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INFORMATION PAPER

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Agenda Item 4: [Quality management of meteorological services]

COMPETENCY ASSESSMENT AND CONPETENCY-BASED TRAINING PROGRAM FOR AERONAUTICAL METEOROLOGICAL PERSONNEL IN VIETNAM

(Presented by Viet Nam)

This paper presents new version (2021) of competency assessment program and consequent competency-based training decision for aviation forecasters and observers in Vietnam, which helps to improve the professional and practical qualification of aeronautical meteorological personnel, which in turn contribute to improve quality of meteorological services for aviation.

1. INTRODUCTION

1.1 Management and assurance qualification of human resource is a part of quality management system (QMS) required by ICAO for aeronautical meteorological service. In Chapter 2 of ICAO Annex 3 "Meteorological Service for International Air Navigation", under article 2.1 "Objective, determination and provision of meteorological service", clause 2.1.5 states:

> 2.1.5 Each Contracting State shall ensure that the designated meteorological authority complies with the requirements of the World Meteorological Organization (WMO) in respect of qualifications, competencies, education and training of personnel providing meteorological (MET) service for international air navigation.

1.2 Under ICAO and WMO collaboration, a set of competency standards for Aeronautical Meteorological Personnel (AMP) have been developed and are mandatory to be implemented since 2013. In the ICAO APAC MET Subgroup 20th Meeting (2016), WMO's Working Paper WP/10 informed "WMO requirements for competency of AMP, both for aeronautical meteorological observers (AMO) and aeronautical meteorological forecasters (AMF) became a standard practice as of December 2013 (WMO-No. 49, Volume I, Part V, 1.2). Member States have been requested to undertake competency assessment (CA) of their AMP following the guidance developed by the Commission for Aeronautical Meteorology (CAeM), nevertheless, it is clear that some States experience difficulties in the establishment of CA routine and will need further assistance. The best practice is to consider the CA as part of the QMS and to establish a schedule for recurrent CA checks with intervals of 2-3 years."

1.3 During last decade, WMO has continuously updated the document WMO-No. 49, regarding MET personnel competency requirements and assessment. The organization also developed several additional documents to guide States in developing competency assessment and competency-based training programs, such as WMO-No. 1205 "Guide to Competency" (2018) and WMO-No. 1209 "Compendium of WMO Competency Frameworks".

2. DISCUSSION

New version of Program for Aeronautical Meteorological Personnel Competency Assessment (MET CAS)

2.1 To meet ICAO requirement of MET personnel competency management, CAAV commenced a first version of a Manual on AMP Competency Assessment (MET CAS) in 2012 and began to implement MET CAS to all forecasters and observers working on the chain of meteorological service provision for aviation since 2013, periodically every 3 years a round.

2.2 Along with updates of WMO's guidance documents regarding qualifications of AMPs and competency framework, in 2021 CAAV had reviewed and issued version 2 of the MET CAS Manual/Program, then put into implementation of a three-year MET CAS Program 2022-2025, in collaboration with the Vietnam Air Traffic Management Corporation (the body who provides all MET services for aviation in Vietnam).

2.3 The Vietnamese MET CAS Program launched in 2021 includes AMP qualification and competency requirements (standards and criteria) complying with WMO-No. 49; CAS procedure; assessment matrix and assessment toolkit for AMFs and AMOs; a list of MET CAS assessors approved by CAAV; and a three-year roadmap of the assessment period 2022 to 2025. Based on the framework, yearly schedule of assessment is asked to take into account seasonal and local climate patterns for better observe and assess AMPs' job performance in different weather conditions at their work site.

(Full assessment matrix for AMFs and AMOs are in the attachment A and B to this paper).

2.4 In 2022 CAAV in coordination with the Vietnam Air Traffic Management (VATM - aeronautical MET service provider in Vietnam), have competency assessed almost 25% of total AMP (forecasters and observers). Eventhough the assessment round has run just only one third of the way, the first outcome shows that there are some common and some specific gaps in knowledge and job skills required as standards for operational AMPs. A common gap among assessed AMFs is the knowledge of aeronautical terms relevant to aeronautical MET service such as final approach, missed approach, aerodrome operating minima, Category I, II and III aerodrome operations…. At the same time, some forecasters are weak in specific advance competencies such as MET requirements from aviation users; effects of different meteorological factors/parameters on aircraft performance; interpretation and analysis of Skew-T sounding diagram (radiosonde), radar imagery; timely aerodrome weather nowcasting. On the other hand, common gaps among observers found in background knowledge of meteorological science (characteristics of the atmosphere; wind mechanisms and circulations); effects of weather on aircraft performance; aerodrome weather observation equipment (AWOS, measurement sensor/ equipment, interpret weather parameters derived from AWOS, ensure quality of MET observation data, (QMS, checking and identifying measuring equipment's data errors and omissions).

