

MANUAL OF STANDARDS
(174 – METEOROLOGICAL SERVICE FOR INTERNATIONAL AIR
NAVIGATION) 2025

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In exercise of the powers conferred by section 8(1) of the Civil Aviation Authority of Singapore Act 2009 (“the Act”) read with paragraph 4(e) of the Second Schedule to the Act, the Authority issues the following Manual of Standards:

PART 1

PRELIMINARY

Citation and commencement

1. This Manual is the Manual of Standards (174 – Meteorological Service for International Air Navigation) 2025 (“Manual”) and come into operation on 27 November 2025.

Definitions

2. In this Manual, unless the context otherwise requires, any term defined in the First Schedule has the meaning given to that term in that Schedule.

Application of this Manual

3. This Manual applies to the provider of meteorological service for international air navigation within the Singapore Flight Information Region and such other area as the Minister for Transport may authorise (called in this Manual the “Meteorological Service Provider” or “MET SP”).

PART 2

Division 1 – General

Provision of meteorological service for international air navigation

4. The MET SP must comply with the objectives of meteorological service in accordance with paragraphs 2.1.1 and 2.1.2 of Annex 3.

Supply of meteorological information

5. —(1) The MET SP must establish a communication channel with the users of meteorological information in order to comply with paragraph 2.2.1 of Annex 3.

(2) The MET SP must ensure that the meteorological information supplied to the users of such information is consistent with human factors principles and in a form which requires a minimum of interpretation by the users as specified in paragraph 2.2.9 of Annex 3.

Quality management system

6. The MET SP must establish, document and implement a quality system that —
- (a) incorporates the necessary procedures, processes and resources to ensure the consistent quality and reliability of meteorological information supplied to the users of meteorological information;
 - (b) includes an assurance programme that conforms with the International Organisation for Standardisation (“ISO”) 9000 and is certified by an accredited certification body;
 - (c) provides assurance to the users of meteorological information that the supply of such information complies with the requirements in this Manual relating to geographical and spatial coverage, format and content, time and frequency of issuance and period of validity, and accuracy of measurements, observations and forecasts;
 - (d) is capable of detecting excessive transit times of the receipt of messages and bulletins relating to meteorological information, and includes procedures for the verification and validation of, and monitoring adherence to, the transmission schedules for individual messages or bulletins required to be exchanged, and the times of their filing for transmission; and
 - (e) includes taking all necessary measures to monitor compliance with its quality management systems, including:
 - i. engaging an independent auditor to conduct an audit;
 - ii. ensuring that action is taken without undue delay to correct the cause of any nonconformity identified by the independent auditor; and
 - iii. ensuring that all audit observations and remedial actions are evidenced and properly documented.

Notifications required from operators

7. The MET SP must ensure that it is notified, with all necessary details for planning the necessary arrangements, by an aircraft operator that requires meteorological services of the following matters:

- (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) when other changes affecting the provision of meteorological services are planned.

Meteorological service operations manual

8. —(1) The MET SP must establish and maintain an operations manual for its provision of meteorological service for international air navigation.

(2) The meteorological service operations manual established for the purposes of subparagraph (1) must include the following:

- (a) a statement by the MET SP confirming that —

- (i) the operations manual accurately describes the MET SP's organisation structure and the operating procedures that the MET SP's personnel are required to comply with at all times;
 - (ii) its provision of meteorological service is in accordance with the relevant standards in Annex 3;
 - (iii) the means and methods for ensuring continuous compliance with this Manual and any direction given by the Minister responsible for the environment under section 13 of the National Environment Agency Act 2002, including the National Environment Agency (Aeronautical Meteorological Services) Directions 2010 (Ministerial Direction No. 1/2010).
- (b) the title, name and responsibilities of the key personnel appointed under paragraph 16;
 - (c) an organisation chart showing the lines of responsibility of the personnel employed or engaged in its provision of meteorological services;
 - (d) a list of each type of meteorological service to be provided for international air navigation;
 - (e) a list of each type of meteorological facility to be operated for the provision of meteorological services;
 - (f) information on the maintenance arrangements for its facilities;
 - (g) the procedures or processes required to ensure that every meteorological facility utilised by the MET SP in its provision of meteorological services is operated in accordance with the operations and maintenance plan specified in paragraph 23;
 - (h) the procedures or processes required to ensure that every meteorological facility continues to meet the applicable Standards and Recommended Practices in Annex 3 for such time as the facility is used to provide a meteorological service;
 - (i) the procedures for establishing and maintaining a training programme and plan under paragraphs 17 and 18;
 - (j) the procedures for applying human factors principles in the design, operations and maintenance of each meteorological facility;
 - (k) details of the MET SP's resources and procedures to ensure compliance with this Manual;
 - (l) the procedures to control, amend and distribute the operations manual, including the distribution of the initial copy and all subsequent amendments made to the operations manual;
 - (m) the procedures or processes required under this Manual must be included in the operations manual; and
 - (n) the procedures necessary to ensure its compliance with this Manual.

(3) The MET SP must ensure that it provides meteorological services in accordance with the operations manual established under sub-paragraph (2).

