(a) Area 2a;

(b) The take-off flight path area; and

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

11.2.5 Electronic obstacle data shall be provided for:

(a) Area 2a , for those obstacles that penetrate the relevant obstacle data collection surface specified in Appendix 8;

(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.

11.2.6 Electronic terrain and obstacle data shall be provided for Area 4 for terrain and obstacles that penetrate the relevant obstacle data collection surface specified in ICAO Annex 15 Appendix 8, 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 Annex 15 Appendix 8, Table A8-2. Guidance on appropriate obstacles for this chart is given in the ICAO Aeronautical Chart Manual (Doc 8697).

11.3 Terrain data set — content, numerical specification and structure

11.3.1 A terrain data set shall contain digital sets of data representing terrain surface in the form of continuous elevation values at all intersections

(points) of a defined grid, referenced to common datum. A terrain grid shall be angular or linear and shall be of regular or irregular shape.

Note.— In regions of higher latitudes, latitude grid spacing may be adjusted to maintain a constant linear density of measurement points.

11.3.2 Sets of electronic 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. In practical terms, 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 ICAO Annex 15 Appendix 8 Table A8-3. The terrain feature attributes listed in Table A8-3 represent the minimum set of terrain attributes, and those annotated as mandatory shall be recorded in the terrain data set.

11.3.4 Electronic terrain data for each area shall conform to the applicable numerical requirements in ICAO Annex 15 Appendix 8, Table A8-1.

11.4 Obstacle data set — content, numerical specification and structure

11.4.1 Obstacle data shall comprise the digital representation of the vertical and horizontal extent of the obstacle. Obstacles 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 Appendix 8, Table A8-4.

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 Appendix 8, Table A8-4, 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 Electronic obstacle data for each area shall conform to the applicable numerical requirements in ICAO Annex 15 Appendix 8, Table A8-2.

11.5 Terrain and obstacle data product specifications

11.5.1 To allow and support the interchange and use of sets of electronic terrain and obstacle data among different data providers and data users, the ISO 19100 series of standards for geographic information shall be used as a general data modelling framework.

11.5.2 A comprehensive statement of available electronic terrain and obstacle data sets shall be provided in the form of terrain data product specifications as well as obstacle data product specifications on which basis air navigation users will be able to evaluate the products and determine whether they fulfil the requirements for their intended use (application).

Note.— ISO Standard 19131 specifies the requirements and outline of data product specifications for geographic information.

11.5.3 Each terrain data product specification shall include an overview, a specification scope, data product identification, data content and structure, reference system, data quality, data capture, data maintenance, data portrayal, data product delivery, additional information, and metadata.

11.5.4 The overview of terrain data product specification or obstacle data product specification shall provide an informal description of the product and shall contain general information about the data product. Specification of terrain data may not be homogenous across the whole data product but may vary for different parts of the data sets. For each such subset of data, a specification scope shall be identified. Identification information concerning both terrain and obstacle data products shall include the title of the product; a brief narrative summary of the content, purpose, and spatial resolution if appropriate (a general statement about the density of spatial data); the geographic area covered by the data product; and supplemental information.

11.5.5 Content information of feature-based terrain data sets or of feature-based obstacle data sets shall each be described in terms of an application schema and a feature catalogue. Application schema shall provide a formal description of the data structure and content of data sets while the feature catalogue shall provide the semantics of all feature types together with their attributes and attribute value domains, association types between feature types and feature operations, inheritance relations and constraints. Coverage is considered a subtype of a feature and can be derived from a collection of features that have common attributes. Both terrain and obstacle data product specifications shall identify clearly the coverage and/or imagery they include and shall provide a narrative description of each of them.

Note 1.— ISO Standard 19109 contains rules for application schema while ISO Standard 19110 describes feature cataloguing methodology for geographic information.

Note 2.— ISO Standard 19123 contains schema for coverage geometry and functions.

11.5.6 Both terrain data product specifications and obstacle data product specifications shall include information that identifies the reference system used in the data product. This shall include the spatial reference system and temporal reference system. Additionally, both data product specifications shall identify the data quality requirements for each data product. This shall include a statement on acceptable conformance quality levels and corresponding data quality measures. This statement shall cover all the data quality elements and data quality sub-elements, even if only to state that a specific data quality element or sub-element is not applicable.

Note.— ISO Standard 19113 contains quality principles for geographic information while ISO Standard 19114 covers quality evaluation procedures.

11.5.7 Terrain data product specifications shall include a data capture statement which shall be a general description of the sources and of processes applied for the capture of terrain data. The principles and criteria applied in the maintenance of terrain data sets and obstacle data sets shall also be provided with the data specifications, including the frequency with which data products are updated. Of particular importance shall be the maintenance information of obstacle data sets and an indication of the principles, methods and criteria applied for obstacle data maintenance.

11.5.8 Terrain data product specifications shall contain information on how data held with data sets is presented, i.e. as a graphic output, as a plot or as an image. The product specifications for both terrain and obstacles shall also contain data product delivery information which shall include delivery formats and delivery medium information.

Note.— ISO Standard 19117 contains a definition of the schema describing the portrayal of geographic information including the methodology for describing symbols and mapping of the schema to an application schema.

11.5.9 The core terrain and obstacle metadata elements shall be included in the data product specifications. Any additional metadata items required to be supplied shall be stated in each product specification together with the format and encoding of the metadata.

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

11.5.10 The obstacle data product specification, supported by geographical coordinates for each aerodrome included within the dataset, shall describe the following areas:

— Areas 2a, 2b, 2c, 2d;

— the take-off flight path area; and

— the obstacle limitation surfaces.

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.

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

12.3 For the Aerodrome Obstacle Chart – ICAO Type B, the horizontal scale shall be 1:25 000.

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 and Tables 1 to 5 in Appendix 6. The integrity of the data shall be maintained throughout the data process from survey/origin to the next intended user. Aeronautical data integrity requirement shall be based upon the potential risk resulting from the corruption of data and the use to which the data item is put.

12.8 The AIS provider shall ensure that electronic aeronautical data shall be protected by the inclusion in the data sets of a 32-bit cyclic redundancy check (CRC) implemented by the application dealing with the data sets.

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.