2.5 A comprehensive gap analysis shows a 'competency transcript' with overall view of satisfaction upon required competencies of operational MET staff of a MET unit or the State's aeronautical MET personnel as a whole. Based on that, CAAV (also as State's aviation MET authority) asks aviation MET service providers to take this assessment result into account for the organization training goal, training plan and training decision. That competency-based training approach will assist MET service providers in ensuring their staff meet the defined competency standards, and by that way, ensuring the quality of MET services provided for aeronautical purposes.

(Some figures of gap analysis (AMOs, AMFs) are in the attachment C to this paper).

3. ACTION BY THE MEETING

Note the information contained in this paper.

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APPENDIX A: FULL ASSESSMENT MATRIX FOR AMOs COMPETENCY ASSESSMENT (VIETNAM)

Tool **OBS** -A: General aerodrome observation performance

Tool **OBS** -B: Advance aerodrome observation

Tool **OBS** -C: Communicate MET information to users, issuing aerodrome observations and reports

Tool **OBS** -D: Quality of observation information

	Competencies for Aeronautical Met. Observers	TOOL OBS-A	TOOL OBS-B	TOOL OBS -C	TOOL OBS -D
I	**COMPETENCE 1: MONITOR CONTINUALLY THE WEATHER SITUATION** *Competency description: Continually monitor weather phenomena and parameters during hours of operation to identify the significant and evolving weather phenomena that are affecting or will likely affect the area of responsibility (typically the aerodrome and its vicinity).*				
1.1	**Background knowledge required**				
1.1.1	Key characteristics of the troposphere and tropopause	✓			
1.1,2	Properties of air pressure, temperature, density and water vapour in the atmosphere	✓			
1.1.3	Atmospheric stability, inversions	✓			
1.1.4	Generation mechanisms of wind in the atmosphere	✓			
1.1.5	Fog and cloud formation and dissipation	✓			
1.1.6	Precipitation types and intensity	✓			
1.1.7	The general circulation of the Earth's atmosphere	✓			
1.1.8	The International Standard Atmosphere (ISA)	✓			
1.2	**Professional knowledge**				
1.2.1	Characteristics, occurrence and effects of meteorological hazards to aviation, including but not limited to low cloud, low visibility, thunderstorms and associated phenomena, aircraft icing, freezing precipitation, turbulence, tropical cyclones, wind shear and volcanic ash; other weather hazards)	✓			
1.2.2	Interpretation of surface-weather maps, satellite and radar imagery (*at the required level*)	✓			
1.2.3	Region-specific weather phenomena and likely weather sequences that are expected to affect the responsible aerodrome/area of responsibility				

1.2.4	Observe significant changes of weather; Collaborate nowcasting for severe weather phenomena				
1.2.5	Local topography and climatology	✓			
1.2.6	ICAO location indicators and WMO synoptic station numbers, particularly for aerodromes and stations that lay within and close to the area of responsibility	✓			
1.3	**Performance criterion**				
	Analyze and describe the current local weather conditions	✓			
II	**COMPETENCY 2: OBSERVE AND RECORD AERONAUTICAL METEOROLOGICAL PHENOMENA AND PARAMETERS** *Competency description: Observations of weather phenomena and parameters, and their significant changes, are recorded according to documented thresholds and regulations.*				
2.1	**Background knowledge and skills**				
2.1.1	Procedures for performing routine and non-routine aeronautical meteorological observations and reports		✓		
2.1.2	The impact of weather on aircraft and airport operations		✓		
2.1.3	Strengths and weaknesses of manual observations and AWOS		✓		
2.1.4	Directives, procedures and instructions to observers		✓		
2.1.5	Validated sources of weather information		✓		
2.1.6	Quality management systems being implemented at the current MET unit		✓		
2.1.7	Relevant ICAO and WMO documents (*ICAO Annex 3, the Technical Regulations (WMO-No. 49), Volume II, the Manual on Codes (WMO-No. 306), the ICAO Manual of Aeronautical Meteorological Practice (Doc 8896), and the ICAO Manual on Automatic Meteorological Observing Systems at Aerodromes (Doc 9837)*)		✓		
2.1.8	ICAO definitions of relevance to meteorology		✓		
2.1.9	WMO Traditional Alphanumeric Codes (TAC) and national aeronautical meteorological codes and forms of data representation		✓		
2.2	**Performance criteria**				
2.2.1	Perform and record routine and non-routine observations of the following:		✓		
a)	Observation of surface wind *(direction and speed, including spatial and temporal*		✓		