(4) The MET SP must update, amend or add to the operations manual as the Regulator may require for ensuring —

- (a) the accuracy of the operations manual; and
- (b) the safety, efficiency or regularity of air navigation.

Document management and control

9. —(1) The MET SP must take all reasonably practicable measures to verify and maintain the accuracy of all documentation essential for the provision of meteorological services, and the operations and maintenance of meteorological facilities.

(2) Documentation includes —

- (a) the meteorological information and the applicable technical standards;
- (b) the operations manual mentioned in paragraph 8;
- (c) the safety management system manual mentioned in paragraph 11;
- (d) maintenance plans and checklists;
- (e) training programmes and personnel records;
- (f) system and failure reports;
- (g) any other documents necessary for the provision and management of meteorological services.

(3) The MET SP must develop and apply appropriate policies and procedures to ensure —

- (a) the proper collection, storage, processing and dissemination of documentation;
- (b) the timely review and updating of all documentation;
- (c) that amendments to the documentation are approved by an appropriate person in a supervisory position of the MET SP before issue, and the reasons for the amendment are documented;
- (d) that any amendment to the operations manual is notified to the Regulator in a timely manner;
- (e) that up-to-date versions of all relevant documents are accessible to the MET SP's personnel at all locations if required for the provision and operation of meteorological facilities;
- (f) that the current version of each document is identifiable such that the use of obsolete material is precluded; and
- (g) that all obsolete documentation are clearly marked and promptly removed from circulation.

Control of records

10. — (1) The MET SP must develop and apply appropriate policies and procedures for the retention of records specified in the Second Schedule relating to the provision of meteorological services.

(2) The policies and procedures referred to in sub-paragraph (1) must include specifications for the retention period, security measures to safeguard the records and provisions for the timely and easy access to records by authorised personnel.

Division 2 — Safety management system

Safety management system

11. — (1) The MET SP must establish and maintain a safety management system —

- (a) that consists of all the components and elements set out in the Third Schedule; and
- (b) that is commensurate with the size and the complexity of the MET SP's operations.

(2) The MET SP must describe its safety management system in a safety management system manual.

(3) The MET SP must obtain the acceptance of the Regulator for —

- (a) the safety management system mentioned in sub-paragraph (1); and
- (b) any change to its safety management system before making that change.

(4) The MET SP must make amendments or additions to the safety management system manual as the Regulator may require for ensuring:

- (a) the accuracy of the safety management system manual; and
- (b) the safety, efficiency or regularity of air navigation in the provision of meteorological services.

Effectiveness of the MET SP's safety management system

12. — (1) The MET SP must regularly assess and validate the effectiveness of its safety management system.

(2) The MET SP must submit a detailed report on its safety performance to the Regulator within such period as directed by the Regulator.

Implementation of changes

13. — (1) The MET SP must not make any or all of the following changes except in accordance with sub paragraph (2):

- (a) the addition, relocation, removal (whether temporary or permanent) or restoration to service of a meteorological facility;
- (b) any change to any system functionality or capability in the provision of meteorological service, which leads to an operational change in the provision of that service;
- (c) any change that may affect any manual that the MET SP is required to maintain under this Manual; or
- (d) any change to its organisational structure that may have impact on its provision of meteorological services.

(2) The MET SP must, before making any change mentioned in sub-paragraph (1) —

- (a) notify the Regulator as early as practicable of the proposed change; and
- (b) submit a safety risk assessment to the Regulator at least 14 days prior to making the change.

Control of safety management system manual and related documentation

14. — (1) The MET SP must develop and apply appropriate policies and procedures to control, amend and distribute documentation necessary for the planning, operation and maintenance of its safety management system.

(2) The procedures established in accordance with sub-paragraph (1) must require —

- (a) that all safety management system procedures and related documentation are reviewed and approved by the key personnel appointed under paragraph 16, before issuance or amendment;
- (b) that the current version of the safety management system manual and related documentation are up-to-date and made readily available to its personnel;
- (c) that the current version of each document is identifiable such that the use of obsolete documentation is precluded; and
- (d) that all obsolete documentation are clearly marked and promptly removed from circulation.

PART 3

PERSONNEL

Appointment of meteorological personnel

15. — (1) The MET SP must directly employ or otherwise engage personnel for the provision of meteorological service for international air navigation who —

- (a) meet the requirements specified by the World Meteorological Organisation (WMO) in respect of qualifications, competencies, education and training of meteorological personnel;
- (b) have completed the necessary training specified in the training plan for the individual; and
- (c) have been assessed to be competent using the assessment methodology established under paragraph 19.

(2) The MET SP must develop and apply procedures for the appointment of the meteorological personnel mentioned in sub-paragraph (1).

Accountable manager

16. —(1) The MET SP must directly employ or otherwise engage, on a full-time basis, a suitably qualified individual as an accountable manager with the corporate authority to ensure that all meteorological services —

- (a) are provided with adequate resources, including financial resources, by the MET SP; and
- (b) are carried out in compliance with the requirements in this Manual.

