



GUIDANCE MATERIAL

Siting and Maintaining Wind Sensors on Aerodromes (GM-SMWSA)

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PREFACE

This Guidance Material (GM) is published by the Civil Aviation Authority of Fiji for purposes of promulgating supplementary material to that published in the Authority's Standards Documents.

This GM provides guidance to aeronautical meteorological service provider and regulatory staff on requirements that will be used for siting and maintaining of wind sensors on aerodromes.

This GM explains certain regulatory requirements by providing interpretive and explanatory material.

A blue ink handwritten signature is written over a circular official stamp. The stamp contains the text 'CIVIL AVIATION AUTHORITY OF FIJI' around the perimeter and 'CHIEF EXECUTIVE' in the center. Below the stamp, the name 'THERESA LEVESTAM' and the title 'ACTING CHIEF EXECUTIVE' are printed in a bold, black, sans-serif font.

THERESA LEVESTAM
ACTING CHIEF EXECUTIVE



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1 Introduction

- 1.0 Wind has a direct impact on aircraft. The direction of the prevailing wind is taken into account when planning a new runway. Headwind components determine the direction of take-off and landing and crosswinds force the pilot to compensate for the drift.
- 1.1 An important characteristic of wind is its temporal and spatial variability. Pilots need to be aware of local wind conditions at the airport, especially during approach and departure. Temporal variability makes it necessary to define multiple parameters related to wind: mean, minimum and maximum values. Spatial variability is mostly related to temporal variability and can, for example, lead to a relative movement of gusts (like ripples on a body of water). It can also be related to terrain effects of the aerodrome or its surroundings, or to the presence of obstacles. For these reasons, Annex 3 — *Meteorological Service for International Air Navigation* recommends that wind observations for local reports be representative of the touchdown zone (for arriving aircraft) and of conditions along the runway (for departing aircraft), which sometimes leads to the installation of multiple sensors
- 1.2 An AWOS is defined to be an “air navigation facility” distributing weather information and consists of a computerized system that automatically measures one or more weather parameters, analyzes the data, prepares a weather observation that consists of the parameter(s) measured, provides dissemination of the observations and broadcasts the observation to the pilot in the vicinity of the AWOS, typically using an integral very high frequency (VHF) radio or an existing navigational aid (NAVAID), or Automatic Terminal Information Service (ATIS).
- 1.3 The Guidance manual is intended to serve as a reference for sensor siting. This does not require the aeronautical meteorological service provided to change existing sensor installations solely to comply with this GM but will be applied as new stations are established. The planning of automated weather observing equipment at an aerodrome with a control tower, final siting location must obtain the approval of the ATM Manager, as appropriate. Sensor siting in accordance with this GM meets the requirements of ICAO/WMO.
- 1.4 This guidance is issued to compliment the provisions contained in SD AMSP Appendix 3; 4.1.2 and WMO # 48 Volume II Part 2

2 Purpose

- 2.0 The guidance manual establishes the siting criteria that are used in the selection of suitable site locations for automated weather observing systems that provide weather information at aerodromes. This applies to all primary and secondary weather equipment located at aerodromes. Compliance with this GM is required to provide pilots with representative weather information.

- 2.1** If systems are installed in accordance with this GM, there is a high probability that, as far as location is concerned, the systems will be able to provide the usable information desired. Since desired locations are not always available due to excessive physical or economic reasons, compromises may have to be considered and less than desired locations may have to be selected. If this occurs, it must be understood that the alternative location must still allow the system to provide accurate information.

3 Operational Requirements

- 3.0** All instrumentation at an airport must be sited at locations that do not infringe the obstacle limitation surfaces for that particular airport as well as existing limitation surfaces (e.g. for planned additional runways and taxiways) should be considered. However, a new obstacle located in the vicinity of an existing obstacle may be allowable if it fits the regulatory authority's shielding criteria. The buffer area around the enclosure must, where possible, be covered by the natural vegetation or ground cover of the region and should be maintained below approximately 0.5metres in height

4 Surface Wind

- 4.1** At aeronautical meteorological stations, the mean direction and speed of the surface wind should be observed and reported as per Technical Regulations (WMO-No. 49), Volume II, Part II, Appendix 3, 4.1.
- 4.2** To meet the stated operational requirements for reporting surface wind direction and speed with the desirable accuracy, observations should be made using the most suitable instruments available. Integrated instrumental systems should include a sufficient number of sensors as well as the most appropriate equipment for the collection, processing, display and recording of data.
- 4.3** The number and location of sensors depend on the size of the aerodrome, the complexity of the terrain and other features of the aerodrome, such as the number and types of runways. In addition to the number of sensors, the total system design also depends on the types and frequency of operations and the degree of automation necessary for the reporting and recording of relevant surface wind information at different locations around the aerodrome. It should be noted that real-time distribution of surface wind information is essential to meet identified client operational requirements
- 4.4** The choice of the most appropriate observing system depends on all of the above factors. It must also take into account the possible future development of the aerodrome, as well as the cost-effectiveness of specific observing systems being assessed to meet operational requirements