	variations, wind shear, gust)				
b)	Observation of visibility for aeronautical purposes, including spatial and temporal variations (*VIS, principle of reporting VIS measured by AWOS and by human eyes, spatial and temporal variations*)		✓		
c)	Observation of runway visual range (RVR) including spatial and temporal variations (*understanding RVR, observation of RVR, principle of reporting RVR in METAR, SPECI/MET REPORT, SPECIAL*)		✓		
d)	Observation of observation of weather phenomena (*refer ICAO Annex 3 and CAAV's regulations*)		✓ / 		
e)	Observation of cloud (*amount, cloud type and height of cloud base, including spatial and temporal variations*)		✓		
g)	Observation of vertical visibility				
h)	Observation of air temperature and dew-point temperature		✓		
i)	Observation of atmospheric pressure; determining QFE and QNH		✓		
k)	Observation of supplementary information concerning significant meteorological conditions, particularly those in the approach and climb-out areas such as wind shear				
2.2.2	Interpret weather parameters derived from AWOS (*representativeness, differences occur between automatic sensor technologies and manual observing techniques, characteristic of measurement affect the accuracy of observation data, advantage and disadvantage of AWOS observation for each parameters*)		✓		
2.2.3	Prepare and issue observation reports in accordance with ICAO Annex 3 and Vietnam regulations (*regional and national formats, codes and technical regulations on content, representativeness and timeliness*).		✓		
2.2.4	Collaborate with coordinated Aerodrome Meteorological Office in preparing and issuing TREND				
III	**COMPETENCY 3: ENSURE THE QUALITY OF SYSTEM PERFORMANCE AND OF METEOROLOGICAL INFORMATION** *Competency description: understanding of observation techniques/ equipment, quality of meteorological observations at the required level, application of QMS document*				
3.1	**Background knowledge and skills**			✓	
3.1.1	MET service standards and requirement for MET QMS in ICAO Annex 3; quality management procedures (ISO 9001 standards) applied for MET service in Vietnam;			✓	

	- The importance of accurate aerodrome observation for flight safety (wind, VIS/RVR, height of cloud base, pressure)				
3.1.2	Knowledge of AWOS and alternate observation equipment; strengths and weaknesses of manual observations and AWOS, operational procedures applied for aerodrome weather observation.			✓	
3.1.3	Procedures for checking and identifying errors and omissions (in automatically- and manually-derived data)			✓	
3.1.4	ICAO standards and Vietnam legislation for QMS implementation for MET service				
3.1.5	Methods for identifying significant differences between observational and forecast data			✓	
3.2	**Performance criteria**				
3.2.1	Check and confirm the operational status of meteorological observations technical system/ equipment.			✓	
3.2.2	Monitor observation data derived from AWOS and other equipment; identify errors and omissions in meteorological observations.			✓	
3.2.3	Check and confirm the quality of meteorological observations before issuance, including relevance of content, time of validity and location of phenomena.			✓ / 	
3.2.4	Procedures for alternate observations, using alternate technique/equipment in case AWOS has errors or misses data for issuance aerodrome weather report			✓ / 	
3.2.5	Apply the organization's quality management system and procedures			✓ / 	
IV	**COMPETENCY 4: COMMUNICATE METEOROLOGICAL INFORMATION TO INTERNAL AND EXTERNAL USERS** *Competency description: All meteorological data and information are concise, complete and communicated in a manner that will be clearly understood by the users*				
4.1	**Background knowledge and skills**				
4.1.1	Knowing how weather information is disseminated within and beyond the aerodrome (methods, regulations, available communication technologies)				✓
4.1.2	Local aeronautical meteorological telecommunication systems				✓
4.1.3	National and local requirements upon provision of meteorological information for ATS units				✓
4.1.4	National and local requirements upon provision of meteorological information for flight planning				✓

