สำนักงานการบินพลเรือนแห่งประเทศไทย
The Civil Aviation Authority of Thailand

Manual of Standards

Aeronautical Meteorological Services

CAAT-ANS-MOSMET

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Approved By

Chula Sukmanop, PhD

Director General

The Civil Aviation Authority of Thailand

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Foreword

The General Director of The Civil Aviation Authority of Thailand is responsible under Section 15/17(4) of the Air Navigation Act B.E. 2497 amended by the Air Navigation Act (No. 14) B.E. 2562 for issuing CAAT regulation on Air Navigation Services for Aeronautical Meteorological Services Standards to stipulate qualifications, rules, procedures, conditions, standards and practical guidance for the following matters to ensure conformity with current and timely International Standards.

The Manual of Standards (hereinafter 'MOS') is the means CAAT uses to meet its responsibilities under Section 15/17 (4) of the Air Navigation Act B.E. 2497 amended by the Air Navigation Act (No. 14) B.E. 2562, CAAT regulation No. 19 on Air Navigation Services for Aeronautical Meteorological Services Standards and CAAT rule on Manual of Standards – Aeronautical Meteorological Services for promulgating standards for Aeronautical Meteorological Services. The MOS prescribes the detailed technical material (aviation safety standards) that is determined to be necessary for the safety of air navigation.

The MOS is referenced in the particular regulation. You should refer to the applicable provisions of the Air Navigation Act B.E. 2497 amended by the Air Navigation Act (No. 14) B.E. 2562 and CAAT Regulation, Requirement and Rules together with this MOS, to ascertain the requirements of, and the obligations imposed by or under the civil aviation legislation.

Readers should forward advice of errors, inconsistencies or suggestions for improvement to this manual to the Manager, Air Navigation Services Standards Department (please see in subsection 1.1.6.3).

The MOS is issued and amended under the authority of the Director General of Civil Aviation Authority of Thailand.

Chula Sukmanop, PhD
Director General
The Civil Aviation Authority of Thailand

Record of Revision

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Chapter 1 Introduction

1.1 General

1.1.1 Background

1.1.1.1 This MOS is made under the Air Navigation Act B.E. 2497 amended by the Air Navigation Act (No. 14) B.E. 2562. CAAT Regulation, Requirement and Rules refers to the standards and methods to be used in regulating:

a) the standards for compliance, include:
   1) the Operations Manual;
   2) the provider's organization, meteorological facilities and equipment, personnel competency and training requirement, quality management system, safety management; and
b) discontinuance of the service.

1.1.2 Document Set

1.1.2.1 The document hierarchy consists of:

a) The Air Navigation Act B.E.2497 amended by the Air Navigation Act (No. 14) B.E. 2562 (the Act) and the Civil Aviation Emergency Decree B.E.2558 (the Decree)[1]; and
b) The Civil Aviation Authority of Thailand Regulation Requirement and Rules[2] (The CAAT Regulation Requirement and Rules); and
c) Manual of Standards (MOS); and
d) Advisory Circulars (ACs).

1.1.2.2 The Decree establishes the Civil Aviation Authority of Thailand (CAAT) with functions relating to civil aviation, in particular the safety of civil aviation, and related purposes.

1.1.2.3 The CAAT regulation and requirement establish the regulatory framework (Regulations) within which all service providers must operate.

1
- พระราชบัญญัติการเดินอากาศ พ.ศ. 2497 แก้ไขเพิ่มเติมโดย พระราชบัญญัติการเดินอากาศ (ฉบับที่ 14) พ.ศ.2562
- พระราชกำหนดการบินพลเรือนแห่งประเทศไทย พ.ศ. 2558

2
- ข้อบังคับของสำนักงานการบินพลเรือนแห่งประเทศไทย ฉบับที่ 19 ว่าด้วยมาตรฐานการบริการการเดินอากาศ ด้านอุตุนิยมวิทยาการบิน
- ข้อกำหนดของสำนักงานการบินพลเรือนแห่งประเทศไทย ฉบับที่ 25 ว่าด้วยการขอและออกใบรับรองบริการการเดินอากาศ
- ประกาศสำนักงานการบินพลเรือนแห่งประเทศไทย เรื่อง การกำหนดประเภทนิติบุคคล อายุใบรับรอง และหน้าที่อื่นของผู้ได้รับใบรับรองบริการการเดินอากาศ
- ระเบียบสำนักงานการบินพลเรือนแห่งประเทศไทย ว่าด้วยการจัดทำรายงานของผู้ได้รับใบรับรองบริการการเดินอากาศ
- ระเบียบสำนักงานการบินพลเรือนแห่งประเทศไทย ว่าด้วยคู่มือมาตรฐานการให้บริการอุตุนิยมวิทยาการบิน
- ระเบียบสำนักงานการบินพลเรือนแห่งประเทศไทย ว่าด้วยคู่มือการดำเนินงานด้านอุตุนิยมวิทยาการบิน

1.1.2.4 The MOS comprises specifications (Standards) prescribed by CAAT, of uniform application, determined to be necessary for the safety of air navigation. In those parts of the MOS where it is necessary to establish the context of standards to assist in their comprehension, the sense of parent regulations has been reiterated.

1.1.2.5 Readers should understand that in the circumstance of any perceived disparity of meaning between MOS and the CAAT regulations/requirements, primacy of intent rests with the regulations/requirements. Where there is any inconsistency between the regulations/requirements and the MOS, the regulations/requirements prevail.

1.1.2.6 Service providers must document internal actions (Rules) in their own operational manuals, to ensure the maintenance of and compliance with standards.

1.1.2.7 ACs are intended to provide recommendations and guidance to illustrate a means, but not necessarily the only means of complying with the Regulations/Requirements. ACs may explain certain regulatory requirements by providing interpretive and explanatory materials. It is expected that service providers will document internal actions in their own operational manuals, to put into effect those, or similarly adequate, practices.

1.1.2.8 Where MET service provider is unable to comply with any provision in any of this MET MOS, MET service provider shall inform the CAAT within a reasonable period of time and in writing. MET service provider shall explain the basis for its non-compliance and propose alternative steps to ensure that an equivalent level of safety is established. The CAAT will review MET service provider's proposal in a timely fashion and approve the proposal, subject to such other conditions it may impose. MET service provider is required to follow-up diligently and thereafter report to CAAT within a reasonable period.

1.1.2.9 Where the CAAT has approved MET service provider's proposal in subsection 1.1.2.8, MET service provider shall record the approved alternative steps to be taken in MET service provider's operations manuals. The operations manuals shall also contain the details of and rationale for the alternative steps, and any result limitations or conditions imposed.

1.1.3 Editorial Practices

1.1.3.1 To avoid any misunderstanding within the MOS, the words 'shall' as used within the requirements indicate the compliance is compulsory while 'should' means that it is strongly advisable that an instruction is carried out; it is recommended or discretionary.

1.1.4 Differences Between ICAO Standards and MOS.

1.1.4.1 Notwithstanding the above, where there is a difference between a standard prescribed in ICAO documents and the Manual of Standards (MOS), the MOS standard shall prevail.

1.1.5 Differences Published in AIP.

1.1.5.1 Differences from ICAO Standards, Recommended Practices and Procedures are published in AIP GEN 1.7.

1.1.6 MOS Documentation Change Management.

1.1.6.1 The Air Navigation Services Standards Department (ANS) has responsibility for the technical content of this MOS.

1.1.6.2 This MOS is issued, and may only be amended, under the authority of the DGCA.

1.1.6.3 Suggested changes to this MOS may be given to Manager, Air Navigation Services Standards Department, CAAT by:

Email: ans@caat.or.th

1.1.6.4 Requests for any change to the content of this MOS may come from:

a) technical areas within CAAT; or

b) aviation industry service providers or operators; or

c) individuals or authorization holders.

1.1.6.5 The need to change standards in this MOS may arise for any of the following reasons:

a) to ensure safety;

b) to ensure standardisation;

c) to respond to changed CAAT standards;

d) to respond to ICAO prescription; and

e) to accommodate proposed initiatives or new technologies.

1.1.6.6 CAAT may approve trials of new procedures or technologies to develop appropriate standards.

1.1.7 Related Documents

1.1.7.1 These standards should be read in conjunction with:

a) Civil Aviation Authority of Thailand Regulations and Requirements;

b) ICAO Annex 3: Meteorological Service for International Air Navigation;

c) ICAO Annex 10: Aeronautical Telecommunications, Volume II – Communications Procedures;

d) ICAO Annex 11: Air Traffic Services (MET related issues only);

e) ICAO Annex 15: Aeronautical Information Services (MET related issues only);

f) ICAO Annex 19: Safety Management System;

g) ICAO Manual of Aeronautical Meteorological Practice (Doc 8896);

h) ICAO Manual on coordination between Air Traffic Services Aeronautical Information Services and Meteorological Services (Doc 9377);

i) ICAO Manual of Runway Visual Range Observing and Reporting Practices (Doc 9328);

j) ICAO Manual on Low Level Wind-shear (Doc 9817);

k) ICAO Manual on Automatic Meteorological Observing Systems at Aerodromes (Doc 9837);

l) ROBEX HANDBOOK

m) ASIA/PACIFIC REGIONAL SIGMET GUIDE

n) WMO Technical Regulations on General Meteorological Standards and Recommended Practices (WMO No 49, Volume I); and

o) AIP-Thailand.

1.2 Definitions and Abbreviations

1.2.1 Definitions

For the purpose of this MET MOS, the definition as contained in the ICAO annex and ICAO document, as amended from time to time, shall apply unless as otherwise indicated in AIP or as follow:

Definition	Meaning
Aerodrome	A defined area on land or water (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 climatological summary	Concise summary of specified meteorological elements an aerodrome, based on statistical data.
Aerodrome climatological table	Table providing statistical data on the observed occurrence of one or more meteorological elements at an aerodrome.
Aerodrome control tower	A unit established to provide air traffic control service to aerodrome traffic.
Aerodrome elevation	The elevation of the highest point of the landing area.
Aerodrome meteorological office	An office designated to provide meteorological service for aerodromes serving international air navigation.
Aerodrome reference point	The designated geographical location of an aerodrome.
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 fixed telecommunication network (AFTN)	A worldwide system of aeronautical fixed circuits provided, as part of the aeronautical fixed service, for the exchange of messages and/or digital data between aeronautical fixed stations having the same or compatible communications characteristics.

Definition	Meaning
Aeronautical meteorological Personnel (AMP)	Aeronautical meteorological Personnel (AMP) refers to the Aeronautical Meteorological Forecaster (AMF), Aeronautical Meteorological Observer (AMOB) and Aeronautical Meteorological Technician (AMT) whose duties and responsibilities support aeronautical meteorological services.
Aeronautical meteorological station	A station designated to make observations and meteorological reports for use in international air navigation.
Aeronautical mobile service (RR S1.32)	A mobile service between aeronautical stations and aircraft stations, or between aircraft stations, in which survival craft stations may participate; emergency position-indicating radio beacon stations may also participate in this service on designated distress and emergency frequencies.
Aeronautical telecommunication station	A station in the aeronautical telecommunication service.
Aircraft	Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.
Aircraft observation	The evaluation of one or more meteorological elements made from an aircraft in flight.
AIRMET information	Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of low-level aircraft operations and which was not already included in the forecast issued for low-level flights in the flight information region concerned or sub-area thereof.
Air-report	A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting.

Definition	Meaning
	Note. — Details of the AIREP form are given in the PANS-ATM (Doc 4444).
Air traffic services unit	A generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office.
Alternate aerodrome	An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing where the necessary services and facilities are available, where aircraft performance requirements can be met and which is operational at the expected time of use. Alternate aerodromes include the following: a) Take-off alternate. An alternate aerodrome at which an aircraft would be able to land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure. b) En-route alternate. An alternate aerodrome at which an aircraft would be able to land in the event that a diversion becomes necessary while en route. c) Destination alternate. An alternate aerodrome at which an aircraft would be able to land should it become either impossible or inadvisable to land at the aerodrome of intended landing. *Note. — The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for that flight.*
Altitude	The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).
Approach control unit	A unit established to provide air traffic control service to controlled flights arriving at, or departing from, one or more aerodromes.
Appropriate ATS authority	The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned.
Area control centre (ACC)	A unit established to provide air traffic control service to controlled flights in control areas under its jurisdiction.

Definition	Meaning
Area navigation (RNAV)	A method of navigation which permits aircraft operations 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.*
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 event contract, ADS demand contract, ADS periodic contract or an emergency mode.*
Briefing	Oral commentary on existing and/or expected meteorological conditions.
Ceiling	The height above the ground or water of the base of the lowest layer of cloud below 20 000 ft (6 000 m) covering more than half the sky.
Cloud of operational significance	A cloud with the height of cloud base below 5 000 ft (1 500 m) or below the highest minimum sector altitude, whichever is greater, or a cumulonimbus cloud or a towering cumulus cloud at any height.
Consultation	Discussion with a meteorologist or another qualified person of existing and/or expected meteorological conditions relating to flight operations; a discussion includes answers to questions.
Control area (CTA)	A controlled airspace extending upwards from a specified limit above the earth.
Cruising level	A level maintained during a significant portion of a flight.
Elevation	The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.
Extended range operation	Any flight by an aeroplane with two turbine engines where the flight time at the one engine inoperative cruise speed (in ISA and still air

Definition	Meaning
	conditions), from a point on the route to an adequate alternate aerodrome, is greater than the threshold time approved by the State of the Operator.
Flight crew member	A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.
Flight documentation	Written or printed documents, including charts or forms, containing meteorological information for a flight.
Flight information centre (FIC)	A unit established to provide flight information service and alerting service.
Flight information region (FIR)	An airspace of defined dimensions within which flight information service and alerting service are provided.
Flight level	A surface of constant atmospheric pressure which is related to a specific pressure datum, 1013.2 hectopascals (hPa), and is separated from other such surfaces by specific pressure intervals. *Note 1. — A pressure type altimeter calibrated in accordance with the Standard Atmosphere:* *a) when set to a QNH altimeter setting, will indicate altitude;* *b) when set to a QFE altimeter setting, will indicate height above the QFE reference datum;* *c) when set to a pressure of 1013.2 hPa, may be used to indicate flight levels.* *Note 2.— The terms "height" and "altitude", used in Note 1, indicate altimetric rather than geometric heights and altitudes.*
Forecast	A statement of expected meteorological conditions for a specified time or period, and for a specified area or portion of airspace.
GAMET area forecast	An area forecast in abbreviated plain language for low-level flights for a flight information region or sub-area thereof, prepared by the meteorological office designated by MET service provider concerned and exchanged with meteorological offices in adjacent flight information regions, as agreed between MET service provider concerned.

