



ADVISORY CIRCULAR

UCAA-AC-MET003

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GUIDANCE ON DEVELOPMENT OF TRAINING PROGRAMME FOR TECHNICAL STAFF PROVIDING METEOROLOGICAL SERVICES FOR AIR NAVIGATION

1.0 PURPOSE

- 1.1 This Advisory Circular (AC) is issued to provide general information and guidance on development of a training programme for technical staff providing meteorological services for air navigation.

2.0 REFERENCES.

- 2.1 Regulation 7(c) of the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022;
2.2 Regulation 28 of the Civil Aviation (Certification of Air Navigation Services) Regulations, 2022;
2.3 Doc 8896–Manual of Aeronautical Meteorological Practice;

3.0 GUIDANCE AND PROCEDURES

3.1 General

- 3.1.1 This Advisory Circular (AC) guides the service provider on implementation of Regulation 7(c) of the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022, in respect of qualifications, competencies, education and training of meteorological personnel providing services for air navigation.
- 3.1.2 The Advisory Circular further provides guidelines on a systematic approach in the provision of training to technical staff engaged in provision of meteorological services for air navigation.

3.2 Critical Technical Personnel Training

The training programme for the following categories of personnel are covered under this Advisory Circular:

- 3.2.1 Aeronautical Meteorological Observers and Communication Personnel
3.2.2 Aeronautical Meteorological Forecasters/Meteorologists

3.3 Qualification Requirements for Aeronautical Meteorology Personnel

- 3.3.1 Meteorologist/Aeronautical Meteorological Forecaster: a person who holds a university-level degree or equivalent; has acquired an appropriate level of knowledge of Meteorology, Mathematics, Physics,

Geography, Statistics and Computer science and has completed the Basic Instruction Package for Meteorologists (BIP-M)

3.3.2 Aeronautical Meteorological Observers (Meteorological Technician): a person who has completed the Basic Instruction Package for Meteorological Technicians (BIP-MT)

3.4 Approved Training Organizations

The Uganda Civil Aviation Authority shall recognise training conducted and qualifications attained at any approved training organisation or WMO recognised/approved training institution.

3.5 Requirements for Training

3.5.1 Aeronautical Meteorological Forecasters (Meteorologist)

3.5.1.1 The basic education and training of meteorological personnel engaged in the provision of meteorological forecasts for aeronautical purposes is similar to that of all meteorological personnel engaged in operational weather forecasting, with addition of Basic Instruction Package for Meteorologists (BIP-M).

3.5.1.2 The required knowledge and skills for a forecaster should be supplemented by special courses in aviation knowledge and procedures for meteorological service to air navigation. Particular emphasis shall be placed on;

- (i) the study, analysis and forecasting of the influence of the atmosphere on the operation of aircraft.
- (ii) particular hazardous weather phenomena to be such as low visibility and/or low cloud at aerodromes.
- (iii) low-level wind shear; turbulence (including clear-air turbulence);
- (iv) icing and thunderstorms.
- (v) tropical cyclones.
- (vi) upper winds and temperatures, jet streams and tropopause; and
- (vii) volcanic ash.

3.5.1.3 The syllabus for the subjects is given in subsection 3.5.5 below, which reiterates the requirements of Regulation 7(c) of the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022.

3.5.1.4 The time taken to acquire this aeronautical meteorology specialization will primarily depend on the prior meteorological training and experience of the individual trainee and shall be attained as follows;

- (i) an experienced forecaster from an alternative specialization would require around 60 hours of tuition combined with some two to six weeks supervised on-the-job experience in order to perform competently as an aeronautical forecaster.
- (ii) for a trainee with little forecasting experience, the aeronautical specialization would require a minimum of around 240 hours of tuition combined with some three to nine months supervised on-the-job experience.
- (iii) to gain maximum benefit of the on-the-job experience, this period should encompass situations where the trainee will be exposed to both hazardous and non-hazardous weather conditions.