(2) An accountable manager must be responsible for —

- (a) the planning and operations of all activities of the MET SP; and
- (b) the establishment and promotion of a quality management system and safety management system required by paragraphs 6 and 11 respectively.

Training programme

17. The MET SP must establish and maintain a training programme for its meteorological personnel in accordance with the procedures established in its operations manual, which must include —

- (a) a training plan established under paragraph 18; and
- (b) a competency assessment methodology established under paragraph 19.

Training plan

18. — (1) The MET SP must establish and maintain a training plan for the training of each meteorological personnel that includes the following information —

- (a) the specific skills and competencies required of the individual for their role;
- (b) a list of all courses completed by the individual since their appointment to the role; and
- (c) the courses to be completed by the individual, and the period within which each course must be completed.

(2) The training plan mentioned in sub-paragraph (1) must be reviewed at least once a year to —

- (a) identify any gaps in competency or changes in training requirements;
- (b) prioritise the type of training required for the year;
- (c) record information relating to the courses that had been completed by the individual in that year; and
- (d) incorporate any new training as directed by the Regulator.

Competency

19. — (1) The MET SP must establish and implement a methodology for the assessment of the competency of all meteorological personnel.

(2) The methodology established under sub-paragraph (1) must —

- (a) be capable of assessing the competency of an individual with respect to the requirements mentioned in paragraph 15;
- (b) include a defined period of supervised on-the-job training appropriate to the scope and responsibilities of the personnel; and
- (c) incorporate a process for continual competency assessment.

(3) The MET SP must ensure that the competency assessment of each meteorological personnel is conducted —

- (a) in accordance with the methodology established under sub-paragraph (1); and
- (b) by a competency assessor appointed by the MET SP who meets the criteria specified in sub-paragraph (4).

(4) The competency assessor appointed by the MET SP must —

- (a) be an experienced meteorologist or meteorological technician (as the case may be); and
- (b) have completed formal training in the competency assessment methods, including practical checks and oral assessment.

(5) Where the competency assessor is also the supervisor of the meteorological personnel under assessment, an independent second assessor must validate the assessment.

PART 4

METEOROLOGICAL FACILITIES

Division 1 — Commissioning, temporary removal and decommissioning of a meteorological facility

Commissioning of meteorological facility

20. – (1) The MET SP must take all reasonably practicable measures to ensure that each meteorological facility is designed, installed and commissioned to meet the applicable operational specifications for that facility.

(2) The MET SP must establish and apply appropriate procedures for commissioning a meteorological facility for operational use in any of the following circumstances (called in this Manual “commissioning procedures”) —

- (a) implementation and operationalisation of a new meteorological facility;
- (b) relocation of an existing meteorological facility;
- (c) modification of an existing meteorological facility leading to changes in the provision of meteorological service; or
- (d) restoration to service of a meteorological facility that was removed from service temporarily.

(3) The commissioning procedures established under sub-paragraph (2) must ensure that

-
- (a) each meteorological facility meets the operational specifications applicable to that facility;
 - (b) each meteorological facility complies with this Manual and other applicable documents issued by the International Civil Aviation Organisation as specified in this Manual;
 - (c) all O&M personnel are appropriately qualified, trained and competent before performing any system-related tasks, including but not limited to operational checks, maintenance work, and system modifications;
 - (d) human factors principles are appropriately applied in the design, operations and maintenance of the meteorological facility;
 - (e) the system performance of the meteorological facility is properly verified and accepted by the MET SP, by representatives of the end-user groups who use the meteorological facility for operations, and by the relevant O&M personnel; and
 - (f) a safety risk assessment is conducted and recorded in accordance with paragraph 13.

(4) The MET SP must not use any meteorological facility to provide a meteorological service unless the commissioning procedures established under sub-paragraph (2) are applied to that facility.

Temporary removal of meteorological facility from service

21. – (1) The MET SP must take all reasonably practicable measures and develop and apply appropriate procedures to ensure that the temporary removal from service of a meteorological facility is performed safely and with minimal disruption to service.

(2) The procedures established under sub-paragraph (1) must include —

- (a) an identification of the risks arising from the disruption to the meteorological facility's interfaces (for example, with stakeholders, software or hardware) and verification that measures have been taken to mitigate such risks; and
- (b) an identification and implementation of maintenance procedures that need to be carried out while the meteorological facility is not in use.

Decommissioning of meteorological facility

22. – (1) The MET SP must take all reasonably practicable measures and develop and apply appropriate procedures to ensure that the permanent decommissioning and removal from service of a meteorological facility is performed safely and with minimal disruption to service.

(2) The procedures established under sub-paragraph (1) must include the identification and mitigation of the risks arising from the disruption to the meteorological facility's interfaces (e.g. stakeholders, software or hardware) and verification that measures have been taken to mitigate such risks.

Division 2 — Operations and maintenance of meteorological facilities

Operations and maintenance plan

23. – (1) The MET SP must establish, implement and maintain an operations and maintenance plan for each meteorological facility.