Definition	Meaning
Grid point data in digital form	Computer processed meteorological data for a set of regularly spaced points on a chart, for transmission from a meteorological computer to another computer in a code form suitable for automated use. *Note. — In most cases, such data are transmitted on medium- or high-speed telecommunications channels.*
Height	The vertical distance of a level, a point or an object considered as a point, measured from a specified 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.
ICAO meteorological information exchange model (IWXXM)	A data model for representing aeronautical meteorological information.
International airways volcano watch (IAVW)	International arrangements for monitoring and providing warnings to aircraft of volcanic ash in the atmosphere. *Note. — The IAVW is based on the cooperation of aviation and non-aviation operational units using information derived from observing sources and networks that are provided by States. The watch is coordinated by ICAO with the cooperation of other concerned international organizations.*
Level	A generic term relating to the vertical position of an aircraft in flight and meaning variously height, altitude or flight level.
Meteorological authority	The authority providing or arranging for the provision of meteorological service for international air navigation on behalf of a Contracting State.
Meteorological bulletin	A text comprising meteorological information preceded by an appropriate heading.

Definition	Meaning
Meteorological information	Meteorological report, analysis, forecast, and any other statement relating to existing or expected meteorological conditions.
Meteorological office	An office designated to provide meteorological service for international air navigation.
Meteorological report	A statement of observed meteorological conditions related to a specified time and location.
Meteorological satellite	An artificial Earth satellite making meteorological observations and transmitting these observations to Earth.
Meteorological watch office (MWO)	An office designated to provide information concerning the occurrence or expected occurrence of specified en-route weather and other phenomena in the atmosphere that may affect the safety of aircraft operations within its specified area of responsibility.
Minimum sector altitude (MSA)	The lowest altitude which may be used which will provide a minimum clearance of 1 000 ft (300 m) above all objects located in an area contained within a sector of a circle of 25 NM (46 km) radius centred on a significant point, the aerodrome reference point (ARP) or the heliport reference point (HRP).
Navigation specification	A set of aircraft and flight crew requirements needed to support performance-based navigation operations within a defined airspace. There are two kinds of navigation specifications: a) Required navigation performance (RNP) specification. A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP, e.g. RNP 4, RNP APCH. b) Area navigation (RNAV) specification. A navigation specification based on area navigation that does not include the requirement for performance monitoring and alerting, designated by the prefix RNAV, e.g. RNAV 5, RNAV 1. *Note. — The Performance-based Navigation (PBN) Manual (Doc 9613), Volume II, contains detailed guidance on navigation specifications.*

Definition	Meaning
Observation (meteorological)	The evaluation of one or more meteorological elements.
Operational control	The exercise of authority over the initiation, continuation, diversion or termination of a flight in the interest of the safety of the aircraft and the regularity and efficiency of the flight.
Operational flight plan	The operator's plan for the safe conduct of the flight based on considerations of aeroplane performance, other operating limitations and relevant expected conditions on the route to be followed and at the aerodromes concerned.
Operational planning	The planning of flight operations by an operator.
Operator	The person, organization or enterprise engaged in or offering to engage in an aircraft operation.
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 specification (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.*
Pilot-in-command	The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.
Prevailing visibility	The greatest visibility value, observed in accordance with the definition of "visibility", which is reached within at least half the horizon circle or within at least half of the surface of the aerodrome. These areas could comprise contiguous or non-contiguous sectors. *Note. — This value may be assessed by human observation and/or instrumented systems. When instruments are installed, they are used to obtain the best estimate of the prevailing visibility*

Definition	Meaning
Prognostic chart	A forecast of a specified meteorological element(s) for a specified time or period and a specified surface or portion of airspace, depicted graphically on a chart.
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 organization with regard to quality (ISO 9000). *Note. — ISO Standard 9000 — Quality Management Systems — Fundamentals and Vocabulary.*
Regional air navigation agreement	Agreement approved by the Council of ICAO normally on the advice of a regional air navigation meeting.
Reporting point	A specified geographical location in relation to which the position of an aircraft can be reported.
Rescue coordination centre	A unit responsible for promoting efficient organization of search and rescue services and for coordinating the conduct of search and rescue operations within a search and rescue region.
Runway	A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.
Runway visual range (RVR)	The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.
Search and rescue services unit	A generic term meaning, as the case may be, rescue coordination centre, rescue subcentre or alerting post.
SIGMET information	Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather

Definition	Meaning
	and other phenomena in the atmosphere that may affect the safety of aircraft operations.
Space weather centre (SWXC)	A centre designated to monitor and provide advisory information on space weather phenomena expected to affect high-frequency radio communications, communications via satellite, GNSS-based navigation and surveillance systems and/or pose a radiation risk to aircraft occupants. *Note. — A space weather centre is designated as global and/or regional.*
Standard isobaric surface	An isobaric surface used on a worldwide basis for representing and analysing the conditions in the atmosphere.
State volcano observatory	A volcano observatory, designated by regional air navigation agreement, to monitor active or potentially active volcanoes within a State and to provide information on volcanic activity to its associated area control centre/flight information centre, meteorological watch office and volcanic ash advisory centre.
Threshold	The beginning of that portion of the runway usable for landing.
Touchdown zone	The portion of a runway, beyond the threshold, where it is intended landing aeroplanes first contact the runway.
Tropical cyclone	Generic term for a non-frontal synoptic-scale cyclone originating over tropical or sub-tropical waters with organized convection and definite cyclonic surface wind circulation.
Tropical cyclone advisory centre (TCAC)	A meteorological centre designated by regional air navigation agreement to provide advisory information to meteorological watch offices, world area forecast centres and international OPMET databanks regarding the position, forecast direction and speed of movement, central pressure and maximum surface wind of tropical cyclones.
Upper-air chart	A meteorological chart relating to a specified upper-air surface or layer of the atmosphere.

Definition	Meaning
Visibility	Visibility for aeronautical purposes is the greater of: a) the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background; b) the greatest distance at which lights in the vicinity of 1 000 candelas can be seen and identified against an unlit background. *Note. — The two distances have different values in air of a given extinction coefficient, and the latter b) varies with the background illumination. The former a) is represented by the meteorological optical range (MOR).*
Volcanic ash advisory centre (VAAC)	A meteorological centre designated by regional air navigation agreement to provide advisory information to meteorological watch offices, area control centres, flight information centres, world area forecast centres and international OPMET databanks regarding the lateral and vertical extent and forecast movement of volcanic ash in the atmosphere.
VOLMET	Meteorological information for aircraft in flight. a) Data link-VOLMET (D-VOLMET). Provision of current aerodrome routine meteorological reports (METAR) and aerodrome special meteorological reports (SPECI), aerodrome forecasts (TAF), SIGMET, special air-reports not covered by a SIGMET and, where available, AIRMET via data link. b) VOLMET broadcast. Provision, as appropriate, of current METAR, SPECI, TAF and SIGMET by means of continuous and repetitive voice broadcasts.
World area forecast centre (WAFC)	A meteorological centre designated to prepare and issue significant weather forecasts and upper-air forecasts in digital form on a global basis direct to States using the aeronautical fixed service Internet-based services.

Definition	Meaning
World area forecast system (WAFS)	A worldwide system by which world area forecast centres provide aeronautical meteorological en-route forecasts in uniform standardized formats.

1.2.2 Abbreviations

Unless otherwise stated, abbreviations in this MET MOS have the meanings given in the AIP or as follows:

Abbreviations	Full Name
ACC	Area Control Centre
AIREP	Air-Report
AMF	Aeronautical Meteorological Forecaster
AMO	Aerodrome Meteorological Office
AMOB	Aeronautical Meteorological Observer
AMP	Aeronautical Meteorological Personnel
AMS	Aeronautical Meteorological Station
AMT	Aeronautical Meteorological Technician
AIS	Aeronautical Information Service
ATS	Air Traffic Service
CAT	Category
CAAT	Civil Aviation Authority of Thailand
CTA	Control Area
FIC	Flight Information Centre
FIR	Flight Information Region
IWXXM	ICAO Meteorological Information Exchange Model
MWO	Meteorological Watch Office
NOTAM	Notice To Airmen
QMS	Quality Management System
RVR	Runway Visual Range

Abbreviations	Full Name
SIGMET	Significant Meteorological Information
SIGWX	Significant Weather
SSR	Secondary Surveillance Radar
TAF	Terminal Aerodrome Forecast
VAR	Volcanic Activity Report
VAAC	Volcanic Ash Advisory Centre
WAFC	World Area Forecast Centre
WAFS	World Area Forecast System
WMO	World Meteorological Organization

1.2.3 Terms used with a limited meaning

For the purpose of this MET MOS, the following terms are used with a limited meaning as indicated below:

a) to avoid confusion in respect of the term “service” between the meteorological service considered as an administrative entity and the service which is provided, “meteorological authority” is used for the former and “service” for the latter;

b) “provide” is used solely in connection with the provision of service;

c) “issue” is used solely in connection with cases where the obligation specifically extends to sending out the information to a user;

d) “make available” is used solely in connection with cases where the obligation ends with making the information accessible to a user; and

e) “supply” is used solely in connection with cases where either c) or d) applies.

Chapter 2 Operations Manual

2.1 General

2.1.1 MET service provider shall provide, maintain, amend and keep up to date its operations manuals relating to the provision of its services that complies with the standards set out in this manual for the use and guidance of operations personnel.

2.1.2 MET service provider shall ensure the operations manuals contain the instructions and information required by the operations personnel to perform their duties.

2.1.3 MET service provider shall:

a) keep the manual in a readily accessible form; and

b) ensure that each member of its personnel who performs functions in connection with any aeronautical information service that it provides has ready access to the manual.

c) ensure that the operations personnel are informed of amendments to the operations manual applying to their duties in a manner that enables their application as of their entry into force.

2.1.4 MET service provider shall submit an operation manual to CAAT for an approval. If MET service provider is given a direction by CAAT to amend the manual, the provider shall comply with the direction.

2.1.5 MET service provider shall ensure:

a) that all the amendments are incorporated in all copies of the manual kept by the operator; and

b) that copies of the amendments are given to CAAT.

2.2 Content of the Operations Manual

2.2.1 An operations manual shall contain:

a) a table contains based on the items in the manual, including the page number on which each item begins;

b) a description of the provider's organizational structure and a statement setting out the functions that the provider performs, or proposed to perform;

c) a description of the chain of command established, or proposed to be established, by the provider and a statement of the duties and responsibilities of any positions within the organizational structure;

d) a statement showing how the provider determines the number of operational staff;

e) a list of the aeronautical meteorological services that the provider provides, or proposes to provide including service type (e.g. aeronautical meteorological station service, aerodrome meteorological office service and/or meteorological watch office service) scope and/or location and operation hours;

f) a statement of the job description for each operating position;

g) a description of the processes and documentation used to present to staff the relevant standards, rules and procedures contained in Manual of Standards, ICAO Annexes 3, ICAO DOC 8896, etc. And any of the provider's site specific instructions for the provision aeronautical meteorological services;

h) a description of the processes and documentation used to provide operational instructions to staff;

i) a description of facilities and equipment used for providing aeronautical meteorological services;

j) a copy of any agreement entered into by the provider in relation to the provision of any of the aeronautical meteorological services;

k) a copy of the document that sets out the provider's quality management system include safety management;

l) a copy of the provider's contingency plan;

m) a description of the provider's training program;

n) a description of the procedures that ensure that all equipment, including software, is operated in accordance with the manufacturer's operating instructions and manuals;

o) the procedures to be followed for revising the operations manual;

p) a description of the provider's document control and record keeping system;

q) a copy of the provider's security program;

r) a description of the procedures to be followed to ensure all operational staff are familiar with any operational changes that have been issued since they last performed operational duties.

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Chapter 3 General Provisions for Aeronautical Meteorological Services

3.1 General

3.1.1 This Chapter sets out the general provisions for aeronautical meteorological services.

3.1.2 MET service provider shall determine the meteorological service which it will provide to meet the needs of air navigation. This determination shall be made in accordance with the provisions of this MET MOS and in accordance with Asia and Pacific Regions (APAC) Air Navigation Plan; it shall include the determination of the meteorological service to be provided for air navigation over international waters and other areas which lie outside the territory of the State.

3.2 Meteorological data and information.

3.2.1 MET service provider shall provide the meteorological data and information that is required for safe, regular and efficient air navigation as well as meteorological support to the near real-time activities of the aviation industry, in accordance with the provisions of this MET MOS.

3.2.2 MET service provider shall provide operators, flight crew members, air traffic services units, search and rescue services units, aerodrome operators, accident and incident investigation bodies, and other service providers and aviation entities with the meteorological data and information necessary for the performance of their respective functions.

3.2.3 MET service provider shall confirm the operationally desirable accuracy of the data and information distributed for operations, including the source of such data and information, whilst also ensuring that such data and information is distributed in a timely manner and updated, as required.

3.2.4 Owing to the variability of meteorological elements in space and time, to limitations of observing techniques and to limitations caused by the definitions of some of the elements, the specific value of any of the elements given in a report shall be understood by the recipient to be the best approximation to the actual conditions at the time of observation.

Note. — Guidance on the operationally desirable accuracy of measurement or observation is given in ICAO Annex 3, Attachment A.