3.5.1.5 Assess the competency of Aeronautical Meteorological Forecasters trainee before they would be assigned to the position of Aeronautical Meteorological Forecasters. Passing this assessment could be

regarded as a proof of fulfilling competency requirements, irrespective of the length of the training period (which may fall outside the above recommended number of tuition hours).

3.5.2 Knowledge and Skills Requirements in Weather Forecasting

The forecasters working in meteorological offices serving air navigation must have the knowledge and skills to maintain an appropriate weather watch, to analyse the weather situation and to prepare and communicate weather forecasts. The guidance below is recommended by WMO and is a requirement in the Civil Aviation (meteorological services for air navigation) Regulations, 2022:

- 3.5.2.1 Understanding atmospheric processes and phenomena; the forecaster should know and be able to explain the main atmospheric processes and phenomena from the planetary to local scales; and know the region-specific weather phenomena and interpret the major meso-local scale particularities of the atmospheric dynamics over the entire Ugandan airspace.
- 3.5.2.2 Analysing and monitoring the weather; the forecaster should be able to analyse and interpret synoptic charts, diagrams and graphics; integrate all available data to produce a consolidated diagnosis; perform real-time weather monitoring, utilising all available remote sensing technologies such as radar surveillance and satellite imagery; constantly monitor the actual weather evolution, particularly the severe weather aspects associated with microclimates in the assigned area.
- 3.5.2.3 Weather forecasting; the forecaster should know and be able to apply weather forecasting principles, methods and techniques; understand the operation of Numerical Weather Prediction (NWP) models; and be able to utilize their strengths while being aware of their weaknesses. Verify, interpret and use NWP output, adding value to model or guidance forecasts where appropriate.
- 3.5.2.4 Preparing user-specific forecasts and warnings; the forecaster should be able to elaborate and distribute regional/local and user specific forecasts; verify the ongoing forecasts; identify errors and amend erroneous forecasts as appropriate; issue warnings; and provide reliable emergency services whenever needed. Forecaster should also be able to comprehend users' needs and risk-taking limitations.
- 3.5.2.5 Information technology and data processing; the forecaster should know and be able to use the operational system technology; understand and be able to apply basic operating system functions, data processing and visualization technology.

3.5.3 Specific Knowledge and Skills for Aeronautical Meteorological Forecaster

- 3.5.3.1 In addition to the general weather analysis and forecasting skills, an aeronautical meteorological forecaster is required to have skills in diagnosing and forecasting aviation specific phenomena, knowledge and skills in the use of aviation specific codes and practices, as well as an appreciation of the impact of their forecasts on aviation operations.
- 3.5.3.2 Weather phenomena; the forecaster should understand the weather phenomena hazardous to aviation, their analysis and forecasting; understand which meteorological parameters are crucial for the safety and regular operations of aviation user groups.

3.5.4 Competency Requirements for Aeronautical Meteorological Forecaster

- 3.5.4.1 In addition to the knowledge requirements set out in 3.5.3 above, a practising aeronautical meteorological forecaster shall have to develop appropriate 'job competencies. These comprise the

characteristics that should be displayed on a day-to-day basis and not only demonstrate that a forecaster can apply the knowledge identified in sections 3.5.2 and 3.5.3 above, but also that the knowledge has been adapted to the local area/conditions.

3.5.4.2 These job competencies shall also demonstrate that a forecaster has understood the special requirements of the area of operations and can interpret which elements of the job competencies are of high and which are of lower importance. That balance may change depending on local conditions.

3.5.5 Courses for Aeronautical Meteorological Forecasters (Meteorologist)

The following courses form the requirement specified in the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022. The requirements enumerate the courses that should be covered to provide the basic skills and knowledge for the Forecasters;

3.5.5.1 Aircraft Icing:

- Theory of formation of icing; processes and dependence upon temperature, drop size, liquid-water content, airframe configuration and aircraft speed.
- Types of icing, clear ice, rime ice, hoar frost and mixed ice.
- Ice accretion rates; association with cloud types; thunderstorms; freezing precipitation; orographic and frontal lifting effects.
- ICAO criteria for reporting icing.
- Methods of diagnosing and forecasting the risk of icing, and means of avoiding icing areas.