(2) The operations and maintenance plan established under sub-paragraph (1) must —

(a) describe the following matters regarding each meteorological facility —

- i. the role of the meteorological facility in the provision of meteorological service;
- ii. date of commissioning;
- iii. power supply configuration;
- iv. current system design architecture;
- v. location of the meteorological facility;
- vi. list of software in use and its associated system;
- vii. list of standards which that the facility is compliant with;
- viii. list of interfaces with other systems;
- ix. list of completed safety assessments associated with the meteorological facility;
- x. list of safety performance indicators, if applicable; and
- xi. list of services that support the operations and maintenance of the facility.

(b) describe the following matters regarding the parties involved in the operations and maintenance of the meteorological facility —

- i. the roles and responsibilities of these parties;
- ii. job descriptions for its personnel involved in the operations and maintenance of the facility, which must contain the job function, key responsibilities, qualification requirements, training requirements, competency requirements and outcomes to be achieved by the personnel; and
- iii. analysis of the number of the personnel required to operate and maintain the meteorological facility based on the workload required.

(c) specify the procedures to ensure the reliability and availability of each meteorological facility, including —

- i. the preventive and corrective maintenance plans, and where the repair of modules and components are undertaken;
- ii. the periodic inspection, and testing of the meteorological facility to verify that the facility meets the operational and performance specifications;
- iii. the intervals between various types of inspections and testing, and the basis for those intervals;
- iv. the operations and maintenance instructions;

- v. the timely and appropriate detection, warning and rectification of failures and degradations, of each meteorological facility and its monitoring systems;
- vi. the measures to control the probability of failures and degradations to as low as reasonably practicable, which may include, but are not limited to, analysis of trends;
- vii. the contingency plans in the event of meteorological facility failure or degradation, including backup facilities or procedures;
- viii. the documentation of the actions to be performed to address meteorological facility failures and degradations, and the outcomes of unresolved failures and degradations;
- ix. the measures to ensure a safe and conducive environment for the operation and maintenance of the meteorological facility, including fire prevention, optimal temperature and humidity, pest control, grass cutting, lightning protection, decluttering;
- x. the recording of all actions that were performed on each facility, such as those related to maintenance, failure, degradation, modification, removal and restoration of the meteorological facility;
- xi. the meteorological facility support plan for the life cycle of each facility, which may include spares support, spares management and provision of technical support; and
- xii. the management of obsolete hardware and software.

Inspection, measuring and test equipment

24. – (1) The MET SP must ensure that appropriate inspection, measuring and testing equipment are used for testing and maintenance of every meteorological facility.

(2) The MET SP must ensure that —

- (a) there is adequate availability of inspection, measuring and testing equipment; and
- (b) every inspection, measuring and testing equipment for each meteorological facility —
 - i. meets the requisite standards for precision and accuracy;
 - ii. is calibrated before use;
 - iii. is identified with a suitable indicator to show its calibration status;
 - iv. is calibrated in accordance with the appropriate standards specified for that equipment;
 - v. is readily available for personnel to carry out their duties and functions; and
 - vi. is properly handled, preserved and stored.

(3) The MET SP must establish procedures to control, calibrate and maintain all the inspection, measuring and testing equipment required under sub-paragraph (2).

PART 5

METEOROLOGICAL SERVICE FOR INTERNATIONAL AIR NAVIGATION

Global systems, supporting centres and meteorological offices

25. -(1) An aerodrome meteorological office established by the MET SP must comply with paragraph 3.2.2 and 3.2.3 of Annex 3.

(2) The MET SP must establish the means by which meteorological information can be supplied to the aerodromes that are without an aerodrome meteorological office.

(3) A meteorological watch office established by the MET SP must comply with the paragraph 3.3.2 of Annex 3.

Aerodrome meteorological observational information

26. -(1) For the purpose of providing meteorological observations and reports, the MET SP must establish at aerodromes in its territory such aeronautical meteorological stations as it determines to be necessary.

(2) The MET SP must provide meteorological observations and reports in compliance with paragraphs 4.1.3, 4.1.5 and 4.1.8 of Annex 3.

(3) The MET SP must inspect its aeronautical meteorological stations 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.

(4) The MET SP must enter into an agreement with the Air Traffic Services provider that meets the requirements in paragraph 4.2 of Annex 3.

(5) The MET SP must –

- (a) make routine observations and reports in compliance with paragraph 4.3 of Annex 3;
- (b) make special observations and reports in compliance with paragraph 4.4 of Annex 3;
- (c) provide meteorological reports that comply with paragraphs 4.5.1 and 4.5.3 of Annex 3;
- (d) comply with paragraphs 4.6.1.1, 4.6.1.2, 4.6.2.1, 4.6.3.1, 4.6.3.3, 4.6.3.4, 4.6.3.5, 4.6.4.1, 4.6.5.1, 4.6.6.1, 4.6.7 and 4.7.3 of Annex 3 relating to observing and reporting meteorological elements;
- (e) comply with paragraphs 4.9.1.1, 4.9.1.2, 4.9.1.3 and 4.9.2 of Annex 3 relating to dissemination of meteorological reports; and
- (f) comply with any applicable procedures, technical specifications or guidance relating to aerodrome meteorological observational information in Chapter 2 of PANS-MET.

