**TRAINING COURSE FOR AERONAUTICAL**

**METEOROLOGICAL OBSERVERS**

**Course Description**

The purpose of this course is to build capacities of trainees for monitoring and observing aeronautical meteorological phenomena and parameters.

Aeronautical meteorological observations are made for a variety of reasons. They are used for the real-time preparation of weather analyses, forecasts and severe weather warnings, for local aerodrome flying operations, for the study of climate, and for research in meteorology and climatology. Good performance of aeronautical meteorological measurements and observations is vital for the safety, regularity and efficiency of air navigation.

Following the Aeronautical Meteorological Personnel Competency Standards approved by the WMO Cg-XVI (2011), some WMO Members raise the need of training to update the knowledge of their aeronautical meteorological observers (AMO). This training course addresses the background knowledge and skills for the AMO competencies.

**Expected Learning Outcomes**

Upon completion of this training course, participants are expected to acquire theoretical and practical knowledge to

* Monitor continuously the weather situation;
* Observe and record aeronautical meteorological phenomena and parameters;
* Ensure the quality of the performance of systems and the quality of meteorological information;
* Communicate meteorological information to internal and external users.

**Target Audience**

The course is addressed to aeronautical meteorological observers in National Meteorological Services or in the civil aviation companies.

**Course Content and Topic Objectives**

**Topic 1 Introduction**

* Objective, determination and provision of aeronautical meteorological service for international air navigation
* Competency standards and requirements for aeronautical meteorological observer (AMO)
* Objectives, types and characteristics of aeronautical meteorological observations and reports
* Techniques and methods for and future development of aeronautical meteorological observations
* List of relevant ICAO and WMO documents

**Topic objectives:** In this topic, instructor will have a general review on aeronautical meteorological service including the observational aspect, and competency requirements for AMO. List of relevant ICAO and WMO documents will enable participants to check when confront with various problems on duty.

**Topic 2 Impact of meteorological phenomena and parameters on aviation operations**

* Temperature and humidity
* Wind including temporal and spatial variability (wind-shear, directional variability and gusts)
* Pressure
	+ Sea Level Standard Atmosphere Pressure (QNE)
	+ Field Elevation Atmospheric Pressure (QFE)
	+ Atmospheric pressure at nautical height (QNH)
* Cloud (types, amounts, height of base and vertical extent, formation and evolvement)
* Precipitation (intensity and temporal variations, onset/cessation and/or duration, amount and types)
* Visibility
* Fog (types, formation and dissipation)

**Topic objectives:** Upon completion of this topic, participants will have general knowledge on some meteorological phenomena and parameters which impact aviation operations.

**Topic 3 Formation mechanisms and characteristics of aeronautical**

**meteorological phenomena and aviation hazards**

* Thunderstorms and associated phenomena
* Jet-stream
* Turbulence
* Aircraft icing
* Wind shear
* Microburst
* Tropical cyclones
* Tornado/waterspout
* Volcanic ash
* Low-level cloud
* Poor visibility

**Topic objectives:** Upon completion of this unit of instruction (Topics 2 & 3), participants will demonstrate knowledge of meteorological theory enabling them to make intelligent decisions when confront with various weather phenomena and hazards.

**Topic 4 Local topography and its effects on weather**

* Gap flows
* Downslope windstorms
* Orographic turbulence
* Sea breezes
* Upslope fog
* Airport climatology

**Topic objectives:** In this topic, effects of local topography on various weather phenomena will be addressed, participants should be able to make a case study on a specific situation in their countries.

**Topic 5 Meteorological instruments and observational methods**

5.1 Measurement of temperature

* The four main devices of temperature measurement
* Heat stagnation effects of thermometers
* Radiation shield devices of temperature measurement

5.2 Measurement of atmospheric pressure

* Mercury Barometers
* Aneroid Barometers
* Electronic Barometers
* Hypsometer
* Corrections for sea level pressure
* Field elevation pressure (QFE)
* Atmospheric pressure at nautical height (QNH)
* Barometer Exposure
* Comparison and calibration

5.3 Measurement of humidity

* Definitions and units of humidity parameters
* The psychrometric method
* The Condensation method
* Electrical resistive and capacitive hygrometers
* Optical hygrometers