3.5.5.2 Turbulence:

- Turbulence near the ground; mechanical turbulence; convective turbulence; effects of boundary-layer turbulence on take-offs and landings; turbulence related to clouds, fronts and thunderstorms.
- High-level Clear Air Turbulence (CAT); turbulence association with wind shear, jet streams, stability and tropopause inversion.
- Mountain wave turbulence (both boundary layer and high-level).
- Gravity waves.
- Wake vortex.
- ICAO criteria for reporting turbulence and mountain waves.
- Methods of diagnosis and forecasting the risk of turbulence.
- Operational problems associated with turbulence; means of avoiding turbulence areas.

3.5.5.3 Other hazardous phenomena:

- Reduced surface visibility; fog types and their formation and dissipation; and other weather phenomena causing reduced surface visibility.
- Low-level clouds; operational problems associated with low-level clouds in the terminal area and en-route.
- Thunderstorms; associated phenomena and types: air-mass and severe thunderstorms.
- Use of weather/Doppler radar for detecting and forecasting hazardous phenomena.
- Wind shear; operational problems associated with wind shear in the approach and landing phases of flight.
- Volcanic ash; operational problems associated with volcanic ash.

3.5.5.4 Meteorological services for international air navigation:

- Air navigation plans; the associated facilities and implementation document (FASID).

- World Area Forecast System (WAFS); and World Area Forecast Centres (WAFCs)
- Warnings for volcanic ash; VAACs and their functions; and IAVW.
- Warnings for tropical cyclones; TCACs and their functions.
- Meteorological offices and their functions; trend forecasts and TAF; wind shear and aerodrome warnings.
- Meteorological watch offices; scope of meteorological watch; SIGMET and AIRMET information.
- Aeronautical meteorological stations; their functions; local routine and special reports, METAR and SPECI.
- Information for operators and flight crew members prior to departure, display of meteorological information and flight documentation and Information for search and rescue.
- Information for aircraft in flight, VOLMET broadcasts and D-VOLMET.
- Information for and from ATS; types of meteorological information required by ATS; transmission of aircraft meteorological reports by ATS.
- Forms of meteorological messages; local routine and special reports; METAR and SPECI, TAF and amendments thereto; trend forecasts;

3.5.5.5 Meteorological aspects of flight planning:

- Meteorological basis for flight planning: great circle track; composite tracks; wind components; minimum time tracks; D-value; drift angle.
- Requirements for en-route and aerodrome forecasts and reports; use of forecasts from the WAFS; direct supply of information to operators for centralised operational control.
- Preparation of area and route forecasts.
- Briefing of flight crews and operational personnel.

3.5.5.6 Air traffic services:

- Visual and Instrument Flight Rules (VFR/IFR); and Visual and Instrumental Meteorological Conditions (VMC/IMC).
- Flight Information Service, Automatic Terminal Information Service (ATIS).
- Low Visibility Procedures (LVP)
- Air Traffic Control Service; terrain clearance; cruising level system; vertical separation minima; horizontal separation.
- Functions of Area Control Centre, Approach Control Unit, Aerodrome Control Tower and Flight Information Centre; holding and approach procedures.
- Search and Rescue Services.
- CNS/ATM systems.
- Co-ordination between ATS units and the meteorological service; meteorological observations performed by ATC.
- Transition levels, layers and altitudes; the lowest usable flight level en-route.
- Category II and III operations; role of runway visual range and height of cloud base.

3.5.5.7 Aerodromes:

- Aerodrome lighting; its relation to operations in lower visibility conditions and to runway visual range (RVR) assessment.
- Effects of meteorological parameters on aerodrome ground services; snow (snow clearing), precipitation (the effect of wet runways on braking action).
- Parameters related to meteorology required by aerodrome authorities; aerodrome reference temperature, state of the runway, local climatological conditions (their effects on noise and atmospheric emissions by aircraft operations).

- Aerodrome capacity management and its relation to operations in poor weather conditions.