Aircraft meteorological observational information

27. The MET SP must make arrangements with the air traffic services provider to ensure that air-reports related to meteorological reporting received by air traffic services units are relayed without delay in accordance with paragraph 5.8.1 of Annex 3.

28. The MET SP must record special aircraft observations of volcanic activity in compliance with paragraph 5.9.1, 5.9.2, 5.9.3 and 5.9.6 of Annex 3.

29. The MET SP must comply with any applicable procedures, technical specifications or guidance relating to aircraft meteorological observational information in Chapter 3 and Appendix 3 of PANS-MET.

Aerodrome and en-route meteorological forecast information

30. -(1) In accordance with paragraph 6.1 of Annex 3, the MET SP must ensure that the issuance of a new aerodrome forecast cancels automatically any forecast of the same type previously issued for the same place and for the same period of validity or part thereof.

(2) The MET SP must prepare and issue forecasts in compliance with the following paragraphs in Annex 3:

- (a) aerodrome forecasts (TAF) – paragraphs 6.2.1.1, 6.2.1.2, 6.2.1.3, 6.2.1.4, 6.2.1.5, 6.2.1.7, and 6.2.1.8,
- (b) landing forecasts (trend forecasts) – paragraph 6.2.2; and
- (c) forecasts for take-off – paragraph 6.2.3.1

31. The MET SP must comply with any applicable procedures, technical specifications or guidance relating to aerodrome and en-route meteorological forecast information in Chapter 4 of PANS-MET.

Meteorological information containing advisories, alerts, warnings and notices

32. -(1) The MET SP must ensure that SIGMET information is issued in accordance with paragraphs 7.4.1.1, 7.4.1.2, 7.4.1.3, 7.4.1.5, 7.4.1.6 and 7.4.2 of Annex 3.

(2) The MET SP must ensure that aerodrome warnings are issued in accordance with paragraph 7.6.1.1 of Annex 3.

(3) Where wind shear is considered a factor at Changi or Seletar aerodrome, the MET SP must prepare a wind shear warning in accordance with paragraph 7.7.1.1 of Annex 3.

(4) The MET SP must ensure that:

- (a) there is an arrangement with the appropriate air traffic services unit and the airport operator with respect to the issuance of wind shear warnings; and
- (b) wind shear warnings and alerts are prepared and disseminated –

- (i) in accordance with such arrangements; and
 - (ii) in compliance with paragraphs 7.7.1.2, 7.7.1.3 and 7.7.2 of Annex 3.
- (5) The MET SP must comply with any applicable procedures, technical specifications or guidance relating to meteorological information containing advisories, alerts, warnings and notices (such as SIGMET information, aerodrome warning, wind shear warnings and alerts) in Chapter 6 of PANS-MET.

Aeronautical climatological information

33. -(1) The MET SP must prepare aeronautical climatological information in compliance with paragraph 8.1.1 of Annex 3.

(2) The MET SP must, upon request and to the extent practicable, make available meteorological observational data to other meteorological authorities, operators and other parties concerned with the application of meteorology to international air navigation, for purposes such as research, investigation or operational analysis.

(3) The MET SP must comply with any applicable procedures, technical specifications or guidance relating to aeronautical climatological information in Chapter 7 of PANS-MET.

Meteorological service for operators and flight crew members

34. -(1) The MET SP must supply meteorological information in compliance with paragraphs 9.1.1, 9.1.2, 9.1.3, 9.1.4, 9.1.5, 9.1.6, 9.1.7, and 9.1.10 of Annex 3.

(2) The MET SP must arrange with the meteorological authorities of other States to obtain from them the reports and/or forecasts required.

(3) The supply of meteorological information to aircraft operators and flight crew members must be in compliance with the following:

- (a) paragraphs 9.2.1, 9.2.2, 9.2.3, and 9.2.4 of Annex 3 relating to briefings, consultations and displays;
- (b) paragraphs 9.3.1, 9.3.2, and 9.3.5 of Annex 3 relating to flight documentation;
- (c) paragraphs 9.4.1 and 9.4.4 of Annex 3 relating to automated pre-flight information systems for briefings, consultations, flight planning and flight documentation;
- (d) paragraphs 9.5.1, 9.5.2, and 9.5.4 of Annex 3 relating to meteorological information for aircraft in flight

(4) The MET SP must retain 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.

(5) The MET SP must ensure that the information for inquiries or investigations be retained until the inquiry or investigation is completed.

(6) The MET SP must ensure that the quality control and quality management of meteorological information provided through automated pre-flight information systems, used to provide operators, flight crew members and other aeronautical personnel with a harmonized,

common point of access to meteorological information and aeronautical information services information, are in accordance with paragraph 6 of this Manual.

(6) The MET SP must comply with any applicable procedures, technical specifications or guidance relating to meteorological service for operators and flight crew members in Chapter 8 of PANS-MET.

Meteorological information for air traffic services, search and rescue services and aeronautical information services

35. -(1) The MET SP must ensure that an aerodrome meteorological office or meteorological watch office is designated to be associated with each air traffic services unit.