3.2.5 Owing to the variability of meteorological elements in space and time, to limitations of forecasting techniques and to limitations caused by the definitions of some of the elements, the specific value of any of the elements given in a forecast shall be understood by the recipient to be the most probable value which the element is likely to assume during the period of the forecast. Similarly, when the time of occurrence or change of an element is given in a forecast, this time shall be understood to be the most probable time.

Note. — Guidance on the operationally desirable accuracy of forecasts is given in ICAO Annex 3, Attachment B.

3.2.6 The meteorological information supplied to the users listed in 3.2.2 shall be consistent with Human Factors principles and shall be in forms which require a minimum of interpretation by these users, as specified in the following chapters.

Note. — Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).

3.3 Meteorological information exchange requirements.

3.3.1 MET service provider shall ensure it has systems and processes in place, as well as access to suitable telecommunications facilities to:

a) enable the exchange of operational meteorological information with other MET service provider; and

b) provide the required meteorological information to the users in a timely manner.

3.3.2 MET service provider responsible for the area concerned shall provide meteorological bulletins to the relevant users, via the aeronautical fixed service or the internet.

3.3.3 Operational meteorological information is disseminated to international OPMET databanks and the centres for the operation of aeronautical fixed service Internet-based services.

Note. —The list of relevant meteorological exchange requirements for OPMET can be found in ROBEX Handbook.

3.4 Liaison with users.

3.4.1 Close liaison shall be maintained between those concerned with the supply and those concerned with the use of meteorological information on matters which affect the provision of meteorological service for international air navigation.

3.5 Notifications Required from Operators.

3.5.1 An operator requiring meteorological service or changes in existing meteorological service shall notify MET service provider or concerned aerodrome meteorological, sufficiently in advance. The minimum amount of advance notice required shall be as agreed between MET service provider and the operator concerned.

3.5.2 MET service provider shall be notified by the operator requiring service when:

a) new routes or new types of operations are planned;

b) changes of a lasting character are to be made in scheduled operations; and

c) other changes, affecting the provision of meteorological service, are planned such information shall contain all details necessary for the planning of appropriate arrangements by MET service provider.

3.5.3 The operator or a flight crew member shall ensure that, where required by MET service provider in consultation with users concerned is notified:

a) of flight schedules;

b) when non-scheduled flights are to be operated; and

c) when flights are delayed, advanced or cancelled.

3.5.4 The notification to MET service provider of individual flights should contain the following information except that, in the case of scheduled flights, the requirement for some or all of this information may be waived as agreed between MET service provider and the operator concerned:

a) aerodrome of departure and estimated time of departure;

b) destination and estimated time of arrival;

c) route to be flown and estimated times of arrival at, and departure from, any intermediate aerodrome(s);

d) alternate aerodromes needed to complete the operational flight plan and taken from the relevant list contained in the Asia/Pacific regional air navigation plan;

e) cruising level;

f) type of flight, whether under visual or instrument flight rules;

g) type of meteorological information requested for a flight crew member, whether flight documentation and/or briefing or consultation; and

h) time(s) at which briefing, consultation and/or flight documentation are required.

Chapter 4 Human Resource Management

4.1 General

4.1.1 This chapter sets out the standards for human resources management to ensure that human resources are properly managed with the provision of MET services.

4.2 Requirements

4.2.1 MET service provider shall systematically address human resources management in the following key aspects:

a) management responsibilities and accountabilities;

b) staff deployment;

c) operational watch rostering; and

d) operational support arrangements.

4.2.2 MET service provider should identify the key personnel responsible for the quality management to conduct of the MET services. Organization chart should be clearly defined and provide the specific positions, responsibilities, functions, accountabilities and authorities.

4.2.3 MET services provider shall establish and develop job descriptions for Aeronautical Meteorological Personnel.

4.2.4 MET services provider shall document and define the method of determining staffing levels to ensure safe and efficient MET operations.

4.2.5 MET services provider shall deploy sufficient number of personnel to provide meteorological services for air navigation at the MET service units.

4.2.6 MET service provider shall employ sufficient number of competent Aeronautical Meteorological Personnel to perform the operation of the service. MET service provider shall provide in the operations manual an analysis of the number of personnel required to perform the aeronautical meteorological service taking into account the duties and workload required.

4.2.7 MET service provider shall plan the level of Aeronautical Meteorological Personnel requirements taking into account the following factors:

a) rest days between shifts;

b) limits on night shifts;

c) interval after night shifts;

d) leave and holidays requirements; and

e) sick leave reserve.

4.2.8 MET service provider should develop policies and procedures to enable recruitment and retention of adequate Aeronautical Meteorological Personnel.

Chapter 5 Personnel

5.1 General

5.1.1 This Chapter sets out the standards, requirements pertaining to the aeronautical meteorological personnel.

5.1.2 MET service provider shall keep records of the qualifications of all personnel involved in the provision of aeronautical meteorological for air navigation.

5.1.3 MET service provider shall ensure that AMP complies with the requirements of the World Meteorological Organization (WMO) in respect of qualifications, competencies, education and training of meteorological personnel providing service for international air navigation.

Note 1.— Requirements concerning the qualifications, competencies, education and training of meteorological personnel in aeronautical meteorology are given in the Technical Regulations (WMO-No. 49), Volume I — General Meteorological Standards and Recommended Practices, Part V — Qualifications and Competencies of Personnel Involved in the Provision of Meteorological (Weather and Climate) and Hydrological Services, Part VI — Education and Training of Meteorological Personnel, and Appendix A — Basic Instruction Packages.

Note 2.— WMO Publication 1083 Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology, Volume I – Meteorology.

5.2 Categories of personnel

5.2.1 The aeronautical meteorological personnel (AMP) shall be classified as follows:

a) Aeronautical Meteorological Forecaster (AMF); A person who has successfully completed the requirement of the Basic Instruction Package for Meteorologist at university degree level.
b) Aeronautical Meteorological Technician (AMT) or Aeronautical Meteorological Observer (AMOB); A person who has successfully completed the requirements of the Basic Instruction Package for Meteorological Technician.

5.3 Qualifications.

5.3.1 MET service provider shall ensure that each person assigned duties as aeronautical meteorological personnel is competent and holds appropriate qualifications to perform the duties which they are assigned.

5.3.2 MET service provider shall ensure that each person assigned duties as aeronautical meteorological personnel has been:

a) appropriately trained: and

b) assessed as competent through a formal process by a person who is qualified.

5.3.3 MET service provider shall develop a periodic and comprehensive recurrent training program to ensure that each person assigned duties as Aeronautical Meteorological Personnel maintains the appropriate level of qualification.

5.4 Competencies.

5.4.1 MET service provider shall establish procedures to ensure that all Aeronautical Meteorological Personnel, possess the skills and competencies.

5.4.2 The competencies of AMF shall:

a) analyse and monitor continually the weather situation;

b) forecast aeronautical meteorological phenomena and parameters;

c) warn of hazardous phenomena;

d) ensure the quality of meteorological information and services; and

e) communicate meteorological information to internal and external users.

5.4.3 The competencies of AMOB shall:

a) monitor continually the weather situation;

b) observe and record aeronautical meteorological phenomena and parameters;

c) ensure the quality of system performance and of meteorological information; and

d) communicate meteorology information to internal and external users.

5.4.4 An Aeronautical Meteorological Personnel shall successful complete of the competency assessment.

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Chapter 6 Training and Checking Program

6.1 General

6.1.1 This Chapter sets out the standards for a Training and Checking program.

6.1.2 MET service provider shall develop an overall training policy and program and detailed job descriptions for its Aeronautical Meteorological Personnel. The training policy and program shall lay down the training courses that different levels of Aeronautical Meteorological Personnel have to undergo to perform their duties, including initial, on-the-job training (OJT), recurrent and specialized training.

6.1.3 The job description shall depict the job purpose, key responsibilities, and outcome to be achieved of each Aeronautical Meteorological Personnel. Initial and periodic assessments shall be established that require personnel to demonstrate the required competencies.

6.1.4 MET service provider shall ensure that its Aeronautical Meteorological Personnel undergo a suitable period of supervised on-the-job training (OJT) before being deployed for duties.

6.1.5 MET service provider shall maintain individual training records including certificate for each of its Aeronautical Meteorological Personnel.

6.1.6 MET service provider shall conduct a yearly review of the training plan for each Aeronautical Meteorological Personnel 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.

6.2 Training Requirements for Aeronautical Meteorological Forecaster (AMF)

Note. — The education and training of aeronautical meteorological personnel in accordance with the Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology (WMO-No. 1083) Volume I - Meteorology.

6.2.1 AMF shall be a person who successful completion of a university degree in meteorology or a successful completion in Basic Instruction Package for Meteorologists (BIP-M) or equivalent (after acquiring a university degree that includes

the foundation topics in mathematics and physics; such topics are typically covered in science, applied science, engineering or computational courses).

6.2.2 AMF shall also be trained in the Aeronautical Meteorology specialization either through courses at WMO-certified training institutions along with BIP-M or less formally during attachments to aeronautical meteorological office. AMF should be familiar with:

a) Phenomena that may impact on flight operations (aircraft icing, turbulence, volcanic ash, etc.);

b) Procedures for meteorological services for international air navigation, as in MET MOS and MET part of Air Traffic Service Manual;

c) WMO/ICAO regulatory roles and documentation.

6.2.3 AMF shall undergo on-the-job training for a period of at least 3 months as an aeronautical meteorological forecaster. The on-the-job experience shall encompass situations where the trainee will be exposed to both hazardous and non-hazardous weather conditions.

6.2.4 For an experienced meteorological forecaster from an alternative meteorological specialization, the on-the-job experience can be shortened to a period not more than 3 months.

6.3 Training Requirements for Aeronautical Meteorological Technician/Aeronautical Meteorological Observer

Note. — The education and training of aeronautical meteorological personnel in accordance with the Guide to the Implementation of Education and Training Standards in Meteorology and Hydrology (WMO-No. 1083) Volume I - Meteorology.

6.3.1 Aeronautical Meteorological Technician (AMT)/Aeronautical Meteorological Observer (AMOB) shall be a person who successful completion in Basic Instruction Package for Meteorological Technician (BIP-MT) or equivalent.

6.3.2 AMOB shall also be trained in the Aeronautical Meteorology for technicians elective option which covers the following topics;

a) Basic Meteorology including phenomena that may impact on flight operations;

b) observation and relevant WMO/ICAO codes;

c) procedures for meteorological services for international air navigation;

d) Instrumentation and/or any other appropriate topics as decided by MET service provider.

6.3.3 AMOB shall undergo at least 3 months of on-the-job training as an aeronautical meteorological observer. The on-the-job experience shall encompass situations where the trainee will be exposed to both hazardous and non-hazardous weather conditions.

6.3.4 For an experienced Observer from an alternative meteorological specialization, the on-the-job experience can be shortened to a period not more than 3 months.

6.4 Requirement for Assessors

6.4.1 Competency shall be demonstrated through job performance and assessed through competency assessment procedures, as appropriate.

Note. — Guidance on competency development and assessment procedures is provided in Guide for the Development and Implementation of Competency-based Frameworks in Support of Meteorological, Hydrological and Climatological Services (in preparation) (WMO-No. 1205).

6.4.2 MET service provider shall:

a) appoint Assessors to conduct the competency assessment for its Aeronautical Meteorological Personnel;

b) ensure that the Assessors are not the direct Supervisor of the Aeronautical Meteorological Personnel under assessment in order to prevent conflict of interest;

c) ensure that the Assessors are adequately trained to conduct the assessment;

d) ensure that the Assessors of the Aeronautical Meteorological Forecaster (AMF) possess a meteorological qualification which satisfies the WMO's Basic Instruction Package for Meteorologists (BIP-M) and have at least five years of operational experience as an AMF; and

e) ensure that the Assessors for the Aeronautical Meteorological Observer (AMOB) and Aeronautical Meteorological Technician (AMT) possess a meteorological qualification which satisfies the WMO's Basic Instruction Package for

Meteorological Technician (BIP-MT) and have at least five years of operational experience as an AMOB.

6.5 Conduct of Assessment

6.5.1 MET service provider shall:

a) assess the competency of its Aeronautical Meteorological Personnel.

b) establish competency assessment programmes for different categories of operational personnel, competency assessments shall be repeated at regular intervals defined by the quality management practice of each MET service provider.

c) ensure that the competency assessment is in accordance to the guidelines developed and endorsed by the WMO Commission for Aeronautical Meteorology (CAeM).

d) ensure that all Aeronautical Meteorological Personnel satisfy the competency standards.

Chapter 7 Meteorological Facilities and Equipment

7.1 General

7.1.1 This Chapter sets out the standards for meteorological facilities and equipment.

7.1.2 MET facilities and equipment shall:

a) be tested for normal operations on a routine basis;

b) meet the required level of accuracy, reliability and availability through a combination of routine calibrations, testing and/or regular parts replacement, and timely resolution of system failures;

c) provide for the timely and appropriate detection and warning of system failures and degradations;

d) include documentation on the consequences of system, sub-system and equipment failures and degradations; and

e) include measures to control the probability of failures and degradations.

7.1.3 MET service provider shall establish maintenance plan for each equipment. The plan shall include:

a) procedure for the periodic maintenance of each equipment;

b) calibration displays related to integrated automatic systems that provide to air traffic services units; and

c) The spare support plan for each facility.

7.1.4 MET service provider shall establish procedures to ensure that:

a) each of the meteorological offices and facilities is provided with suitable power supplies and means to ensure appropriate continuity of service; and

b) each of the remote weather sensing facilities is installed and maintained in a technically appropriate position to ensure that the facility provides an accurate representation of the local meteorological conditions.

7.1.5 MET service provider shall arrange for its aeronautical meteorological stations to be inspected at sufficiently frequent intervals to ensure that a high standard of observation is maintained, that instruments and all their indicators are functioning correctly, and that the exposure of the instruments has not changed significantly.

Note. — Guidance on the inspection of aeronautical meteorological stations including the frequency of inspections is given in the Manual on Automatic Meteorological Observing Systems at Aerodromes (Doc 9837).