3.5.5.8 Operation of aircraft:

- Aerodrome operating minima; minima applicable to the regular and alternate international aerodromes.
- Approach systems: visual and instrumental.
- Categories of operations.
- Altimeter setting procedures; the ICAO Standard Atmosphere.
- Basic flight navigation, the principal aids to navigation basic aerodynamics; methods of determining wind in flight.

3.5.5.9 Aeronautical information services:

- Aeronautical Information Publication (AIP); Aeronautical Information Circular (AIC); meteorological elements required.
- NOTAM/ASHTAM/SNOWTAM.
- ICAO Abbreviations and Codes.
- Information concerning the meteorological service aeronautical charts.

3.5.5.10 Aeronautical telecommunications:

- Organization of aeronautical telecommunications; procedures applicable to the preparation of meteorological messages.
- Operation of the Aeronautical Fixed Service (AFS); Aeronautical Fixed Telecommunication Network (AFTN); Aeronautical Telecommunications Network (ATN).
- Message headings, addressing of messages, priorities of messages; regional aeronautical MET telecommunication procedures (AMBEX, ROBEX).

3.5.5.11 Interpretations in Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022:

- Air-report, meteorological report, briefing, forecast, observation and SIGMET information.
- Visibility (for aeronautical purposes); prevailing visibility; runway visual range.
- Altitude, elevation, height, density altitude, pressure altitude, flight level, cruising level, transition altitude, transition level, transition layer.
- Operator, operator's local representative, pilot-in-command.
- Aerodrome, instrument runway, landing area, movement area, obstacle free zone, final approach, circling approach, initial visual approach, missed approach; take-off and initial climb-out phase.

3.6 Requirements for Training Aeronautical Meteorological Observers (AMO) and Communication (COMM) Personnel

3.6.1 Basic

3.6.1.1 For training AMOs and COMM personnel, the weather observations and communication instruction shall be supplemented by special courses in aviation knowledge and procedures for meteorological service to air navigation. Particular emphasis shall be placed on the observation of phenomena that influence the operation of aircrafts. Syllabi for these subjects are given in section 3.6.4 below, which reiterates the provisions of the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022;

3.6.1.2 The time taken to acquire this aeronautical meteorology specialization will primarily depend on the prior meteorological training and experience of the individual trainee. As a guide, an experienced meteorological observer from an alternative specialization would likely require around 30 hours tuition combined with some two (2) to four (4) weeks supervised on-the-job experience in order to perform competently as an aeronautical meteorological observer.

3.6.1.3 The Authority shall require assessment of the competency of aeronautical meteorological observers and communication personnel before they are assigned to the position of aeronautical meteorological observer and Communicator. Passing this assessment shall be regarded as a proof of fulfilling competency requirements.

3.6.2 Specific Knowledge and Skills for Aeronautical Meteorological Observer

In addition to the general observing skills, an aeronautical meteorological observer is required to constantly monitor the meteorological conditions at the aerodrome and its vicinity; and to have skills and knowledge in the use of aviation specific codes and practices as well as an appreciation of the impact of their observations on aviation operations as have been recommended by the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022 and are summarized below;

- (i) Aeronautical observations; Knowledge of the procedures for the making of routine and special observations and reports.
- (ii) Hazardous phenomena; Elementary knowledge of the phenomena hazardous to aviation
- (iii) Meteorological aspects of flight planning; Knowledge of the technical regulations
- (iv) Reporting, coding and dissemination of weather information.
- (v) Aeronautical telecommunications and elementary knowledge of the general organization of aeronautical telecommunications
- (vi) Courses for the training required to acquire this knowledge and skill is in section 3.6.4 below.

3.6.3 Competency Requirements in Aeronautical Meteorological Observations and Communication

3.6.3.1 When establishing the minimum job competencies that an observer must reach before becoming an 'independent aeronautical meteorological observer and Communicator', it is essential to understand the area of operations and to interpret which job competencies are of high and which are of lower importance. That balance will change depending on local area of operation. Therefore, a critical part of the OJT is to become familiar with the procedures used in the area of operation.