4.1.5	Specifications related to flight documentation, briefing and consultations				✓
4.1.6	The range of significant weather phenomena; Extent/ Coverage/ Range/ and Limitation of AWOS at the aerodrome				✓
4.1.7	Thresholds for significant weather changes and their meanings				✓
4.1.8	Local climatology				✓
4.1.9	Extent, scope and exclusions of QMS implementation				✓
4.1.10	Communication language(s)				✓
4.2	**Performance criteria**				
4.2.1	Ensure that all observations are disseminated through the authorized communication means and channels to designated user groups				✓
4.2.2	Present aeronautical meteorological data and information in a clear and concise manner using suitable terminology that will be clearly understood by the users				✓
4.2.3	Alert forecasters to observed or imminent significant changes in the weather within the local area or in vicinity				✓

✓: Criteria that is mandatory (standard) to meet

: May be assessed by using simulating circumstance/case study/ exercise

: Optional criteria for assessment.

APPENDIX B: FULL ASSESSMENT MATRIX FOR AMF COMPETENCY ASSESSMENT (VIETNAM)

(*) Tools applied for all Forecasters (Aerodrome MET Centres and Met Watch Office - MWO)

(**) Tools applied for Aerodrome Forecasters: Tool DB-B is for general aerodrome forecasting and warning and Tool DB-D for advance assessment

(***) Tools applied for MWO forecasters: Tool DB-C is for general en-route weather forecasting and warning, Tool DB-D for advance assessment

	Competencies for Aeronautical Met. Forecasters	TOOL FCT-A (*)	TOOL FCT -B (**)	TOOL FCT -C (***)	TOOL FCT -D (**)	TOOL FCT -E (***)	TOOL FCT -G (*)	TOOL FCT -H (*)
I	**COMPETENCY 1: ANALYSE AND MONITOR CONTINUALLY THE WEATHER SITUATION** *Competency description: Observations and forecasts of weather parameters and significant weather phenomena are continually monitored during hours of operation to determine the need for issuance, cancellation or amendment/update of forecasts, warnings and alerts according to documented thresholds and regulations.*							
1.1	**Background knowledge and skills**							
1.1.1	Knowledge of Atmosphere, Atmospheric circulation, International Standard Atmosphere (ISA)	✓						
1.1.2	Mechanisms generating different types of cloud and precipitation, and local mechanisms enhancing cloud and precipitation	✓						
1.1.3	Topographic influences on cloud, precipitation, fog and visibility, in typical wind and moisture regimes	✓						
1.1.4	Interpretation of radar, Lidar, wind profiler and satellite imagery to identify fog and stratus, gravity waves in cirrus cloud and jet streams, inference of icing potential in layer cloud, and of volcanic ash and wind shear	✓						
1.1.5	Numerical weather prediction (NWP) guidance and other forms of objective guidance, to be incorporated into forecasts, warnings and alerts	✓						
1.1.6	Observed parameters when variations result from differences between automatic sensor technologies and manual observing techniques	✓						
1.1.7	Aeronautical weather monitoring and observing technologies, and aeronautical forecasting techniques in use at the relevant MET unit	✓						

1.1.8	Common terms relevant to aeronautical meteorology, including: - Visual and instrument Flight rules - Flight Information Region (FIR) - Final approach, missed approach - Cruising and transition level, transition layer, transition altitude, flight level - Minimum safe altitude (MSA), indicated altitude, true altitude - Category I, II and III aerodrome operations, Aeronautical Information Publication (AIP) - NOTAMs/ASHTAMs - ATIS/VOLMET	✓						
1.1.9	ICAO location indicators for aerodromes or stations that lay within and near the area of responsibility.	✓						
1.2	**Performance criteria**							
1.2.1	Analyze and diagnose the weather situation as required in forecast, warning and alert preparation (Interpretation of surface-weather and upper-air maps, analyze global and regional circulations; regional and local climatological characteristics..)	✓						
1.2.2	Monitor weather parameters and evolving significant weather phenomena, and validate current forecasts, warnings and alerts (TREND, TAF, SIGMET…)	✓						
1.2.3	Appraise the need for amendments to forecasts and updates of warnings and alerts against documented criteria and thresholds.	✓						
II	**COMPETENCY 2: FORECAST AERONAUTICAL METEOROLOGICAL PHENOMENA AND PARAMETERS** *Competency description: Forecasts of weather phenomena and parameters; prepared and issued aeronautical forecasts and warnings in accordance with documented requirements/regulations, priorities, content and deadlines*							
2.1	**Background knowledge and skills**							