(2) The MET SP must coordinate with the air traffic services unit to supply up-to-date meteorological information as required.

(3) The MET SP must ensure that the designated aerodrome meteorological office or meteorological watch office supplies, or arranges to supply, meteorological information to the relevant air traffic services unit in compliance with paragraphs 10.1.1.3, 10.1.1.5. and 10.1.2.1 of Annex 3.

(4) The MET SP must:

(a) supply meteorological information to the search and rescue unit in a format that:

(i) has been mutually agreed upon between both parties; and

(ii) complies with paragraph 10.2.2 of Annex 3.

(b) maintain liaison with the search and rescue services unit throughout search and rescue operations.

(5) The MET SP must ensure that up-to-date meteorological information is supplied to the relevant AIS provider, as necessary for the conduct of the AIS' function comply with the standards on information for aeronautical information services units in accordance with paragraph 10.3.2 of Annex 3.

(6) The MET SP must comply with any applicable procedures, technical specifications or guidance relating to meteorological information for air traffic services, search and rescue services and aeronautical information services in Chapter 9 of PANS-MET.

Use of communications to exchange meteorological information

36. - (1) The MET SP must make available suitable aeronautical telecommunications facilities for the supply of the required meteorological information to air traffic services units, search and rescue units at Changi and Seletar aerodromes, in compliance with paragraphs 11.1.1, 11.1.2, 11.1.3, 11.1.4 and 11.1.8 of Annex 3.

(2) The MET SP must ensure that –

(a) meteorological bulletins on operational meteorological information are originated by the appropriate meteorological office or aeronautical meteorological station;

- (b) meteorological bulletins on operational meteorological information are transmitted via the aeronautical fixed service or the internet; and
 - (c) the transit time for messages and bulletins containing operational meteorological information comply with paragraph 11.2.1.2 of Annex 3.
- (3) The MET SP must ensure that the content and format of meteorological information –
- (a) that the MET SP transmits to an aircraft; and
 - (b) that is transmitted by an aircraft to the MET SP,
- is consistent with the provisions of Annex 3.
- (4) The MET SP must comply with paragraph 11.4 of Annex 3 on use of aeronautical data link service – contents of D-VOLMET.
- (5) The MET SP must comply with paragraph 11.5 of Annex 3 on use of aeronautical broadcasting service – contents of VOLMET broadcasts.
- (6) The MET SP must comply with any applicable procedures, technical specifications or guidance relating to use of communications to exchange meteorological information in Chapter 10 of PANS-MET and Chapter 4 of Annex 10's Volume II.

PART 6

MANAGEMENT OF OCCURRENCES AND REPORTED SEVERE WEATHERS

Managing occurrences

- 37.** The MET SP must take all reasonably practicable measures and develop and apply appropriate procedures to respond to every occurrence, including measures to —
- (a) report the occurrence to the Regulator;
 - (b) notify relevant persons (including the system owner, O&M personnel and the building services provider) of the occurrence;
 - (c) determine the cause of the occurrence;
 - (d) resolve the occurrence in an expeditious and effective manner;
 - (e) implement measures to prevent recurrence of the occurrence, where necessary;
 - (f) make and retain records and documents with respect to the above actions; and
 - (g) periodically review every occurrence with relevant persons (including its O&M personnel and building services provider) to —
 - i. determine if the measures implemented to prevent recurrence of the occurrences are still in place and effective;
 - ii. determine adverse trends; and
 - iii. implement appropriate measures to improve the safety performance of the provision of meteorological service.

Obligation to report occurrences

38. – (1) The MET SP must report to the Regulator any occurrence of which the MET SP has knowledge.

(2) The report must be made to the Regulator through the most expeditious means available as soon as practicable within 24 hours of the occurrence.

(3) The MET SP must submit a formal written notification to the Regulator within 72 hours of the occurrence, detailing:

- (a) a description of the occurrence;
- (b) initial analysis or suspected cause; and
- (c) any immediate corrective actions taken.

Investigation of occurrences

39. – (1) The MET SP must conduct an investigation of —

- (a) any occurrence that occurs on or after 27 November 2025; or
- (b) any other occurrence which the Regulator requires to be investigated.

(2) The MET SP must develop and apply appropriate procedures for the conduct of an investigation that is required to be investigated under sub-paragraph (1).

(3) The investigation procedures mentioned in sub-paragraph (2) must require that all relevant records necessary to support the investigation report specified in sub-paragraph (5), are preserved for investigation purposes.

(4) The MET SP must submit to the Regulator a report of each investigation required by sub-paragraph (1)(a) or (b), within six weeks after the date the occurrence or other occurrence required to be investigated had occurred (or any longer period that the Regulator may allow in any particular case).

(5) The investigation report must include —

- (a) a factual description of the occurrence, including relevant information and evidence;
- (b) the operational effect on the provision of meteorological service, and the MET SP's stakeholders;
- (c) an analysis of the occurrence, taking into account information from relevant stakeholders;
- (d) identification of causal factors, systemic issues and safety hazards;
- (e) a description of any non-adherence in this Manual, MET SP's policies or procedures, where applicable;
- (f) an assessment of the effectiveness of existing safety measures;
- (g) the corrective, preventive and safety actions taken; and
- (h) any other recommendations to enhance the MET SP's safety performance and the safety awareness of relevant stakeholders, or to address hazards (including with respect to training, procedures, systems and processes).