7.1.6 At aerodromes which can be used for Category II and III instrument approach and landing operations, automated equipment for measuring or assessing, as appropriate, and for monitoring and remote indicating of surface wind, visibility, runway visual range, height of cloud base, air and dew-point temperatures and atmospheric pressure shall be installed to support approach and landing and take-off operations. These devices shall be integrated automatic systems for acquisition, processing, dissemination and display in real time of the meteorological parameters affecting landing and take-off operations. The design of integrated automatic systems shall observe Human Factors principles and include back-up procedure.

Note 1.— Categories of precision approach and landing operations are defined in ICAO Annex 6, Part I.

Note 2.— Guidance material on the application of Human Factors principles can be found in the Human Factors Training Manual (Doc 9683).

7.1.7 At aerodromes with runways intended for Category I instrument approach and landing operations, automated equipment for measuring or assessing, as appropriate, and for monitoring and remote indicating of surface wind, visibility, runway visual range, height of cloud base, air and dew-point temperatures and atmospheric pressure should be installed to support approach and landing and take-off operations. These devices shall be integrated automatic systems for acquisition, processing, dissemination and display in real time of the meteorological parameters affecting landing and take-off operations. The design of integrated automatic systems should observe Human Factors principles and include back-up procedures.

7.2 Automated Weather Observing System (AWOS)

Note. — The installation of Automated weather observing System in accordance with ICAO Annex 3 Appendix 3, ICAO DOC 8896, 9328, 9837 and 9157 Part 6.

7.2.1 Where an integrated semi-automatic system is used for the dissemination/display of meteorological information, it should be capable of accepting the manual insertion of data covering those meteorological elements which cannot be observed by automatic means

7.2.2 The meteorological instruments used at an aerodrome should be situated in such a way as to supply data which are representative of the area for which the measurements are required ICAO Annex 3, Appendix 3, 1.1.

Note. — Specifications concerning the siting of equipment and installations on operational areas, aimed at reducing the hazard to aircraft to a minimum, are contained in ICAO Annex 14, Volume I, Chapter 9.

7.2.3 Meteorological instruments at aeronautical meteorological stations should be exposed, operated and maintained in accordance with the practices, procedures and specifications promulgated by the World Meteorological Organization (WMO).

7.2.4 Where automated equipment forms part of an integrated semi-automatic observing system, displays of data which are made available to the local air traffic services units should be a subset of and displayed parallel to those available in the local meteorological service unit. In those displays, each meteorological element should be annotated to identify, as appropriate, the locations for which the element is representative.

7.2.5 **Surface wind**

7.2.5.1 Siting

a) Surface wind should be observed at a height of 10 ± 1 m (30 ± 3 ft) above the ground.

b) Representative surface wind observations should be obtained by the use of sensors appropriately sited. Sensors for surface wind observations for local routine and special reports should be sited to give the best practicable indication of conditions along the runway and touchdown zones. At aerodromes where topography or prevalent weather conditions cause significant differences in surface wind at various sections of the runway, additional sensors should be provided.

Note. — Since, in practice, the surface wind cannot be measured directly on the runway, surface wind observations for take-off and landing are expected to be the best practicable indication of the winds which an aircraft will encounter during take-off and landing

7.2.5.2 Displays

a) Surface wind displays relating to each sensor shall be located in the meteorological station with corresponding displays in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units shall relate to the same sensors, and where separate sensors are required as specified in subsection 7.2.5.1, b), the displays shall be clearly marked to identify the runway and section of runway monitored by each sensor.

b) The mean values of, and significant variations in, the surface wind direction and speed for each sensor should be derived and displayed by automated equipment.

7.2.5.3 Accuracy of measurement

a) The reported direction and speed of the mean surface wind, as well as variations from the mean surface wind, should meet the operationally desirable accuracy of measurement as given in ICAO Annex 3, Attachment A.

7.2.6 **Visibility**

7.2.6.1 Siting

a) When instrumented systems are used for the measurement of visibility, the visibility should be measured at a height of approximately 7.5 ft (2.5 m) above the runway.

b) When instrumented systems are used for the measurement of visibility representative visibility observations should be obtained by the use of sensors appropriately sited. Sensors for visibility observations for local routine and special reports should be sited to give the best practicable indications of visibility along the runway and touchdown zone.

7.2.6.2 Displays

a) When instrumented systems are used for the measurement of visibility, visibility displays relating to each sensor should be located in the meteorological station with corresponding displays in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units should relate to the same sensors, and where separate sensors are required as specified in subsection 7.2.6.1, the displays should be clearly marked to identify the area, e.g. runway and section of runway, monitored by each sensor.

7.2.7 Runway visual range

7.2.7.1 Siting

a) Runway visual range should be assessed at a height of approximately 2.5 m (7.5 ft) above the runway for instrumented systems or assessed at a height of approximately 5 m (15 ft) above the runway by a human observer.

b) Runway visual range should be assessed at a lateral distance from the runway centre line of not more than 120 m. The site for observations to be representative of the touchdown zone should be located about 300 m along the runway from the threshold. The sites for observations to be representative of the mid-point and stop-end of the runway should be located at a distance of 1 000 to 1500 m along the runway from the threshold and at a distance of about 300 m from the other end of the runway. The exact position of these sites and, if necessary, additional sites should be decided after considering aeronautical, meteorological and climatological factors such as long runways, swamps and other fog-prone areas.

7.2.7.2 Instrumented systems

Note. — Since accuracy can vary from one instrument design to another, performance characteristics are to be checked before selecting an instrument for assessing runway visual range. The calibration of a forward-scatter meter has to be traceable and verifiable to a transmissometer standard, the accuracy of which has been verified over the intended operational range. Guidance on the use of transmissometers and forward-scatter meters in instrumented runway visual range systems is given in the Manual of Runway Visual Range Observing and Reporting Practices (Doc 9328).

a) Instrumented systems based on transmissometers or forward-scatter meters shall be used to assess runway visual range on runways intended for Category II and III instrument approach and landing operations.

b) Instrumented systems based on transmissometers or forward-scatter meters should be used to assess runway visual range on runways intended for Category I instrument approach and landing operations.

7.2.7.3 Display

a) Where runway visual range is determined by instrumented systems, one display or more, if required, shall be located in the meteorological station with corresponding displays in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units shall be related to the same sensors, and where separate sensors are required as specified in subsection 7.2.7.1, b), the displays shall be clearly marked to identify the runway and section of runway monitored by each sensor.

b) Where runway visual range is determined by human observers, runway visual range should be reported to the appropriate local air traffic services units, whenever there is a change in the value to be reported in accordance with the reporting scale (except where the provisions of ICAO Annex 3, Appendix 3, 3.2.2, (a) or (b) apply). The transmission of such reports should normally be completed within 15 seconds after the termination of the observation.

7.2.7.4 Runway light intensity

a) When instrumented systems are used for the assessment of runway visual range, computations should be made separately for each available runway. For local routine and special reports, the light intensity to be used for the computation should be:

1) for a runway with the lights switched on and the light intensity of more than 3 percent of the maximum light intensity available, the light intensity actually in use on that runway;

2) for a runway with the lights switched on and the light intensity of 3 per cent or less of the maximum light intensity available, the optimum light intensity that would be appropriate for operational use in the prevailing conditions; and

3) for a runway with lights switched off (or at the lowest setting pending the resumption of operations), the optimum light intensity that would be appropriate for operational use in the prevailing conditions.

Note.1 — In METAR and SPECI, the runway visual range should be based on the maximum light intensity available on the runway.

Note.2 — Guidance on the conversion of instrumented readings into runway visual range is given at ICAO Annex 3, Attachment D.

7.2.8 **Present weather**

7.2.8.1 Siting

a) When instrumented systems are used for observing present weather phenomena listed under ICAO Annex 3, Appendix 3, 4.4.1.3 and 4.4.1.4, representative information should be obtained by the use of sensors appropriately sited.

7.2.9 **Clouds**

7.2.9.1 Siting

a) When instrumented systems are used for the measurement of the cloud amount and the height of cloud base, representative observations should be obtained by the use of sensors appropriately sited. For local routine and special reports, in the case of aerodromes with precision approach runways, sensors for cloud amount and height of cloud base should be sited to give the best practicable indications of the cloud amount and height of cloud base at the threshold of the runway in use. For that purpose, a sensor should be installed at a distance of less than 1 200 m (4 000 ft) before the landing threshold.

7.2.9.2 Display

a) When automated equipment is used for the measurement of the height of cloud base, height of cloud base display(s) should be located in the meteorological station with corresponding display(s) in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units should relate to the same sensor, and where separate sensors are required as specified in subsection 7.2.9.1, a), the displays should clearly identify the area monitored by each sensor.

7.2.9.3 Reference level

a) The height of cloud base shall be reported above aerodrome elevation. When a precision approach runway is in use which has a threshold elevation 15 m (50 ft) or more below the aerodrome elevation, local arrangements shall be made in order that the height of cloud bases reported to arriving aircraft shall refer to

the threshold elevation. In the case of reports from offshore structures, the height of cloud base shall be given above mean sea level.

7.2.10 **Air temperature and dew-point temperature**

7.2.10.1 Display

a) When automated equipment is used for the measurement of air temperature and dew-point temperature, air temperature and dew-point temperature displays should be located in the meteorological station with corresponding displays in the appropriate air traffic services units. The displays in the meteorological station and in the air traffic services units should relate to the same sensors.

7.2.11 **Atmospheric pressure**

7.2.11.1 Display

a) When automated equipment is used for the measurement of atmospheric pressure, QNH and, if required in accordance with ICAO Annex 3, Appendix 3, 4.7.3.2 (b), QFE displays relating to the barometer shall be located in the meteorological station with corresponding displays in the appropriate air traffic services units. When QFE values are displayed for more than one runway, as specified in ICAO Annex 3, Appendix 3, 4.7.3.2 (d), the displays shall be clearly marked to identify the runway to which the QFE value displayed refers.

7.2.11.2 Reference level

a) The reference level for the computation of QFE should be the aerodrome elevation. For non-precision approach runways, the thresholds of which are 2 m (7 ft) or more below the aerodrome elevation, and for precision approach runways, the QFE, if required, should refer to the relevant threshold elevation.

7.3 Low level wind shear alert system (LLWAS)

7.3.1 Low level wind shear alert system shall detect, identify, and locate microburst and wind shear events along and near the runways and estimate the runway component of wind speed loss resulting from a microburst wind shear event.

7.3.2 Low level wind shear alert system should detect wind shear and any microburst whose center is within 700 metres to either side of the centerline of a runway, and its extension to the middle marker (approximately 700 metres from the end of the runway).

7.3.3 LLWAS station geometry should be taken in the design of an LLWAS Network Expansion.

7.3.4 Wind sensors station location.

7.3.4.1 Wind sensor stations should be located between 600 and 1,000 metres to either side of the runway and beyond each end of the runway.

7.3.4.2 The spacing between adjacent wind sensor stations along the runway should be greater than 1 kilometre but less than 2 kilometres.

7.3.5 The number of wind sensor stations are 6 to 22 stations varies with the number of runways and their length. An airport with 2 runways should have wind sensor 12 stations, an airport with 3 runways should have wind sensor 18 stations.

Chapter 8 Management System

8.1 General

8.1.1 This Chapter sets out the standards for the quality management system and safety management.

8.2 Quality Management System

8.2.1 MET service provider shall establish and implement a properly organized quality system comprising procedures, processes and resources necessary to provide for the quality management of the meteorological information to be supplied to the aviation users.

8.2.2 The quality system established in accordance with 8.2.1 should be in conformity with the International Organization for Standardisation (ISO) 9000 series of quality assurance standards and should be certified by an approved organization.

Note.— The ISO 9000 series of quality assurance standards provide a basic framework for the development of a quality assurance programme. The details of a successful programme are to be formulated by each State and in most cases are unique to the State organization. Guidance on the establishment and implementation of quality management system is given in the Guide to the Implementation of Quality Management Systems for National Meteorological and Hydrological Services and Other Relevant Service Providers (WMO-No. 1100).

8.2.3 The quality system should provide the users with assurance that the meteorological information supplied complies with the CAAT requirements in terms of the geographical and spatial coverage, format and content, time and frequency of issuance and period of validity, as well as the accuracy of measurements, observations and forecasts. When the quality system indicates that meteorological information to be supplied to the users does not comply with the stated requirements, and automatic error correction procedures are not appropriate, such information should not be supplied to the users unless it is validated with the originator.

Note.— Requirements concerning the geographical and spatial coverage, format and content, time and frequency of issuance and period of validity of meteorological information to be supplied to aeronautical users are given in Chapters 12, 13, 14, 15, 16 and 17 of this MET MOS and ICAO Annex 3, Appendices 2, 3, 5, 6, 7, 8 and 9 and Asia/Pacific regional air navigation plan. Guidance

concerning the accuracy of measurement and observation, and accuracy of forecasts is given in ICAO Annex 3, Attachments A and B, respectively.

8.2.4 In regard to the exchange of meteorological information for operational purposes, the quality system should include verification and validation procedures and resources for monitoring adherence to the prescribed transmission schedules for individual messages and/or bulletins required to be exchanged, and the times of their filing for transmission. The quality system should be capable of detecting excessive transit times of messages and bulletins received.

Note.— Requirements concerning the exchange of operational meteorological information are given in Chapter 16 and ICAO Annex 3, Appendix 10.

8.2.5 Demonstration of compliance of the quality system applied shall be by audit. If nonconformity of the system is identified, action shall be initiated to determine and correct the cause. All audit observations shall be evidenced and properly documented.

8.3 Safety Management

8.3.1 MET service provider shall demonstrate that they identified hazards associated with its meteorological products or services, considered and taken action to mitigate any risks and capitalized on any opportunities that may affect their organization. The approach to risk must be proportionate to the consequences, should the risk be realized.

8.3.2 MET service provider shall establish Safety Risk Management.

a) Hazard identification:

MET service provider shall develop and maintain a process that ensures that hazards associated with its aviation meteorological products or services are identified. Hazard identification shall be based on a combination of reactive, proactive and predictive methods of safety data collection.

b) Risk assessment and mitigation process:

MET service provider shall develop and maintain a process for effectively collecting data critical for risk assessment. MET service provider is responsible for carrying out the assessment based on reports of incidents (which may be minor by themselves) and fault reports of critical systems/processes.