2.1.1	Local topography and its effects on weather conditions which may impact to aeronautical operations within the area of responsibility		✓	✓				
2.1.2	International, national and local aeronautical forecast, warning and monitoring procedures, directives and instructions		✓	✓				
2.1.3	The formation and dissipation, characteristics, occurrence and effects of fog and other forms of obscuration and low-level cloud, and associated diagnostic and prognostic parameters for TAF, TAF AMD, TREND, AD WRNG, WS WRNG		✓					
2.1.4	Formation mechanisms and characteristics of convective clouds, thunderstorm, heavy precipitation; and associated diagnostic and prognostic parameters for TAF, TAF AMD, TREND, AD WRNG, WS WRNG		✓		✓			
2.1.5	Formation mechanisms and characteristics of JET stream, strong wind, gusting wind and windshear in the near-to-ground layer of atmosphere; their negative effects to airplane performance			❄	✓ / ❄			
2.1.6	Interpretation of surface-weather maps, satellite and radar imagery, wind profile, Skew-T sounding diagram (radiosonde) and other basic MET data for predicting and forecasting process.		✓	✓	❄	❄		
2.1.7	Knowledge on numerical weather prediction (NWP); Interpretation of NWP products for predicting and forecasting process		❄	❄	✓	✓		
2.1.8	Local forecasting guides, techniques and instructions; ability to use available tools at the MET unit for forecast		✓	✓	❄	❄		
2.1.9	ICAO, WMO and national aeronautical meteorological codes and forms of data representation; Ability to interpret all observational products and encode forecast products following ICAO and Vietnam SARPs and technical regulations		✓	✓				
2.1.10	Aviation user requirements: - Regulation and procedures and types of MET information provided for relevant ATS units (TWRs, APPs, ACCs, FICs), AIS, SAR, airport operators, airlines and other MET users. - Effects of unfavorable meteorological conditions on aeronautical		✓	✓	❄	❄		

	operations in the area of responsibility, including air traffic disruption, holding and diversions. - Effect of meteorological conditions/factors on flight planning and fuel consumption (air density, humidity, air pressure, aerodrome weather hazards, low-level and upper-air wind, turbulence, icing, CB cloud, tropical storm, volcanic ash...)							
2.1.11	Aviation user requirements (aerodrome MET service): - Low-visibility runway operating procedures; - Aerodrome operating minima, the need for alternates and impacts on fuel consumption; - Meteorological effects on aerodrome ground services, such as snow clearing, the effect of wet runways, and the effect of thunderstorms and strong winds on apron operations; - Altimeter setting procedures related to QNH, QFE concept.				✓	❄		
2.2	**Performance criteria**							
2.2.1	Forecast the following weather phenomena and parameters for the area of responsibility: - Cloud (type, amount, height of cloud base and vertical extent); - CB, thunderstorm (mechanism, conditions for performing, tools and techniques for forecasting CB/thunderstorm, local factors in the area of responsibility) - Precipitation (type, amount, intensity and temporal variations, onset and cessation or duration)		✓	✓	❄	❄		
2.2.2	Keep monitoring forecasts, warnings issued for other locations or regions. Collaborate with adjacent MET Units to ensure forecasts are consistent (spatially and temporally) across boundaries of the area of responsibility as far as practicable, while maintaining meteorological integrity				✓	✓		
2.2.3	Specific local aeronautical weather forecast: - Temperature and relative humidity and their change; - Wind including temporal and spatial variability (wind shear, directional variability and gusts);		✓	❄				