Managing reported severe weathers

40. – (1) The MET SP must take all reasonably practicable measures and develop and apply appropriate procedures to respond to every severe weather of which the MET SP has knowledge.

(2) The MET SP must submit a report to the Regulator on its response to any incidence of severe weather.

(3) The report mentioned in sub-paragraph (2) must include —

- (a) a factual description of the reported severe weather, including relevant information and evidence;
- (b) relevant records necessary to support the reported severe weather;
- (c) an analysis of the reported severe weathers, taking into account information from relevant stakeholders;
- (d) a description of any non-adherence in this Manual, MET SP's policies or procedures, where applicable;
- (e) identification of causal factors, systemic issues and safety hazards for any non-adherence referred to in sub-paragraph 3(d);
- (f) an assessment of the effectiveness of warnings (including wind-shear and aerodrome) and trend forecasts for the timing and intensity of significant weather;
- (g) the corrective, preventive and safety actions taken; and
- (h) recommendations to enhance the MET SP's safety performance and the safety awareness of relevant stakeholders, or to address hazards (including with respect to training, procedures, systems and processes).

(4) The report required by sub-paragraph (2) must be submitted within such period as directed by the Regulator.

FIRST SCHEDULE – DEFINITIONS

Paragraph 2

“Aerodrome meteorological office” means an office designated to provide meteorological service for aerodromes serving international air navigation.

“Aeronautical meteorological station” means a station designated to make observations and meteorological reports for use in international air navigation.

“Aeronautical telecommunication station” means a station in the aeronautical telecommunication service.

“Aircraft” means 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” means the evaluation of one or more meteorological elements made from an aircraft in flight.

“Air-report” means a report from an aircraft in flight prepared in conformity with requirements for position, and operational or meteorological reporting.

“Air traffic services unit” means the generic term meaning variously, air traffic control unit, flight information centre or air traffic services reporting office.

“AIS provider” means the provider of aeronautical information services in Singapore.

“Annex 3” means Annex 3 to the Chicago Convention, entitled “Meteorological Service for International Air Navigation,” including all amendments to Annex 3 that are in force and as applicable to Singapore.

“Chicago Convention” means the Convention on International Civil Aviation concluded in Chicago on 7 December 1944 (as in force and amended from time to time).

“Competency” means the knowledge, skills and behaviors required to perform specific tasks in the fulfilment of a job responsibility.

“Flight crew member” means a licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period.

“Flight documentation” means a written or printed documents, including charts or forms, containing meteorological information for a flight.

“Flight Information Region” means an airspace of defined dimensions within which flight information service and alerting service are provided.

“Forecast” means statement of expected meteorological conditions for a specified time or period, and for a specified area or portion of airspace.

“Human factors principles” means the 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.

“Meteorologist” means a person who has successfully completed the requirements of the Basic Instruction Package for meteorologists at university degree level, as specified in the Technical Regulations (WMO-No. 49) of the World Meteorological Organisation.

“Meteorological facility” means the system (such as VOLMET, information exchange system, weather radar and automated weather observing system, and any other system the Regulator requires), operated for the purpose of providing meteorological service. This includes equipment and services and amenities supporting these systems, housed in a building or structure (such as meteorological office, meteorological watch office and aeronautical meteorological station).

“Meteorological information” means meteorological report, analysis, forecast, and any other statement relating to existing or expected meteorological conditions.

“Meteorological office” means an office designated to provide meteorological service for international air navigation.

“Meteorological personnel” means a ‘meteorologist’ or ‘meteorological technician’ appointed by MET SP.

“Meteorological report” means a statement of observed meteorological conditions related to a specified time and location.

“Meteorological service” means meteorological service provided for international air navigation.

“Meteorological service provider” mean the relevant entity providing meteorological service for international air navigation on behalf of a Contracting State.

“Meteorological technician” means a person who has successfully completed the requirements of the Basic Instruction Package for Meteorological Technicians, as specified in the Technical Regulations (WMO-No. 49) of the World Meteorological Organisation.

“Meteorological watch office” means 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.

“Occurrence” means an occurrence that involves a hazard to the operations of provision of meteorological service, and includes the following —

- (a) a total loss of meteorological service or meteorological facility;

(b) an occurrence which poses a hazard to the provision of meteorological service, including —

- (i) structurally unsound facility;
- (ii) electrical power supply failure;
- (iii) fire-related occurrence, including fire suppression gas discharge;
- (iv) security-related breach;
- (v) operational manning, including loss of manpower to man 24/7 observations and/or forecast;

(c) an occurrence which provision of meteorological service has posed a hazard in an aviation incident, serious incident and accident.

(d) any other occurrence which the MET SP reasonably knows has a significant safety impact on the provision of meteorological service.