5 Siting

- 5.1 The location of sensors to meet the operational requirement for wind measurements representative of the touchdown and take-off areas of runways involves considerations of the nature of vertical and horizontal variations of the wind.
- 5.2 Obstacle restrictions may dictate that wind sensors should be located at a considerable distance from the runway. Guidance material on these matters is available in:–Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8), Part I, Chapter 5;–Manual of Aeronautical Meteorological Practice (ICAO Doc 8896), Appendix 2, 5.5 Surface wind
- 5.3 Surface wind should be observed at a height of 10 ± 1 m (30 ± 3 ft.) above the ground
- 5.4 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.
- 5.4 Wind speed can vary considerably through the first few tens of metres above the ground. Over open terrain (defined as an area where the distance between the anemometer and any obstruction is at least 10 times the height of the obstruction), changes of wind direction with height are relatively small.
- 5.5 The sole consideration for the vertical placement of a wind sensor, therefore, is to meet the operational requirement that it should be 10 metres above the runway. Placement of the sensor at 10 metres is preferable in view of compatibility with synoptic and climatological practices and due to the large size (height) of today's aircraft.
- 5.6 Wind measured in a sheltered location on a building or even a low hill may differ by 90° or more in direction and by half to twice the speed from the wind over the open runway area.
- 5.7 Generally, due to obstacle limitations at aerodromes, the wind over the runway is relatively undisturbed by surrounding terrain and buildings, except for disturbances caused by larger-scale local topographical features. Near the limits of the obstacle clearance area, where wind sensors are likely to be located, however, smaller-scale topography, buildings or vegetation may considerably affect the surface wind. At times, it may be difficult to find suitable open terrain where the rule of at least 10 times the obstruction height is satisfied in all directions. In such cases, it may be necessary to locate a frangible and illuminated mast within the obstacle clearance area, preferably “shielded” by an existing essential navigation aid
- 5.8 If the solution above is adopted, users of this Guide are advised to seek the advice of the responsible aviation authority on the precise definition of frangible. Agreement of the aerodrome authority should be obtained before any expense is incurred.
- 5.9 Siting will be governed by obstacle limitation areas and local prevailing surface wind conditions. To identify the number of sensors required and their location, a detailed study, sometimes under different wind conditions, of all relevant factors must be

undertaken by experts. At many aerodromes, for example those with homogeneous wind conditions, only one strategically sited wind sensor may suffice.

- 5.10 In more complicated cases, and at aerodromes with more than one runway of appreciable length, two or more sensors are usually needed and should be located to provide observations representative of the conditions along the runway(s), such as take-off and touchdown zones. It should also be noted that anemometers located too close to runways and taxiways can be affected by aircraft engine exhaust and thereby give a false indication of a gust. Care should be taken to avoid this possibility when anemometers are sited.
- 5.11 Consideration should also be given to the availability of the following siting requirements:
- (a) Power (including backup and/or uninterrupted power supply);
 - (b) Telephone lines, fiber-optic links, satellite links, radio or other communications;
 - (c) Restrictions to, and licenses for, the use of radio frequencies;
 - (d) Extent of site and civil works required, including restrictions imposed in airfield locations and all cable trenching requirements;
 - (e) Access roads;
 - (f) Cost of the site and necessary buffer zone required to maintain the correct long-term instrument exposure (including purchase, lease and rental costs), bearing in mind the likely permanent nature of the installation, security and safety requirements of the site (radar)

6. Maintenance and Calibration

- 6.1 In choosing an instrumental system, it is essential to take into account the procedures and costs of maintenance and calibration needed to keep the system operating at the required level of availability and accuracy. For example, there are significant differences between analogue and digital signal processing and display techniques. A higher degree of automatic checking is normally an integral part of the digital technique.
- 6.2 Regardless of the choice of system, checks must be established to ensure the provision of continuous data of acceptable quality including, as a regular routine:
- (a) Checks of all system components, i.e. sensors, cables, signal conditioning and data-processing devices, displays and recorders, by use of signal substitutes as prescribed by the system designer;
 - (b) Sensor sensitivity and bearing friction checks as recommended by the manufacturer;
 - (c) Inspection of field installations for physical damage, vane orientation and anemometer zero level
 - (d) Inspection and maintenance of recorders and displays, if applicable, for the detection and prevention of faults;
 - (e) Periodic checks to ensure that exposure of sensors is not impaired by

new buildings or other new installations, by the growth of trees or shrubs, etc.

- 6.3 Aerodromes should ensure that the accuracy of wind speed and direction remain within the operationally desirable accuracy values specified in Technical Regulations (WMO-No. 49), Volume II, Part II, Attachment A Operationally desirable accuracy of measurement or observation
- 6.4 As stated above, operational requirements can only be met by the use of instruments. Manual observations are limited to:
- (a) The estimation of required mean values and extreme values from system out
 - b) Where more than one measurement site is in use, the selection of wind information appropriate for the runway or runways in use;
 - (c) Monitoring indicators and graphs for significant changes that necessitate a special report

These functions may be fully or partly undertaken by automatic aerodrome observation systems and manual observations may be needed only as a backup.

7. Siting Approval

- 7.1 Commissioning or approval of an installed site or sensor may be delayed until it functionally demonstrates the validity of the information provided. If the information meets the requirements, it must be commissioned approved.
- 7.2 Corrective action will be required if system/sensor information does not demonstrate valid data. This may mean removal of the sensor, correction of whatever is adversely affecting the sensor, or relocation of the sensor or system. Since the desire is to provide accurate and reliable weather information, and since deviation from the standard may result in less than desired results, economic expediency should not be used as the sole basis for acceptance of a less than desired site location

8. References

- i. FAA (ORDER JO 6560.20C - SUBJ: Siting Criteria for Automated Weather Observing Systems
- ii. WMO-No.49 Volume II – Meteorological Service for International Air Navigation Part II Appendix 3 -4
- iii. ICAO Annex 3 Meteorological Service for International Air Navigation Appendix 3 - 4