8.3.3 MET service provider shall develop and maintain a process to identify changes (e.g. major organizational change, or changes in equipment/software deemed critical for provision of aviation services) within the organization, which may significantly affect established processes and services. A risk assessment shall be carried out before the implementation of such changes, such as when upgrading or modification is made to a MET facility, in order to ensure safety performance.

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Chapter 9 Contingency Plan

9.1 General

9.1.1 This Chapter sets out the standards for contingency plans.

9.1.2 MET service provider shall establish a contingency plan that sets out the procedures to be followed if aeronautical meteorological services are interrupted.

9.1.3 A contingency plan shall describe in detail the actions that operational staffs are to follow to maintain aeronautical meteorological services in the event of the meteorological services system failure or non-availability of staffs, facilities or equipment which affects the provision of aeronautical meteorological services. The plan shall also cover procedures for the safe and orderly transition back to full service provision.

9.1.4 The contingency plan shall include:

a) the actions to be taken by personnel responsible for providing the service;

b) possible alternative arrangements for providing the service; and

c) arrangements for resuming normal provision of the service.

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Chapter 10 Security Program

10.1 General

10.1.1 This Chapter sets out the standards for Security Program.

10.2 Security Program

10.2.1 MET service provider shall develop the security program cover the following information:

a) the procedure to be used for preventing and detecting intentional or unintentional damage to any system, equipment, software or data used for providing services;

b) the procedure to be used for responding to a threat of intentional damage to a system, equipment, software or data;

c) the procedure to be used for preventing unauthorized people from having access to working space, working area, any system, equipment, software or data used by MET service provider in providing services.

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Chapter 11 Documents and Records

11.1 General

11.1.1 This Chapter sets out the standards for Documents and Records.

11.2 Documents and Records to be maintained

11.2.1 MET service provider shall maintain documents and records of operation and maintenance of the service for both safety oversight and quality management purposes. These documents and records shall include but not limited to:

a) Copies of the Air Navigation Act and related regulations and requirements;

b) Copies of Annex 3, and Annex 15;

c) Copies of ICAO Doc. 8896, 9328, 9377, 9817 and 9837;

d) a copy of the parts of the AIP that are relevant to any Aeronautical Meteorological Services that it provides;

e) the Manual of Standards - Aeronautical Meteorological Services (MET MOS);

f) all manuals and documents indicated in the Manual of Standards - Aeronautical Meteorological Services (MET MOS);

g) a copy of any instruction issued to its personnel in relation to the provision of its Aeronautical Meteorological Services;

h) manuals for equipment used by staff in the provision of Aeronautical Meteorological Services;

i) other necessary documents concerned;

j) reports of queries on weather information for incidents/accidents;

k) records of internal quality audit reports;

l) archive of low level wind shear alert system and automated weather observing system; and

m) record of job description, training programme and training plan of each year.

11.3 Document Control

11.3.1 MET service provider shall establish a process for the authorization and amendment of these documents to ensure that they are updated all the time. The process shall ensure that:

a) the currency of the documentation can be readily determined;

b) all amendments to the documentation are controlled in accordance with organized quality system; and

c) only current versions of documents are available.

11.3.2 Documents should be held as computer based records provided that where paper copies of computer-based records are made, they are subjected to the same control as paper documents.

11.4 Retention period

11.4.1 MET service provider shall retain meteorological data and information:

a) retain meteorological information supplied to flight crew members either as printed copies or in computer files, for a period of at least 30 days from the date of issue; and

b) the meteorological information supplied to flight crew members shall be made available, on request, for inquiries or investigations and, for these purposes, shall be retained until the inquiry or investigation is completed.

11.4.2 MET service provider shall retain all records exclude subsection 11.4.1, at least five years.

Chapter 12 The use of meteorological information from Global Systems, Supporting Centres and OPMET Data Exchange Centres.

12.1 General

12.1.1 This Chapter sets out the standards for the use of meteorological information from Global Systems, Supporting Centres and OPMET Data Exchange Centres

12.1.2 Technical specifications and detailed criteria related to Global Systems and Supporting Centres are contained in ICAO Annex 3, Appendix 2.

12.1.3 Technical specifications and detailed criteria related to OPMET Data Exchange Centres are contained in ROBEX HANDBOOK.

12.2 World area forecast centres (WAFCs)

12.2.1 The objective of the world area forecast system shall be to supply MET service provider and other users with global aeronautical meteorological en-route forecasts in digital form. This objective shall be achieved through a comprehensive, integrated, worldwide and, as far as practicable, uniform system, and in a cost-effective manner, taking full advantage of evolving technologies.

12.2.2 MET service provider shall have to be familiar with the roles/functions of WAFCs so as to be able to interact with them and use their products/services effectively.

12.3 Volcanic ash advisory centres (VAACs)

12.3.1 MET service provider shall have to be familiar with the roles/functions of VAACs so as to be able to interact with them and use their products/services effectively.

12.4 Tropical cyclone advisory centres (TCACs)

12.4.1 MET service provider shall have to be familiar with the roles/functions of TCACs so as to be able to interact with them and use their products/services effectively.

12.5 Space weather centres (SWXCs)

12.5.1 MET service provider shall have to be familiar with the roles/functions of SWXCs so as to be able to interact with them and use their products/services effectively.

12.6 OPMET Data Exchange Centres

12.6.1 National OPMET center (NOC)

12.6.1.1 The role of the NOC is responsible for collect all OPMET messages generated by the originating stations in Thailand and to send them to the Regional OPMET Centre (ROC).

12.6.2 Regional OPMET Centre (ROC)

12.6.2.1 The role of the ROC is responsible for collection of OPMET messages from the originating stations or NOCs in their area of responsibility and for compiling these messages into ROBEX bulletins, in accordance with Tables A and B, in Appendices A and B respectively of the ROBEX Handbook determine the areas of responsibility (or, collection areas) of the Regional OPMET Centre for METAR/SPECI and TAF.

12.6.2.2 The Regional OPMET Centre is responsible for the transmission of the bulletins compiled by them to:

a) Other Regional OPMET Centres, according to predefined distribution lists, specific for each bulletin;

b) ASIA/PAC RODBs;

c) NOCs or other COM or MET offices in Thailand in their area of responsibilities, as agreed between the Regional OPMET Centres and the States' authorities concerned.

12.6.3 Regional OPMET Data Bank Bangkok (RODB Bangkok)

12.6.3.1 RODB Bangkok is responsible, as follows:

a) to support the ROBEX Scheme and to facilitate a regular exchange of OPMET information (METAR, SPECI, TAF and SIGMET) based on predetermined distribution within the ASIA/PAC Regions;

b) to operate as Inter-regional OPMET Gateway (IROG) with responsibility of exchanging OPMET information between ASIA/PAC Region and the adjacent Regions; and

c) to provide facilities for request/response type of access to the stored OPMET data for users to obtain non-regular or occasional information.

Note. — The interrogation procedures applicable to the OPMET data banks and catalogues are provided in the "ASIA/Pacific OPMET Data Banks Interface Control Document (ICD)", published and maintained by the ICAO Asia and Pacific Office, Bangkok.

12.6.4 Bangkok Inter-regional OPMET Gateway (Bangkok IROG)

12.6.4.1 The Bangkok Inter-regional OPMET Gateway in ASIA/PAC Region is responsible for exchange of OPMET information with other ICAO Regions. The responsibilities of the IROGs for ASIA/PAC and MID Region, in accordance with p. 11.1 in ROBEX HANDBOOK.

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Chapter 13 Standards for Aeronautical Meteorological Stations

13.1 General

13.1.1 This Chapter sets out the standards for aeronautical meteorological stations.

13.1.2 MET service provider shall provide observations and reports in accordance with Technical specifications in ICAO Annex 3, Appendix 3.

13.1.3 MET service provider shall establish aeronautical meteorological stations at aerodromes. An aeronautical meteorological station may be a separate station or may be combined with a synoptic station.

Note. — Aeronautical meteorological stations may include sensors installed outside the aerodrome, where considered justified, by MET service provider to ensure the compliance of meteorological service for air navigation with the provisions of this MET MOS.

13.1.4 MET service provider should establish, or arrange for the establishment of, aeronautical meteorological stations on offshore structures or at other points of significance in support of helicopter operations to offshore structures, if required by Asia/Pacific air navigation agreement.

13.1.5 The observations shall form the basis for the preparation of reports to be disseminated at the aerodrome of origin and of reports to be disseminated beyond the aerodrome of origin.

13.2 Aeronautical meteorological station function

13.2.1 Aeronautical meteorological stations shall make routine observations at fixed intervals. At aerodromes, the routine observations shall be supplemented by special observations whenever specified changes occur in respect of surface wind, visibility, runway visual range, present weather, clouds and/or air temperature.

13.2.2 At aerodromes, routine observations shall be made throughout the 24 hours of each day, unless otherwise agreed between MET service provider, the appropriate ATS authority and the operator concerned. Such observations shall be made at intervals of one hour or, if so, determined by Asia and Pacific Regions (APAC) Air Navigation Plan and ASIA/PAC FASID (facilities and services implementation document), at

intervals of one half-hour. At other aeronautical meteorological stations, such observations shall be made as determined by MET service provider taking into account the requirements of air traffic services units and aircraft operations.

13.2.3 At aerodromes that are not operational throughout 24 hours:

a) METAR should be issued at least 3 hours prior to the aerodrome resuming operations.

b) SPECI shall be issued, as necessary.

13.2.4 Reports of routine observations shall be issued as:

a) local routine reports, only for dissemination at the aerodrome of origin (intended for arriving and departing aircraft); and

b) METAR for dissemination beyond the aerodrome of origin (mainly intended for flight planning, VOLMET broadcasts and D-VOLMET).

Note. — Meteorological information used in ATIS (voice-ATIS and D-ATIS) is to be extracted from the local routine report, in accordance with ICAO Annex 11, 4.3.6.1 g).

13.2.5 Reports of special observations shall be issued as:

a) local special reports, only for dissemination at the aerodrome of origin (intended for arriving and departing aircraft); and

b) SPECI for dissemination beyond the aerodrome of origin (mainly intended for flight planning, VOLMET broadcasts and D-VOLMET) unless METAR are issued at half-hourly intervals.

Note. — Meteorological information used in ATIS (voice-ATIS and D-ATIS) is to be extracted from the local special report, in accordance with ICAO Annex 11, 4.3.6.1 g)

13.2.6 A list of criteria for special observations shall be established by MET service provider, in consultation with the appropriate ATS authority, operators and others concerned.

13.3 Contents of reports

13.3.1 Local routine reports, local special reports, METAR and SPECI shall contain the following elements in the order indicated:

a) identification of the type of report;

b) location indicator;

c) time of the observation;

d) identification of an automated or missing report, when applicable;

e) surface wind direction and speed;

f) visibility;

g) runway visual range, when applicable;

h) present weather;

i) cloud amount, cloud type (only for cumulonimbus and towering cumulus clouds) and height of cloud base or, where measured, vertical visibility;

j) air temperature and dew-point temperature; and

k) QNH and, when applicable, QFE (QFE included only in local routine and special reports).

Note. — The location indicators referred to under b) and their significations are published in Location Indicators (ICAO DOC 7910).

13.3.2 Addition to elements listed under subsection 13.3.1 a) to k), Local routine reports, local special reports, METAR and SPECI should contain supplementary information to be placed after element k).

13.3.3 Optional elements included under supplementary information shall be included in METAR and SPECI in accordance with Asia and Pacific Regions (APAC) Air Navigation Agreement.

13.4 Observing and reporting meteorological elements

13.4.1 Surface wind

a) The mean direction and the mean speed of the surface wind shall be measured, as well as significant variations of the wind direction and speed, and reported in degree true and knots (or metres per second), respectively.

b) When local routine and special reports are used for departing aircraft, the surface wind observations for these reports should be representative of conditions along the runway; when local routine and special reports are used for arriving aircraft, the surface wind observations for these reports should be representative of the touchdown zone

c) For METAR and SPECI, the surface wind observations should be representative of conditions above the whole runway where there is only one runway and the whole runway complex where there is more than one runway.

13.4.2 **Visibility**

a) the visibility as defined in subsection 1.2.1 shall be measured or observed, and reported in metres or kilometers.

Note. — Guidance on the conversion of instrument readings into visibility is contained in ICAO Annex 3, Attachment D.

b) when local routine and special reports are used for departing aircraft, the visibility observations for these reports should be representative of conditions along the runway; when local routine and special reports are used for arriving aircraft, the visibility observations for these reports should be representative of the touchdown zone of the runway.

c) for METAR and SPECI, the visibility observations should be representative of the aerodrome.

13.4.3 **Runway visual range**

Note. — Guidance on the subject of runway visual ranges is contained in the Manual of Runway Visual Range Observing and Reporting Practices (Doc 9328).

a) runway visual range as defined in subsection 1.2.1 shall be assessed on all runways intended for Category II and III instrument approach and landings operations.

b) runway visual range as defined in subsection 1.2.1 should be assessed on all runways intended for use during periods of reduced visibility, including:

1) precision approach runways intended for Category I instrument approach and landing operations; and

2) runways used for take-off and having high-intensity edge lights and/or centre line lights.

Note. — Precision approach runways are defined in ICAO Annex 14, Volume I, Chapter 1, under "Instrument runway".

c) the runway visual range, assessed in accordance with subsection 13.4.3 a) and b), shall be reported in metres throughout periods when either the visibility or the runway visual range is less than 1 500 m.

d) runway visual range assessments shall be representative of:

1) the touchdown zone of the runway intended for non-precision or Category I instrument approach and landing operations;

2) the touchdown zone and the mid-point of the runway intended for Category II instrument approach and landing operations; and

3) the touchdown zone, the mid-point and stop-end of the runway intended for Category III instrument approach and landing operations.

e) the units providing air traffic service and aeronautical information service for an aerodrome shall be kept informed without delay of changes in the serviceability status of the automated equipment used for assessing runway visual range.