	- Air pressure (the evolution of air masses, large- and meso-scale weather systems, diurnal and local variations…) - Visibility; Weather phenomena which impact the visibility							
2.2.4	Analyze, diagnose and forecast potential for occurrence of low-level turbulence, aerodrome icing				⛈ / ❄			
2.2.5	Other hazardous weather phenomena following Annex 3 and Vietnamese Standard Basis on Aeronautical Meteorology or typical local weather hazards for aviation				⛈ / ❄	❄		
2.2.6	Prepare, issue TAF and corrected, amended TAF or cancel (CNL) TAF for recent aerodrome (where the Aerodrome MET Office locates), following ICAO and Vietnam SARPs and technical regulations on codes, content, accuracy and timeliness		✓					
2.2.7	Prepare, issue TAF and corrected, amended TAF or cancel (CNL) TAF for other aerodromes within area of responsibility, following ICAO and Vietnam SARPs and technical regulations on codes, content, accuracy and timeliness		❄		✓			
2.2.8	Prepare, issue TREND and update TREND for recent aerodrome (where the Aerodrome MET Office locates)		✓					
2.2.9	Prepare, issue TREND and update TREND for other aerodromes within area of responsibility		❄		✓			
2.2.10	Prepare, issue Forecast for take-off for aerodromes of responsibility				⛈			
2.2.11	Forecast movement, change of intensity of tropical cyclones		❄	✓	⛈ / ❄	✓		
2.2.12	Analyze, diagnose and forecast potential for occurrence of upper-air turbulence (mechanism, conditions, forecasting techniques, tools for forecast used at the MET unit)			✓ / ⛈		✓ / ⛈		
2.2.13	Analyze, diagnose and forecast potential for occurrence of upper-air icing (mechanism and conditions for forming, forecasting techniques, tools for forecast used at the MET unit)			⛈ / ❄		⛈ / ❄		
2.214	Forecast other en-route significant weather phenomena that need to issue					⛈ / ❄		

	SIGMET, AIRMET (such as mountain waves…)							
III	**COMPETENCY 3: WARN OF HAZARDOUS PHENOMENA** *Competency description: Warnings are issued in a timely manner when hazardous weather phenomena are occurring, expected to occur or when parameters are expected to reach documented threshold values. They are updated or cancelled according to documented warning criteria*							
3.1	**Background knowledge and skills**							
3.1.1	ICAO's SARPs and Vietnam's regulations, procedures, directives, instructions on aeronautical weather forecast and warning		✓	✓	✓	✓		
3.1.2	Ability to interpret all observational products; encode forecast products into TAC or other required formats as required by ICAO and Vietnam SARPs and technical regulations.		✓			❄		
3.1.3	Weather hazards that impact operational activities in aerodrome (mechanisms and conditions for forming, characteristics, frequency of occurrence of phenomena for AD WRNG, WS WRNG)		✓		✓	❄		
3.1.4	Ability to interpret all observation and forecast products (for example, METAR), and encode meteorological parameters for en-route significant weather warnings			✓	❄	❄		
3.1.5	Mechanisms and conditions for forming, characteristics, frequency of occurrence of other weather hazards for aviation such as dust-storm, sandstorm, squall-lines, tornados/waterspouts, mountain waves…)				❄	✓		
3.1.6	Mechanisms and conditions for forming, characteristics, frequency of occurrence of tropical cyclone. Techniques for TC forecast and instructions and procedures for issuing WC SIGMET			✓ / ⛈	❄			
3.1.7	Knowledge of volcanic eruptions, volcanic ash cloud displacement and dispersion; Areas of likely volcanic activity that may affect the region of responsibility. Issuing VA SIGMET				❄	✓ / ⛈		
3.1.8	Other significant weather phenomena for en-route flight operations. Mechanisms and conditions for forming, characteristics, frequency of occurrence (WS SIGMET)			✓ / ⛈	❄	✓ / ⛈		
3.1.9	Local diagnostic and forecast tools and aeronautical forecast preparation				✓	✓		

	systems for forecasting and warning hazardous weather phenomena (including technical system, data processing and visualization technologies)							
3.1.10	Aviation user requirements (aerodrome MET service): - The effects on aircraft and aerodrome ground services of the weather hazards which need to issue AD WRNG, WS WRNG; - The significance of warning thresholds on aviation operations (wind, visibility, clouds, weather phenomena…) at the aerodromes of responsibility; understand about these thresholds from the perspectives of aviation; - Regulations on responsibility of provision hazardous weather warnings to relevant aviation users.		❄		✓			
3.1.11	Aviation user requirements (en-route MET service): - Effects of hazardous weather phenomena on en-route aircraft performance - Criteria and thresholds for warning about en-route weather conditions within FIR and airspace of responsibility; understand about these thresholds - Regulations on responsibility of provision en-route hazardous weather warnings to relevant aviation users			❄		✓		
3.2	**Performance criteria**							
3.2.1	Identify the occurrence or potential occurrence of weather conditions which need to issue AD WRNG, WS WRNG for the aerodromes of responsibility		❄		✓ / ⛈			
3.2.2	Prepare and issue AD WRNG, WS WRNG in accordance with ICAO and Vietnam SARPs and technical regulations on thresholds for hazardous warnings, formats, codes, accuracy and timeliness		❄		✓ / ⛈			
3.2.3	Evaluate the need for amendments or cancel of issued AD WRNG, WS WRNG		❄		✓ / ⛈			
3.2.4	Prepare and issue low-level significant weather chart when required *(optional)*				⛈ / ❄			
3.2.5	Identify the occurrence or potential occurrence of following weather phenomena which need to issue SIGMET for the FIR of responsibility (spatial extent, onset and cessation, duration, intensity and changes in accordance with documented thresholds):							