5.4 Measurement of surface wind

* Measurement of wind direction
* Cup and propeller sensors
* Hot-wire anemometers
* Sonic anemometers

5.5 Observation of meteorological phenomena

* precipitation
* Mist
* Sandstorm
* Smoke
* Windstorm
* Blowing Snow
* Ground Condensation
* Thunder and Lightning
* Snow Accumulation

5.6 Observation of clouds

* Observation of cloud amount, height and type
* Instrumental measurements of cloud amount
* Measurement of cloud height using a searchlight
* Measurement of cloud height using a balloon
* Laser ceilometers

5.7 Measurements at automatic weather stations

* Types of automatic weather stations
* Automatic weather station hardware
* Automatic weather station software
* Maintenance

5.8 General review on special profiling techniques for the boundary layer and the troposphere

* Acoustic sounders (sodars)
* Wind profiler radars
* Microwave radiometers
* Laser radars (lidars)
* Balloon tracking
* Boundary layer radiosondes
* Instrumented towers and masts

5.9 General review on observation system for aviation operations in China

**Topic objectives:** This topic will summarize the best practice and techniques for making observation of weather phenomena and parameters which have significant impact on aviation operations, enable participants to observe and record aeronautical meteorological phenomena and parameters properly.

**Note:** Measurements of sunshine duration, radiation, evaporation, upper-air pressure, upper wind are not made operationally in CAAC weather stations, CAAC forecasters use relevant data obtained from WMO Global Observation System. Therefore, they are not included here.

**Topic 6 Interpretation of observational data and preparation of meteorological reports**

* Basic meteorology
* Interpretation of surface weather maps, satellite and radar imagery
* Interpretation of automatic observed parameters
* Strengths and weaknesses of manual observations and automatic observing systems
* Encoding of observations into traditional alphanumeric codes (METAR/SPECI)
* Procedures for performing routine and non-routine aeronautical meteorological observations and reports

**Topic objectives:** This topic will summarize the best practice and techniques for reporting observational records, and enable participants to report aeronautical meteorological phenomena and parameters properly.

**Topic 7 Air traffic services, aviation user requirements and aeronautical meteorological telecommunications**

* Air traffic control and management services
* Aerodrome operating minima
* Meteorological effects on aerodrome ground services
* Meteorological aspects of flight planning
* Dissemination of aeronautical meteorological data and information
* Communication with internal and external users

**Topic objectives:** Upon completion of this topic, participants will demonstrate knowledge enabling them to communicate meteorological information to internal and external users properly.

**Topic 8 Quality management and aviation safety management system**

* Supply, use and quality management of meteorological information
* Notifications required from operators
* Fallback procedures and contingency arrangements

**Topic objectives:** Upon completion of this topic, participants will demonstrate knowledge enabling them to ensure the quality of the performance of systems and the quality of meteorological information.

**Topic 9 Practice**

* To be arranged according to the specific requirements of participants.
* If the training course is conducted in Nanjing, a study tour to the weather station in Lukou International Airport can be also arranged.

**Topic objectives:** Practice will enhance or improve the skill of participants on duty.

**Course Format**

Lectures, discussion in the classroom, practical exercises in the NUIST Atmosphere Observational Base, and study tour to the Meteorological Service Division of Lukou International Airport.

**Assessment**

* Student assessment: Tests on theoretical knowledge will be taken to assess student learning. The trainers are requested to make an assessment for each student on his/her performances in the practical exercises.
* Course assessment: An internal assessment will be performed using self evaluation approach: from trainees and from trainers. Based on the assessments of both trainees and trainers, the training office of the RTC Nanjing will make an evaluation report for both training aspect and administrative management aspect after the completion of the course.

**Instructors**

* Prof. Shaowen Shou, Professor in Meteorology, School of Atmospheric Sciences, NUIST.
* Prof. Xiaofeng Xu, Professor in Atmospheric Physics, School of Atmospheric Physics, NUIST.
* Ms Yan Wu, expert of Aeronautical Meteorological Observation, Air Traffic Management Bureau of Eastern China, Shanghai, China.

**Working Language**

* English

**References**

* *Meteorological Service for International Air Navigation*, Annex 3 to *the Convention on International Civil Aviation*
* WMO-No.8, *Guide to Meteorological Instruments and Methods of Observation*