13.4.4 Present weather

a) the present weather occurring at the aerodrome shall be observed and reported as necessary. The following present weather phenomena shall be identified, as a minimum: rain, drizzle, snow and freezing precipitation (including intensity thereof), haze, mist, fog, freezing fog and thunderstorms (including thunderstorms in the vicinity).

b) for local routine and special reports, the present weather information should be representative of conditions at the aerodrome.

c) for METAR and SPECI, the present weather information should be representative of conditions at the aerodrome and, for certain specified present weather phenomena, in its vicinity.

13.4.5 Clouds

a) cloud amount, cloud type and height of cloud base shall be observed and reported as necessary to describe the clouds of operational significance. When the sky is obscured, vertical visibility shall be observed and reported, where measured, in lieu of cloud amount, cloud type and height of cloud base. The height of cloud base and vertical visibility shall be reported in feet (or metres).

b) cloud observations for local routine and special reports should be representative of the runway threshold(s) in use.

c) cloud observations for METAR and SPECI should be representative of the aerodrome and its vicinity.

13.4.6 **Air temperature and dew-point temperature**

a) the air temperature and the dew-point temperature shall be measured and reported in degrees Celsius.

b) observations of air temperature and dew-point temperature for Local routine reports, local special reports, METAR and SPECI should be representative of the whole runway complex.

13.4.7 **Atmospheric pressure**

a) The atmospheric pressure shall be measured, and QNH and QFE values shall be computed and reported in hectopascals.

13.4.8 **Supplementary information**

a) Observations made at aerodromes should include the available supplementary information concerning significant meteorological conditions, particularly those in the approach and climb-out areas. Where practicable, the information should identify the location of the meteorological condition.

13.5 Reporting meteorological information from automatic observing systems

13.5.1 METAR and SPECI from automatic observing systems should be used at aerodrome during non-operational hours, and during operational hours of the aerodrome should be determined by MET service provider in consultation with users based on the availability and efficient use of personnel.

Note. — Guidance on the use of automatic meteorological observing systems is given in ICAO DOC 9837

13.5.2 Local routine and special reports from automatic observing systems should be used at aerodrome, and during operational hours of the aerodrome should be determined by MET service provider in consultation with users based on the availability and efficient use of personnel.

13.5.3 Local routine reports, local special reports, METAR and SPECI from automatic observing systems shall be identified with the word “AUTO”.

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Chapter 14 Standards for Aerodrome Meteorological Offices

14.1 General

14.1.1 This Chapter sets out the standards for aerodrome meteorological offices.

14.1.2 For an aerodrome without an aerodrome meteorological office located at the aerodrome:

a) MET service provider shall designate one or more aerodrome meteorological office(s) to supply meteorological information as required; and
b) MET service provider shall establish means by which such information can be supplied to the aerodromes concerned.

14.2 Aerodrome meteorological office function

14.2.1 An aerodrome meteorological office shall carry out all or some of the following functions as necessary to meet the needs of flight operations at the aerodrome:

a) prepare and/or obtain forecasts and other relevant information for flights with which it is concerned; the extent of its responsibilities to prepare forecasts shall be related to the local availability and use of en-route and aerodrome forecast material received from other offices;

b) prepare and/or obtain forecasts of local meteorological conditions;

c) maintain a continuous survey of meteorological conditions over the aerodromes for which it is designated to prepare forecasts;

d) provide briefing, consultation and flight documentation to flight crew members and/or other flight operations personnel;

e) supply other meteorological information to aeronautical users;

f) display the available meteorological information; and

g) exchange meteorological information with other aerodrome meteorological offices.

14.3 Use of forecasts

MET service provider shall provide forecasts in accordance with Technical specifications in ICAO Annex 3, Appendix 5.

14.3.1 The issue of a new forecast by an aerodrome meteorological office, such as a routine aerodrome forecast, shall be understood to cancel automatically any forecast of the same type previously issued for the same place and for the same period of validity or part thereof.

14.3.2 **Aerodrome forecasts**

14.3.2.1 An aerodrome forecast shall be prepared in accordance with Asia and Pacific Regions (APAC) Air Navigation Plan and ASIA/PAC FASID (facilities and services implementation document), by the aerodrome meteorological office designated by MET service provider.

Note. — The aerodrome for which aerodrome forecasts are to be prepared and the period of validity of these forecasts are listed in the relevant facilities and services implementation document (FASID).

14.3.2.2 An aerodrome forecast shall be issued at a specified time not earlier than one hour prior to the beginning of its validity period and consist of a concise statement of the expected meteorological conditions at an aerodrome for a specified period.

14.3.2.3 Aerodrome forecasts and amendments thereto shall be issued as TAF and include the following information in the order indicated:

a) identification of the type of forecast;

b) location indicator;

c) time of issue of forecast;

d) identification of a missing forecast, when applicable;

e) date and period of validity of forecast;

f) identification of a cancelled forecast, when applicable;

g) surface wind;

h) visibility;

i) weather

j) cloud; and

k) expected significant changes to one or more of these elements during the period of validity.

Optional elements shall be included in TAF in accordance with Asia and Pacific Regions (APAC) Air Navigation Plan.

Note. — The visibility included in TAF refers to the forecast prevailing visibility.

14.3.2.4 Aerodrome meteorological offices preparing TAF shall keep the forecasts under continuous review and, when necessary, shall issue amendments promptly. The length of the forecast messages and the number of change and probability groups shall be kept to a minimum.

Note. — Guidance on methods to keep TAF under continuous review is given in Chapter 3 of the Manual of Aeronautical Meteorological Practice (Doc 8896).

14.3.2.5 TAF that cannot be kept under continuous review shall be cancelled.

14.3.2.6 The period of validity of a routine TAF should be not less than 6 hours and not more than 30 hours; the period of validity should be determined by Asia and Pacific Regions (APAC) Air Navigation Plan. Routine TAF valid for less than 12 hours should be issued every 3 hours and those valid for 12 to 30 hours should be issued every 6 hours.

14.3.2.7 When issuing TAF, aerodrome meteorological offices shall ensure that not more than one TAF is valid at an aerodrome at any given time.

14.3.3 Landing forecasts

14.3.3.1 A landing forecast shall be prepared by the aerodrome meteorological office designated by MET service provider as determined by Asia and Pacific Regions (APAC) Air Navigation Plan; such forecasts are intended to meet the requirements of local users and of aircraft within about one hour's flying time from the aerodrome.

14.3.3.2 Landing forecasts shall be prepared in the form of a trend forecast.

14.3.3.3 A trend forecast shall consist of a concise statement of the expected significant changes in the meteorological conditions at that aerodrome to be appended to a local routine report, local special report, METAR or SPECI. The period of validity of a trend forecast shall be 2 hours from the time of the report which forms part of the landing forecast.

14.3.4 Forecasts for take-off

14.3.4.1 A forecast for take-off shall be prepared by the aerodrome meteorological office designated by MET service provider as agreed between aerodrome meteorological office and operators.

14.3.4.2 A forecast for take-off should refer to a specified period of time and should contain information on expected conditions over the runway complex in regard to surface wind direction and speed and any variations thereof, temperature, pressure (QNH), and any other elements as agreed locally.

14.3.4.3 A forecast for take-off should be supplied to operators and flight crew members on request within the 3 hours before the expected time of departure.

14.3.4.4 Aerodrome meteorological offices preparing forecasts for take-off should keep the forecasts under continuous review and, when necessary should issue amendments promptly.

14.3.5 Area forecasts for low-level flights

14.3.5.1 When the density of traffic operating below flight level 100 (or up to flight level 150 in mountainous areas, or higher, where necessary) warrants the routine issue and dissemination of area forecasts for such operations, the frequency of issue, the form and the fixed time or period of validity of those forecasts and the criteria for amendments thereto shall be determined by MET service provider in consultation with the users.

14.3.5.2 When the density of traffic operating below flight level 100 warrants the issuance of AIRMET information in accordance with subsection 15.4.1, area forecasts for such operations shall be prepared in a format as agreed between MET service provider in the States concerned. When abbreviated plain language is used, the forecast shall be prepared as a GAMET area forecast, employing approved ICAO abbreviations and numerical values; when chart form is used, the forecast shall be prepared as a combination of forecasts of upper wind and upper-air temperature, and of SIGWX phenomena. The area forecasts shall be issued to cover the layer between the ground and flight level 100 (or up to flight level 150 in mountainous areas, or higher, where necessary) and shall contain information on en-route weather phenomena hazardous to low-level flights, in support of the issuance of AIRMET information, and additional information required by low-level flights

14.3.5.3 Area forecasts for low-level flights prepared in support of the issuance of AIRMET information shall be issued every 6 hours for a period of validity of 6 hours and transmitted to meteorological watch offices and/or aerodrome meteorological offices concerned not later than one hour prior to the beginning of their validity period.

14.4 Aerodrome warnings

MET service provider shall provide aerodrome warnings in accordance with Technical specifications in ICAO Annex 3, Appendix 6.

14.4.1 Aerodrome warnings shall be issued by the aerodrome meteorological office designated by MET service provider and shall give concise information of meteorological conditions which could adversely affect aircraft on the ground, including parked aircraft, and the aerodrome facilities and services.

14.4.2 Aerodrome warnings should be cancelled when the conditions are no longer occurring and/or no longer expected to occur at the aerodrome.

14.5 Wind shear warnings and alerts

MET service provider shall provide wind shear warnings in accordance with Technical specifications in ICAO Annex 3, Appendix 6.

14.5.1 Wind shear warnings shall be prepared by the aerodrome meteorological office designated by MET service provider for aerodromes where wind shear is considered a factor, in accordance with local arrangements with the appropriate air traffic services unit and operators concerned. Wind shear warnings shall give concise information on the observed or expected existence of wind shear which could adversely affect aircraft on the approach path or take-off path or during circling approach between runway level and 1 600 ft (500 m) above that level and aircraft on the runway during the landing roll or take-off run. Where local topography has been shown to produce significant wind shears at heights in excess of 1 600 ft (500 m) above runway level, then 1 600 ft (500 m) shall not be considered restrictive.

14.5.2 Wind shear warnings for arriving aircraft and/or departing aircraft should be cancelled when aircraft reports indicate that wind shear no longer exists or, alternatively, after an agreed elapsed time. The criteria for the cancellation of a wind shear warning

should be defined locally for each aerodrome, as agreed between MET service provider, the appropriate ATS authority and the operators concerned.

14.5.3 At aerodromes where wind shear is detected by automated, ground-based, wind shear remote-sensing or detection equipment, wind shear alerts generated by these systems shall be issued, Wind shear alerts shall give concise, up-to-date information related to the observed existence of wind shear involving a headwind/tailwind change of 15 kt (7.5 m/s) or more which could adversely affect aircraft on the final approach path or initial take-off part and aircraft on the runway during the landing roll or take-off run.

14.5.4 Wind shear alerts should be updated at least every minute, the wind shear alert should be cancelled as soon as the headwind/tailwind change falls below 15 kt (7.5 m/s).

14.6 Service for operators and flight crew members

MET service provider shall provide service for operators and flight crew members in accordance with Technical specifications in ICAO Annex 3, Appendix 8.

14.6.1 **General Provisions**

14.6.1.1 Aerodrome meteorological office shall supply meteorological information to operators and flight crew members for;

a) pre-flight planning by operators;

b) in-flight replanning by operators using centralized operational control of flight operations;

c) use by flight crew members before departure; and

d) aircraft in flight.

14.6.1.2 Meteorological information supplied to operators and flight crew members shall cover the flight in respect of time, altitude and geographical extent. Accordingly, the information shall relate to appropriate fixed times, or periods of time, and shall extend the aerodrome of intended landing, also covering the meteorological conditions expected between the aerodrome of intended landing and alternate aerodromes designated by the operator.

14.6.1.3 Meteorological information supplied to operators and flight crew members shall be up to date and include the following information, as agreed between MET service provider and the operators concerned:

a) forecasts of:

1) upper wind and upper-air temperature;

2) upper-air humidity;

3) geopotential altitude of flight levels;

4) flight level and temperature of tropopause;

5) direction, speed and flight level of maximum wind;

6) SIGWX phenomena; and

7) cumulonimbus clouds, icing and turbulence;

Note 1. — Forecasts of upper-air humidity and geopotential altitude of flight levels are used only in automatic flight planning and need not be displayed.

Note 2. — Forecasts of cumulonimbus clouds, icing and turbulence are intended to be processed and, if necessary, visualized according to the specific thresholds relevant to user operations.

b) METAR or SPECI (including trend forecasts as issued in accordance with Asia and Pacific Regions (APAC) Air Navigation Plan) for the aerodromes of departure and intended landing, and for take-off, en-route and destination alternate aerodromes;

c) TAF or amended TAF for the aerodromes of departure and intended landing, and for take-off, en-route and destination alternate aerodromes;

d) forecasts for take-off;

e) SIGMET information;

Note. — Appropriate special air-reports will be those not already used in the preparation of SIGMET

f) volcanic ash and tropical cyclone advisory information relevant to the whole route;

g) as determined by Asia and Pacific Regions (APAC) Air Navigation Plan, GAMET area forecasts and/or area forecasts for low-level flights in chart form prepared in support of the issuance of AIRMET information, and AIRMET information for low-level flights relevant to the whole route;

h) aerodrome warnings for the local aerodrome;

i) meteorological satellite images;

j) ground-based weather radar information; and

k) space weather advisory information relevant to the whole route.

14.6.1.4 Forecasts listed under subsection 14.6.1.3 a) shall be generated from the digital forecasts provided by the WAFCs whenever these forecasts cover the intended flight path in respect of time, altitude and geographical extent, unless otherwise agreed between MET service provider and the operator concerned.

14.6.1.5 When forecasts are identified as being originated by the WAFCs, no modifications shall be made to their meteorological content.