a)	- Tropical cyclones			❄	❄	✓ / ⛈		
b)	- Volcanic ash on the basis of observations and/or advisory products;					✓ / ⛈		
c)	- Thunderstorms, particularly organized systems of CB cells associated turbulence, in-flight icing, hail, heavy precipitation, electrical phenomena, downburst and microburst, gust front, tornados - Turbulence (moderate or greater) including type (orographic, mechanical, convective and clear air turbulence (CAT)) - Aircraft icing (moderate or greater) including accumulation rate (if known), spatial extent, type (rime or opaque, glaze or clear, freezing rain, hoar frost, mixed ice..)			✓		✓		
d)	- Sandstorms, duststorms				❄	❄		
e)	- Radioactive cloud - Other hazardous en-route weather phenomena (for SIGMET)				❄	❄		
3.2.6	Prepare and issue WS SIGMET for the FIR of responsibility			✓ / ⛈				
3.2.7	Prepare and issue WC SIGMET for the FIR of responsibility			✓ / ⛈				
3.2.8	Prepare and issue WV SIGMET for the FIR of responsibility			✓ / ⛈				
3.2.9	Analyze and use aircraft observations and reports in preparing and issuing SIGMET			✓ / ⛈				
3.2.10	Continuously review and, when necessary, issue new SIGMET or cancel SIGMET promptly			✓ / ⛈		✓ / ⛈		
3.2.11	Prepare and issue AIRMET when required *(optional)*					❄		
3.2.12	Keep monitoring forecasts, warnings issued for other locations or regions. Collaborate with adjacent MET Offices/ Met Watch Offices to ensure that forecasts of weather phenomena and parameters are consistent (spatially and temporally) across boundaries of the area of responsibility as far as				✓	✓		

	practicable, while maintaining meteorological integrity.							
IV	**COMPETENCY 4: ENSURE THE QUALITY OF METEOROLOGICAL INFORMATION AND SERVICES** *Competency description: Ensure the MET forecasts, warnings, alerts meet the required level of QMS implemented at the MET unit.*							
4.1	**Background knowledge and skills**							
4.1.1	The system for assessment of forecast, warning at the MET unit. Historical result and outcome of previous assessments						✓	
4.1.2	Methods for provision of MET products/ information at the MET unit; Communication technology for forecast and warning transmission, and for weather briefing						✓	✓
4.1.3	- Means of dissemination of aeronautical meteorological data and information; Technical systems for global and regional exchange of MET data (WAFS, GTS, ROBEX) - Responsibility of global and regional exchanging aeronautical MET data						✓	✓
4.1.4	Risk assessment and estimation of forecast uncertainties; Effect of that to aeronautical operations.						✓	✓
4.1.5	Extent, scope and exclusions of QMS implementation						✓ / ⛈	
4.1.6	Extent, scope and exclusions of SMS implementation						⛈	
4.1.7	ICAO and Vietnam SARPs and regulations and QMS procedures on: - Procedures for checking and identifying errors and omissions - Methods for identifying significant differences between factual and forecast data; - Knowing when to ignore information and where to go to resolve points of contention; - Desirable accuracy of forecasts as stipulated in ICAO Annex 3; - Priorities and schedules of forecasts and warnings; - Actions to be taken in the event of recurrent discrepancies, inconsistencies and malfunctions;						✓ / ⛈	