“Operations manual” means the document established and maintained by the MET SP in accordance with paragraph 8.

“Operations and maintenance personnel” or “O&M personnel” means a person who is competent in the installation, operation or maintenance of a meteorological facility.

“Operator” means the person, organisation or enterprise engaged in or offering to engage in an aircraft operation.

“PANS-MET” means Doc 10157 “Procedures for Air Navigation Services — Meteorology,” including all amendments to Doc 10157 that are in force and as applicable to Singapore.

“Quality assurance” means part of quality management focused on providing confidence that quality requirements will be fulfilled (ISO 9000).

“Quality control” means part of quality management focused on fulfilling quality requirements (ISO 9000).

“Quality management” means coordinated activities to direct and control an organisation with regard to quality (ISO 9000).

“Regional air navigation agreement” means an agreement approved by the Council of ICAO normally on the advice of a regional air navigation meeting.

“Regulator” means the Civil Aviation Authority of Singapore.

“Severe weather” means any dangerous meteorological phenomenon (such as low-level wind-shear, microburst and low visibility) with the potential to cause damage, serious social disruption, or loss of human life.

“SIGMET information” means information issued by a meteorological watch office 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.

“User” means the operators, flight crew members, air traffic services units, search and rescue services units, airport managements and others concerned with the conduct or development of international air navigation.

“VOLMET” means Meteorological information for aircraft in flight.

“Data link-VOLMET (D-VOLMET)” means 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.

“VOLMET broadcast” means provision, as appropriate, of current METAR, SPECI, TAF and SIGMET by means of continuous and repetitive voice broadcasts.

“World Meteorological Organisation (WMO) personnel requirements” means requirements concerning the qualifications, competencies, education and training of meteorological personnel in aeronautical meteorology as 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.

SECOND SCHEDULE – RECORDS TO BE RETAINED

Paragraph 10

Records related to the meteorological information

1. List of the current meteorological information users
2. List of the current meteorological service provided to meet the needs of international air navigation
3. Regional air navigation agreement
4. Coverage of the international waters and other areas where meteorological service is provided
5. Certificate of the ISO 9000 series of quality assurance standards
6. Written service agreement with every operator on the notifications
7. Reported severe weather events, i.e. windshear, microburst
8. Meteorological information issued to users

Records related to the commissioning of meteorological facilities

9. Verification that the facility complies with these Standards, applicable ICAO Annexes, PANS, and ICAO Documents, and the accepted results of the verification
10. Verification that human factors principles are appropriately applied in the design, operations and maintenance of the facility, and the accepted results of the verification
11. Validation of system performance of the facility, and the accepted results of the validation
12. Hazard logs and risk assessments
13. Results of applicable safety-related tests performed on the meteorological facility, i.e. validation of system performance of the new meteorological facility (e.g. Factory Acceptance Test, Site Acceptance Test, Reliability Acceptance Test)
14. Calibration results of inspection, measuring and test equipment
15. System event logs

Records related to the operations and maintenance of meteorological facilities

16. Internal audit reports
17. Hazard logs and risk assessments
18. Preventive maintenance activity logs
19. Corrective maintenance activity logs
20. Results of applicable safety-related tests performed on the meteorological facility, i.e. validation of system performance of the new meteorological facility (e.g. Factory Acceptance Test, Site Acceptance Test, Reliability Acceptance Test)
21. Calibration results of inspection, measuring and test equipment
22. System event logs
23. Maintenance records

- 24. System failure reports
- 25. Occurrence reports
- 26. Investigation reports
- 27. Notes of meetings related to operations and maintenance of its facilities

Records related to the temporary removal of meteorological facilities from service

- 28. Verification that any risk of disruption to the meteorological facility's interfaces are identified and mitigated

Records related to the decommissioning of meteorological facilities

- 29. Verification that any risk of disruption to the meteorological facility's interfaces (e.g. stakeholder, software and hardware) are identified and mitigated.

Records related to every meteorological personnel

- 30. List of the current aeronautical meteorological personnel
- 31. List of the current competency assessors
- 32. Qualifications, education, training, and testing records
- 33. On-the-job training (OJT) and competency assessments completed
- 34. Job description
- 35. Rostering completed

Records related to every operations and maintenance personnel

- 36. List of the current O&M personnel
- 37. Qualifications, training, and testing records
- 38. Job description
- 39. Rostering completed

THIRD SCHEDULE – SAFETY MANAGEMENT SYSTEM

Paragraph 11

1. The safety management system (called in this paragraph the SMS) required under paragraph 11 must comprise the following components and elements:

<i>First column</i>	<i>Second column</i>
<i>Components</i>	<i>Elements</i>
1. Safety policy and objectives	(a) Management commitment (b) Safety accountability and responsibilities (c) Appointment of key safety personnel (d) Coordination of emergency response planning (e) SMS documentation
2. Safety risk management	(a) Hazard identification (b) Safety risk assessment and mitigation
3. Safety assurance	(a) Safety performance monitoring and measurement (b) The management of change (c) Continuous improvement of the SMS
4. Safety promotion	(a) Training and education (b) Safety communication