14.6.1.6 Charts generated from the digital forecasts provided by the WAFCs shall be made available, as required by operators, for fixed areas of coverage as shown in ICAO Annex 3, Appendix 8, Figures A8-1, A8-2 and A8-3.

14.6.1.7 When forecasts of upper wind and upper-air temperature listed under subsection 14.6.1.3 a), 1) are supplied in chart form, they shall be fixed time prognostic charts for flight levels as specified in ICAO Annex 3, Appendix 2, 1.2.2, (a) When forecasts of SIGWX phenomena listed under subsection 14.6.1.3 a), 6) are supplied in chart form, they shall be fixed time prognostic charts for an atmospheric layer limited by flight levels as specified in ICAO Annex 3, Appendix 2, 1.3.2 and ICAO Annex 3, Appendix 5, 4.3.2.

14.6.1.8 The forecasts of upper wind and upper-air temperature and of SIGWX phenomena above flight level 100 requested for pre-flight planning and in-flight replanning by the operator shall be supplied as soon as they become available, but not later than 3 hours before departure, Other meteorological information requested for pre-flight planning and in-flight replanning by the operator shall be supplied as soon as is practicable.

14.6.1.9 When necessary, MET service provider providing service for operators and flight crew members shall initiate coordinating action with MET service provider of other States with a view to obtaining from them the reports and/or forecasts required.

14.6.1.10 Meteorological information shall be supplied to operators and flight crew members at the location to be determined by MET service provider, after consultation with the operators and at the time to be agreed upon between the aerodrome meteorological office and the operator concerned. The service for pre-flight planning shall be confined to flights originating within the territory of the Thailand. At and aerodrome without an aerodrome meteorological office at the aerodrome, arrangements for the supply of meteorological information shall be as agreed upon between MET service provider and the operator concerned.

14.6.2 **Briefing, consultation and display**

Note. — The requirements for the use of automated pre-flight information systems in providing briefing, consultation and display are given in subsection 14.6.4

14.6.2.1 Briefing and/or consultation shall be provided, on request, to flight crew members and/or other flight operations personnel. Its purpose shall be to supply the latest available information on existing and expected meteorological conditions along the route to be flown, at the aerodrome of intended landing, alternate aerodromes and other aerodromes as relevant, either to explain and amplify the information contained in the flight documentation or, if so agreed between MET service provider and the operator concerned, in lieu of flight documentation.

14.6.2.2 Meteorological information used for briefing, consultation and display shall include any or all of the information listed in subsection 14.6.1.3

14.6.2.3 If the aerodrome meteorological office expresses an opinion on the development of the meteorological conditions at an aerodrome which differs appreciably from the aerodrome forecast included in the flight documentation, the attention of flight crew members shall be drawn to the divergence. The portion of the briefing dealing with the divergence shall be recorded at time of briefing and this record shall be made available to the operator.

14.6.2.4 The required briefing, consultation, display and/or flight documentation shall normally be provided by the aerodrome meteorological office associated with the aerodrome of departure. At an aerodrome where these services are not available, arrangements to meet the requirements of flight crew members shall be as agreed

upon between MET service provider and the operator concerned. In exceptional circumstances, such as an undue delay, the aerodrome meteorological office associated with the aerodrome shall provide or, if that is not practicable, arrange for the provision of a new briefing, consultation and/or flight documentation as necessary.

14.6.2.5 The flight crew member and/or other flight operations personnel for whom briefing, consultation and/or flight documentation has been requested should visit the aerodrome meteorological office at the time agreed upon between the aerodrome meteorological office and the operator concerned, Where local circumstances at an aerodrome make personal briefing or consultation impracticable, the aerodrome meteorological office should provide those services by telephone or other suitable telecommunications facilities.

14.6.3 **Flight documentation**

Note. — The requirements for the use of automated pre-flight information systems in providing flight documentation are given in subsection 14.6.4

14.6.3.1 Flight documentation to be made available shall comprise information listed under subsection 14.6.1.3 a) 1) and 6), b), c), e), f) and, if appropriate, g) and k). However, flight documentation for flights of two hours' duration or less, after a short stop or turnaround, shall be limited to the information operationally needed, as agreed between MET service provider and the operator concerned, but in all cases it shall at least comprise information on subsection 14.6.1.3 b), c), e), f) and, if appropriate, g) and k).

14.6.3.2 Whenever it becomes apparent that the meteorological information to be included in the flight documentation will differ materially from that made available for pre-flight planning and in flight replanning, the operator shall be advised immediately and, if practicable, be supplied with the revised information as agreed between the operator and the aerodrome meteorological office concerned.

14.6.3.3 In cases where a need for amendment arises after the flight documentation has been supplied and before take-off of the aircraft, the aerodrome meteorological office should, as agreed locally, issue the necessary amendment or updated information to the operator or to the local air traffic services unit, for transmission to the aircraft.

14.6.4 **Automated pre-flight information systems**

14.6.4.1 Where MET service provider uses automated pre-flight information systems to supply and display meteorological information to operators and flight crew members for self-briefing, flight planning and flight documentation purposes, the information supplied and displayed shall comply with the relevant provisions in subsection 14.6.1 to 14.6.3 inclusive.

14.6.4.2 Automated pre-flight information systems providing for a harmonized, common point of access to meteorological information and aeronautical information services information by operators, flight crew members and other aeronautical personnel concerned should be as agreed between MET service provider and the civil aviation authority or the agency to which the authority to provide service has been delegated in accordance with Annex 15, 2.1.1 c).

Note. — The meteorological and aeronautical information services information concerned is specified in subsection 14.6.1 to 14.6.3 and Appendix 8 and in the Procedures for Air Navigation Services — Aeronautical Information Management (PANS-AIM, Doc 10066), 5.5, respectively.

14.6.4.3 Where automated pre-flight information systems are used to provide for a harmonized, common point of access to meteorological information and aeronautical information services information by operators, flight crew members and other aeronautical personnel concerned, MET service provider shall remain responsible for the quality control and quality management of meteorological information provided by means of such systems in accordance with Chapter 8, subsection 8.2.

Note. — The responsibilities relating to aeronautical information services information and the quality assurance of the information are given in ICAO Annex 15, Chapters 1, 2 and 3.

14.6.5 **Information for aircraft in flight**

14.6.5.1 Meteorological information for use by aircraft in flight shall be supplied by an aerodrome meteorological office or meteorological watch office to its associated air traffic services unit and through D-VOLMET or VOLMET broadcasts as determined by Asia and Pacific Regions (APAC) Air Navigation Plan. Meteorological information for

planning by the operator for aircraft in flight shall be supplied on request, as agreed between MET service provider and the operator concerned.

14.6.5.2 Meteorological information for use by aircraft in flight shall be supplied to air traffic services units in accordance with the specifications of Chapter 16.

14.6.5.3 Meteorological information shall be supplied through D-VOLMET or VOLMET broadcasts in accordance with the specifications of Chapter 17.

14.7 Aeronautical climatological information

MET service provider shall provide aeronautical climatological information in accordance with Technical specifications in ICAO Annex 3, Appendix 7.

14.7.1 General Provisions

14.7.1.1 In cases where it is impracticable to meet the requirements for aeronautical climatological information on a national basis, the collection, processing and storage of observational data may be effected through computer facilities available for international use, and the responsibility for the preparation of the required aeronautical climatological information may be delegated as aerodrome meteorological office.

14.7.1.2 Aeronautical climatological information required for the planning of flight operations shall be prepared in the form of aerodrome climatological tables and aerodrome climatological summaries. Such information shall be supplied to aeronautical users as agreed between MET service provider and the user concerned.

Note. — Climatological data required for aerodrome planning purposes are set out in ICAO Annex 14, Volume I, 3.1.4 and ICAO Annex 3, Attachment A.

14.7.1.3 Aeronautical climatological information should normally be based on observations made over a period of at least five years and the period should be indicated in the information supplied.

14.7.1.4 Climatological data related to sites for new aerodromes and to additional runways at existing aerodromes should be collected starting as early as possible before the commissioning of those aerodromes or runways

14.7.2 **Aerodrome climatological tables**

14.7.2.1 MET service provider, should make arrangements for collecting and retaining the necessary observational data and have the capability:

a) to prepare aerodrome climatological tables for each regular and alternate international aerodrome within its territory; and

b) to make available such climatological tables to an aeronautical user within a time period as agreed between MET service provider and the user concerned.

14.7.3 **Aerodrome climatological summaries**

14.7.3.1 Aerodrome climatological summaries should follow the procedures prescribed by the World Meteorological Organization (WMO). Where computer facilities are available to store, process and retrieve the information, the summaries should be published or otherwise made available to aeronautical users on request. Where such computer facilities are not available, the summaries should be prepared using the models specified by the World Meteorological Organization and should be published and kept up to date as necessary.

14.7.4 **Copies of meteorological observational data**

14.7.4.1 Each MET service provider, on request and to the extent practicable, shall make available to any other MET service provider, to operators and to others concerned with the application of meteorology to air navigation, meteorological observational data required for research, investigation or operational analysis.

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Chapter 15 Standards for Meteorological Watch Offices

15.1 General

15.1.1 This Chapter sets out the standards for meteorological watch offices.

15.1.2 MET service provider shall establish one or more MWOs, in accordance with regional air navigation agreement are listed in the relevant ANP, Part V of Volume II, Table MET II-1, for providing meteorological service for the Bangkok FIR.

15.2 Meteorological Watch Office function

15.2.1 An MWO shall:

a) maintain continuous watch over meteorological conditions affecting flight operations within its area of responsibility;

b) prepare SIGMET and other information relating to its area of responsibility;

c) supply SIGMET information and, as required, other meteorological information to associated air traffic services units;

d) disseminate SIGMET information;

e) when required by Asia/Pacific air navigation agreement, in accordance with 15.4.1:

1) prepare AIRMET information related to its area of responsibility;

2) supply AIRMET information to associated air traffic services units; and

3) disseminate AIRMET information;

f) supply information received on pre-eruption volcanic activity, a volcanic eruption and volcanic ash cloud for which a SIGMET has not already been issued, to its associated area control centre (ACC)/flight information centre (FIC), as agreed between MET service provider and ATS provider, and to its associated VAAC as determined by Asia and Pacific Regions (APAC) Air Navigation Plan; and

g) supply information received concerning the release of radioactive materials into the atmosphere, in the area for which it maintains watch or adjacent areas, to its associated ACC/FIC, as agreed between MET service provider and ATS provider concerned, and to AIS provider, as agreed between MET service

provider and CAAT. The information shall comprise location, date and time of the release, and forecast trajectories of the radioactive materials.

15.2.2 The boundaries of the area over which meteorological watch is to be maintained by an MWO should be coincident with the boundaries of an FIR or a CTA or a combination of FIRs and/or CTAs.

15.2.3 An MWO should coordinate SIGMET with neighbouring MWO(s), especially when the en-route weather phenomenon extends or is expected to extend beyond the MWO's specified area of responsibility, in order to ensure harmonized SIGMET provision.

Note. — Guidance on the bilateral or multilateral coordination between MWOs of Contracting States for the provision of SIGMET can be found in the Manual of Aeronautical Meteorological Practice (Doc 8896).

15.3 SIGMET information

MET service provider shall provide SIGMET information in accordance with Technical specifications in ICAO Annex 3, Appendix 6.

15.3.1 SIGMET information shall be issued by a meteorological watch office and shall give a concise description in abbreviated plain language concerning the occurrence or expected occurrence of specified en-route weather and other phenomena in the atmosphere that may affect the safety of aircraft operations, and of the development of those phenomena in time and space.

15.3.2 SIGMET information shall be cancelled when the phenomena are no longer occurring or are no longer expected to occur in the area.

15.3.3 The period of validity of a SIGMET message shall be not more than 4 hours. In the special case of SIGMET messages for volcanic ash cloud and tropical cyclones, the period of validity shall be extended up to 6 hours.

15.3.4 SIGMET messages concerning volcanic ash cloud and tropical cyclones should be based on advisory information provided by VAACs and TCACs, respectively, designated by Asia and Pacific Regions (APAC) Air Navigation Plan.

15.3.5 Close coordination shall be maintained between the meteorological watch office and the associated area control centre/flight information centre to ensure that information on volcanic ash included in SIGMET and NOTAM messages is consistent.

15.3.6 SIGMET messages shall be issued not more than 4 hours before the commencement of the period of validity. In the special case of SIGMET messages for volcanic ash cloud and tropical cyclones, these messages shall be issued as soon as practicable but not more than 12 hours before the commencement of the period of validity. SIGMET messages for volcanic ash and tropical cyclones shall be updated at least every 6 hours.

15.4 AIRMET Information

MET service provider shall provide AIRMET information in accordance with Technical specifications in ICAO Annex 3, Appendix 6.

15.4.1 AIRMET information shall be issued by a meteorological watch office in accordance with Asia and Pacific Regions (APAC) Air Navigation Plan taking into account the density of air traffic operating below flight level 100. AIRMET information shall give a concise description in abbreviated plain language concerning the occurrence and/or expected occurrence of specified en-route weather phenomena, which have not been included in Section I of the area forecast for low-level flights issued in accordance with Chapter 14, subsection 14.3.5 and which may affect the safety of low-level flights, and of the development of those phenomena in time and space.

15.4.2 AIRMET information shall be cancelled when the phenomena are no longer occurring or are no longer expected to occur in the area.

15.4.3 The period of validity of an AIRMET message shall be not more than 4 hours.

15.5 Aircraft observations and reports

MET service provider shall provide services related to aircraft observations and reports in accordance with Technical specifications in ICAO Annex 3, Appendix 4.

15.5.1 **Relay of air-reports by air traffic services units**

15.5.1.1 MET service provider shall make arrangements with appropriate ATS provider to ensure that, on receipt by the ATS units of:

a) special air-reports by voice communications, the ATS units relay them without delay to their associated meteorological watch office; and

b) routine and special air-reports by data link communications, the ATS units relay them without delay to their associated meteorological watch office, the WAFCs

and the centres designated by Asia/Pacific air navigation agreement for the operation of aeronautical fixed service Internet-based services.