3.6.3.2 Job competencies may vary, but the following are the generic competencies that should be demonstrated by an aeronautical meteorological observer:

- (i) Make and disseminate aeronautical weather observations in accordance with the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022 and WMO requirements.
- (ii) Identify hazardous aviation conditions and their likely impact on aircraft operations.
- (iii) Describe impact of a range of meteorological conditions on aviation operations and procedures.
- (iv) Assist the aeronautical aviation forecaster.

3.6.4 Courses for Aeronautical Meteorological Observer

The training of new aeronautical meteorological observers prescribed in the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022. The following competencies are intended to be used to both confirm that the training of existing aeronautical meteorological observer and Communicator is adequate and

to help identify any gaps or omissions so that they may be corrected, and the integrity of aviation safety is maintained.

3.6.4.1 Observing techniques:

- Surface wind direction and speed; wind variations.
- Visibility; definition of visibility for aeronautical purposes.
- RVR, spatial and temporal variations, methods of assessment;
- Vertical visibility.
- Cloud amount, height and type; spatial and temporal variations;
- Pressure; determining QFE and QNH;
- Meteorological observing equipment calibration standards and maintenance procedures.

3.6.4.2 Understanding hazardous phenomena:

- Aircraft icing; icing types; formation, accretion rates and association of icing with clouds, freezing precipitation, orographic and frontal lifting.
- Turbulence; turbulence near the ground, high-level turbulence (CAT).
- Reduced surface visibility.
- Low-level clouds.
- Thunderstorms; associated phenomena.
- Volcanic ash.

3.6.4.3 Reporting, coding, dissemination of weather information, ICAO definitions and terms:

- Meteorological codes related to observations and forecasts; METAR, SPECI, SYNOP, PILOT, TEMP, TAF and ROFOR.
- Dissemination of weather information at the aerodrome; special needs of ATC units.
- Plain language forms of meteorological messages, both the local routine and special reports.
- Meteorological report, observation.
- Visibility (for aeronautical purposes), runway visual ranges.
- Altitude, elevation, height, aerodrome elevation, flight-level, transition level.
- Aerodrome meteorological minima, instrument runway, landing area.
- Landing forecast, aerodrome forecast, GAMET area forecast.
- SIGMET and AIRMET information; briefing; routine and special air-report.
- Operator, pilot-in-command.

3.6.4.4 Aeronautical telecommunications:

- Organization of aeronautical telecommunications.
- Aeronautical fixed service (particularly AFTN and ATN), and any special Broadcasts and/or regional telecommunications networks applicable to the region concerned.
- Message headings, addressing of messages, priorities of messages and any appropriate regional procedures.
- ICAO abbreviations and codes.

3.6.5 On-The-Job Training (OJT)

3.6.5.1 The MSP shall ensure that performance based On-Job Training (OJT) programmes are conducted before any individual can be deployed to carry out specified duties.

3.6.5.2 The MSP shall engage qualified OJT instructors or Senior Meteorological personnel to conduct OJT.

3.6.6 Refresher Training

- 3.6.6.1 The MSP shall determine the type of refresher training necessary to meet operational requirements in line with the services described in the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022 and in this Advisory Circular.
- 3.6.6.2 In order to cope with changing technology and operating procedures, it is necessary that the MSP provides personnel with courses of instruction designed to bring knowledge and skills up to date in form of refresher courses.
- 3.6.6.3 The refresher courses may be in form of; in-house induction, skills and experience exchanges, or fully-fledged training in specialized training organizations.

3.6.7 Recurrent Training

- 3.6.7.1 The MSP shall determine the type of recurrent training necessary to meet operational requirements in line with the services described in the Civil Aviation (Meteorological Services for Air Navigation) Regulations, 2022 and in this Advisory Circular.
- 3.6.7.2 Recurrent training will be provided to ensure that the technical staff remain current and that there is no need to retrain personnel following a long period of not practicing.

3.6.8 Training records

- 3.6.8.1 The MSP shall ensure that training records, including those of OJT are properly kept for inspection by the Authority as may be required.
- 3.6.8.2 The training records shall include certificates, training reports, OJT tasks performed reports and any other documents related to training.



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