15.5.1.2 On receipt of a special air-report from the associated ACC or FIC, the MWO shall:

a) issue SIGMET information based on the special air-report; or

b) send the special air-report for onward transmission to MWOs, WAFCs, and other meteorological offices in accordance with Asia/Pacific air navigation agreement in the case that the issuance of SIGMET information is not warranted (e.g., the phenomenon concerned is of transient nature).

15.5.2 **Types of aircraft observations**

The following aircraft observations shall be made:

a) routine aircraft observations during en-route and climb-out phases of the flight; and

b) special and other non-routine aircraft observations during any phase of the flight.

15.5.3 **Routine aircraft observations – designation**

15.5.3.1 When air-ground data link is used and automatic dependent surveillance (ADS-C) or secondary surveillance radar (SSR) Mode S is being applied, automated routine observations should be made every 15 minutes during the en-route phase and every 30 seconds during the climb-out phase for the first 10 minutes of the flight.

15.5.3.2 For helicopter operations to and from aerodromes on offshore structures, routine observations should be made from helicopters at points and times as agreed between the meteorological authorities and the helicopter operators concerned.

15.5.3.3 In the case of air routes with high-density air traffic (e.g. organized tracks), an aircraft from among the aircraft operating at each flight level shall be designated, at approximately hourly intervals, to make routine observations in accordance with subsection 15.5.3.1. The designation procedures shall be in accordance with Asia/Pacific air navigation agreement.

15.5.3.4 In the case of the requirement to report during the climb-out phase, an aircraft shall be designated, at approximately hourly intervals, at each aerodrome to make routine observations in accordance with subsection 15.5.3.1.

15.5.4 **Routine aircraft observations – exemptions**

15.5.4.1 Aircraft not equipped with air-ground data link shall be exempted from making routine aircraft observations.

15.5.5 **Special aircraft observations**

15.5.5.1 Special observations shall be made by all aircraft whenever the following conditions are encountered or observed:

a) moderate or severe turbulence; or

b) moderate or severe icing; or

c) severe mountain wave; or

d) thunderstorms, without hail, that are obscured, embedded, widespread or in squall lines; or

e) thunderstorms, with hail, that are obscured, embedded, widespread or in squall lines; or

f) heavy dust storm or heavy sandstorm; or

g) volcanic ash cloud.

h) pre-eruption volcanic activity or a volcanic eruption; or

Note.— Pre-eruption volcanic activity in this context means unusual and/or increasing volcanic activity which could presage a volcanic eruption.

i) as of 5 November 2020, runway braking action encountered is not as good as reported.

15.5.6 **Other non-routine aircraft observations**

15.5.6.1 When other meteorological conditions not listed under subsection 15.5.5.1, e.g. wind shear, are encountered and which, in the opinion of the pilot-in-command, may affect the safety or markedly affect the efficiency of other aircraft operations, the pilot-in-command shall advise the appropriate air traffic services unit as soon as practicable.

Note. — Icing, turbulence and, to a large extent, wind shear are elements which, for the time being, cannot be satisfactorily observed from the ground and for which in most cases aircraft observations represent the only available evidence.

15.5.7 **Reporting of aircraft observations during flight**

15.5.7.1 Aircraft observations shall be reported by air-ground data link. Where air ground data link is not available or appropriate, special and other non-routine aircraft observations during flight shall be reported by voice communications in according to ICAO DOC 4444, Appendix 1, MODEL AIREP SPECIAL.

15.5.7.2 Aircraft observations shall be reported during flight at the time the observation is made or as soon thereafter as is practicable.

15.5.7.3 Aircraft observations shall be reported as air-reports.

15.5.8 **Recording and post-flight reporting of aircraft observations of volcanic activity**

15.5.8.1 Special aircraft observations of pre-eruption volcanic activity, a volcanic eruption or volcanic ash cloud shall be recorded on the special air-report of volcanic activity form in according to ICAO DOC 4444, Appendix 1, MODEL VOLCANIC ACTIVITY REPORT (VAR): to be used for post-flight reporting. A copy of the form shall be included with the flight documentation provided to flights operating on routes which, in the opinion of MET service provider concerned, could be affected by volcanic ash clouds.

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Chapter 16 Information for Air Traffic Services, Search and Rescue Services and Aeronautical Information Services

16.1 General

16.1.1 This Chapter sets out the standards for Information for Air Traffic Services, Search and Rescue Services and Aeronautical Information Services

16.1.2 MET service provider shall provide information to Air Traffic Services, Search and Rescue Services and Aeronautical Information Services in accordance with Technical specifications in ICAO Annex 3, Appendix 9.

16.2 Information for air traffic services units.

16.2.1 MET service provider shall designate an aerodrome meteorological office or meteorological watch office to be associated with each air traffic services unit. The associated aerodrome meteorological office or meteorological watch office shall, after coordination with the air traffic services unit, supply, or arrange for the supply of, up-to-date meteorological information to the unit as necessary for the conduct of its functions.

16.2.2 An aerodrome meteorological office should be associated with an aerodrome control tower or approach control unit for the provision of meteorological information.

16.2.3 A meteorological watch office shall be associated with a flight information centre or an area control centre for the provision of meteorological information.

16.2.4 Where, owing to local circumstances, it is convenient for the duties of an associated aerodrome meteorological office or meteorological watch office to be shared between two or more aerodrome meteorological offices or meteorological watch offices, the division of responsibility should be determined by MET service provider in consultation with the appropriate ATS provider.

16.2.5 Any meteorological information requested by an air traffic services unit in connection with an aircraft emergency shall be supplied as rapidly as possible.

16.3 Information for search and rescue services units

16.3.1 An aerodrome meteorological offices or meteorological watch offices designated by MET service provider in accordance with Asia and Pacific Regions (APAC) Air Navigation Plan shall supply search and rescue services units with the meteorological information they require in a form established by agreement. For that purpose, the designated aerodrome meteorological office or meteorological watch office shall maintain liaison with the search and rescue services unit throughout a search and rescue operation.

16.4 Information for aeronautical information services units

16.4.1 MET service provider shall arrange for the supply of up-to-date meteorological information to relevant aeronautical information services units, as necessary, for the conduct of their functions.

Chapter 17 Requirements for and Use of Communications

17.1 General

17.1.1 This chapter sets out the standards Requirements for and Use of Communications.

17.1.2 Technical specifications and detailed criteria related to Requirements for and Use of Communications are contained in ICAO Annex 3, Appendix 10.

17.2 Requirements for communications

17.2.1 Suitable telecommunications facilities shall be made available to permit aerodrome meteorological offices and, as necessary, aeronautical meteorological stations to supply the required meteorological information to air traffic services units on the aerodromes for which those offices and stations are responsible, and in particular to aerodrome control towers, approach control units and aeronautical telecommunications stations serving these aerodromes.

17.2.2 Suitable telecommunications facilities shall be made available to permit meteorological watch offices to supply the required meteorological information to air traffic services and search and rescue services units in respect of the flight information regions, control areas and search and rescue regions for which those offices are responsible, and in particular to flight information centres, area control centres and rescue coordination centres and the associated aeronautical telecommunications stations.

17.2.3 Suitable telecommunications facilities shall be made available to permit world area forecast centres to supply the required world area forecast system products to MET service provider.

17.2.4 Telecommunications facilities between aerodrome meteorological offices and, as necessary, aeronautical meteorological stations and aerodrome control towers or approach control units shall permit communications by direct speech, the speed with which the communications can be established being such that the required points may normally be contacted within approximately 15 seconds.

17.2.5 Telecommunications facilities between aerodrome meteorological offices or meteorological watch offices and flight information centres, area control centres,

rescue coordination centres and aeronautical telecommunications stations should permit:

a) communications by direct speech, the speed with which the communications can be established being such that the required points may normally be contacted within approximately 15 seconds; and

b) printed communications, when a record is required by the recipients: the message transit time should not exceed 5 minutes.

Note. — In subsection 17.2.4 and 17.2.5 "approximately 15 seconds" refers to telephony communications involving switchboard operation and "5 minutes" refers to printed communications involving retransmission.

17.2.6 The telecommunications facilities required in accordance with subsection 17.2.4 and 17.2.5 should be supplemented, as and where necessary, by other forms of visual or audio communications, for example, closed-circuit television or separate information processing systems.

17.2.7 As agreed between MET service provider and operators, provision should be made to enable operators to establish suitable telecommunications facilities for obtaining meteorological information from aerodrome meteorological offices or other appropriate sources.

17.2.8 Suitable telecommunications facilities shall be made available to permit meteorological offices to exchange operational meteorological information with other meteorological offices.

17.2.9 The telecommunications facilities used for the exchange of operational meteorological information should be the aeronautical fixed service or, for the exchange of non-time critical operational meteorological information, the public internet, subject to availability, satisfactory operation a bilateral/multilateral and /or Asia/Pacific air navigation agreement.

Note 1. — Aeronautical fixed service Internet-based services, operated by the world area forecast centres, providing for global coverage are used to support the global exchanges of operational meteorological information.

Note 2. — Guidance material on non-time-critical operational meteorological information and relevant aspects of the public Internet is provided in the Guidelines on the Use of the Public Internet for Aeronautical Applications (Doc 9855).

17.3 Use of aeronautical fixed service communications and the public Internet – meteorological bulletins

17.3.1 Meteorological bulletins containing operational meteorological information to be transmitted via the aeronautical fixed service or the public internet shall be originated by the appropriate meteorological office or aeronautical meteorological station.

Note. — Meteorological bulletins containing operational meteorological information authorized for transmission via the aeronautical fixed service are listed in ICAO Annex 10, Volume II, Chapter 4, together with the relevant priorities and priority indicators.

17.4 Use of aeronautical fixed service communications-world area forecast system products

17.4.1 World area forecast system products in digital form should be transmitted using binary data communications techniques. The method and channels used for the dissemination of the products should be as determined by Asia/Pacific air navigation agreement.

17.5 Use of aeronautical mobile service communications

17.5.1 The content and format of meteorological information transmitted to aircraft and by aircraft shall be consistent with the provisions of this MET MOS.

17.6 Use of aeronautical data link service–contents of D-VOLMET

17.6.1 D-VOLMET shall contain current METAR and SPECI, together with trend forecasts where available, TAF and SIGMET, special air-reports not covered by a SIGMET and, where available, AIRMET.

Note.— The requirement to provide METAR and SPECI may be the data link-flight information service (D-FIS) application entitled "Data link-aerodrome routine meteorological report (D-METAR) service" the requirement to provide TAF may be met by the D-FIS application entailed "Data link-aerodrome forecast (D-TAF) service" and the requirement to provide SIGMET messages may be met by the D-FIS application entitled "Data link-SIGMET (D-SIGMET) service" The details of these data

link services are specified in the Manual of Air Traffic Service Data Link Applications (Doc 9694).

17.6.2 Detailed content of meteorological information available for D-VOLMET.

17.6.2.1 The aerodromes for which METAR, SPECI and TAF are to be available for uplink to aircraft in flight shall be determined by Asia and Pacific Regions (APAC) Air Navigation Plan.

17.6.2.2 The flight information regions (FIRs) for which SIGMET and AIRMET messages are to be available for uplink to aircraft in flight shall be determined by Asia and Pacific Regions (APAC) Air Navigation Plan.

17.6.3 Criteria related to information to be available for D-VOLMET

17.6.3.1 The latest available METAR, SPECI and TAF, and valid SIGMET and AIRMET should be used for uplink to aircraft in flight.

17.6.3.2 TAF included in the D-VOLMET should be amended as necessary to ensure that a forecast, when made available for uplink to aircraft in flight, reflects the latest opinion of the aerodrome meteorological office concerned.

17.6.3.3 If no SIGMET message is valid for an FIR, an indication of “NIL SIGMET” should be included in the D-VOLMET.

17.6.4 Format of information to be available

17.6.4.1 The content and format of reports, forecasts and SIGMET and AIRMET information included in D-VOLMET shall be consistent with the provisions of Chapters 13, 14 and 15 of this MET MOS.

17.7 Use of aeronautical broadcasting service-contents of VOLMET broadcasts

17.7.1 Continuous VOLMET broadcasts, normally on very high frequencies (VHF), shall contain current TAF, SIGMET, METAR and SPECI, together with trend forecasts where available.

17.7.2 Scheduled VOLMET broadcasts shall be determined by Asia and Pacific Regions (APAC) Air Navigation Plan.

17.7.3 Detailed content of meteorological information to be included in VOLMET broadcasts.

17.7.3.1 The aerodromes for which METAR, SPECI and TAF are to be included in VOLMET broadcasts, the sequence in which they are to be transmitted and the broadcast time shall be determined by Asia and Pacific Regions (APAC) Air Navigation Plan.

17.7.3.2 The FIRs for which SIGMET messages are to be included in scheduled VOLMET broadcasts shall be determined by Asia and Pacific Regions (APAC) Air Navigation Plan. Where this is done, the SIGMET message shall be transmitted at the beginning of the broadcast or of a five-minute time block.

17.7.4 Criteria related to information to be included in VOLMET broadcasts

17.7.4.1 When a report has not arrived from an aerodrome in time for a broadcast, the latest available report should be included in the broadcast, together with the time of observation.

17.7.4.2 TAF included in scheduled VOLMET broadcasts should be amended as necessary to ensure that a forecast, when transmitted, reflects the latest opinion of the aerodrome meteorological office concerned.

17.7.4.3 Where SIGMET messages are included in scheduled VOLMET broadcasts, an indication of “NIL SIGMET” should be transmitted if no SIGMET message is valid for the FIRs concerned.

17.7.5 Format of information to be included in VOLMET broadcasts

17.7.5.1 The content and format of reports, forecasts and SIGMET information included in VOLMET broadcasts shall be consistent with the provisions of Chapters 13, 14 and 15 of this MET MOS.

17.7.5.2 VOLMET broadcasts should use standard radiotelephony phraseologies.

Note .— Guidance on the standard radiotelephony phraseologies to be used in VOLMET broadcasts is given in the Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services (Doc 9377), Appendix 1.