	- Fall-back procedures in the case of computer failure; - Contingency arrangements in case of emergencies such as fire alarms, bomb alerts and natural disasters.							
4.2	**Performance criteria**							
4.2.1	Promptly disseminate MET information, forecast and warning products to users and documented addresses (local and international); check the result; Ensure that all forecasts, warnings and alerts are disseminated through the authorized communication means and channels to designated user groups						✓	
4.2.2	Apply the organization's quality management system and procedures to MET service, MET information and products						✓	
4.2.3	Assess the impact of known observational error characteristics (for example, bias and achievable accuracy of observations and sensing methods) on MET forecasts, warnings and alerts						✓	
4.2.4	Validate aeronautical meteorological data, products, forecasts, warnings and alerts (timeliness, completeness, accuracy) using real-time checks						✓	
4.2.5	Monitor the functioning of operational systems and take remedial actions when necessary.						✓	
V	**COMPETENCY 5: METEOROLOGICAL FLIGHT DOCUMENTATION, COMMUNICATE METEOROLOGICAL INFORMATION TO INTERNAL AND EXTERNAL USERS** *Competency description:* *- Clearly understand and are address user requirements, Ability to explain aeronautical meteorological data and information in a clear and concise manner* *- Prepare, issue, update flight documentation in accordance with flight schedule (**)*							
5.1	**Background knowledge and skills**							
5.1.1	Ability to carry out a routine, high-quality self-briefing, which may include a shift handover briefing, of the recent and current weather situation, and to integrate all available data to produce a consolidated diagnosis							✓
5.1.2	Ability to explain the meteorological and procedural reasons behind a forecast and warning decision							✓

5.1.3	Use and interpret products issued by World Area Forecast Centres (WAFCs), Volcanic Ash Advisory Centres (VAACs), Tropical Cyclone Advisory Centres (TCACs) and other designated centres.							✓ / ⛈
5.1.4	Documented and locally agreed and criteria and thresholds for weather forecast and warnings between aeronautical MET provider and users							✓
5.1.5	Regulations and instructions on Flight Documentation (content, format, procedures of preparing, issuing, distributing Flight Documentation (**)							✓
5.1.6	Ability to use flight schedules at aerodromes of responsibility; Using means for preparing, issuing and disseminating Flight Documentation to users (**)							✓
5.1.7	Volcanic Ash Advisory Centres (VAACs), Tropical Cyclone Advisory Centres (TCACs) and other designated MET advisory centres (***)							✓ / ⛈
5.1.8	Scope and subjectives of provisions of MET service/ MET products of the Unit							✓
5.1.9	Extent, scope and exclusions of quality management system implementation							✓
5.1.10	Language, communication technology for forecast and warning transmission, and for weather briefing.							✓
5.2	**Performance criteria**							
5.2.1	Communicate/present aeronautical meteorological data, information, Flight Documentation, consultation and briefing in a clear and concise manner using suitable terminology that will be clearly understood by the users							✓
5.2.2	Prepare, issue, distribute Flight Documentation to users (**)							✓
5.2.3	Implementation of quality management system and procedures for issuing, distributing, providing MET products, data and information.							✓

✓: Criteria that is mandatory (standard) to meet

⛈: May be assessed by using simulating circumstance/case study/ exercise

❄: Optional criteria for assessment

APPENDIX C: MET CAS RESULT & GAP ANALYSIS (OBSERVERS/TOOL OBS-A AND FORECASTERS/TOOL FCT-A)

MET CAS RESULT, OBSERVERS, 2022 – TOOL OBS-A

STT	Name of Assessee	Work position	MET Unit/ Aerodrome	CA date	TOOL QT-A														
					1.1.1	1.1.2	1.1.3	1.1.4	1.1.5	1.1.6	1.1.7	1.1.8	1.2.1	1.2.2	1.2.3	1.2.4	1.2.5	1.2.6	1.3
1	Bùi Trâm Anh	Observer	TSN	9/26/2022	3	3	3	3	3	3	3	3	3	3	3	2	3	4	3
2	Phạm Thị Diệp Linh	Observer	TSN	9/27/2022	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3
3	Lê Văn Trung	Observer	ĐN	10/14/2022	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
4	Phạm Đào Thị Hồng Liên	Observer	ĐN	10/13/2022	4	4	4	4	4	4	3	3	4	4	4	4	4	4	4
5	Lê Văn Quán	Observer	ĐN	10/13/2022	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4
6	Nguyễn Kim Yên	Observer	NB	9/29/2022	4	4	4	4	4	4	4	3	4	3	4	4	4	4	4
7	Đàm Trung Kiên	Observer	NB	9/29/2022	3	4	3	4	4	4	3	3	4	3	4	4	4	4	4
8	Nguyễn Văn Nam	Observer	NB	9/30/2022	3	4	4	4	3	4	4	3	4	3	4	4	4	3	4
				Average	**3.50**	**3.75**	**3.63**	**3.75**	**3.63**	**3.75**	**3.38**	**3.25**	**3.75**	**3.38**	**3.75**	**3.63**	**3.75**	**3.88**	**3.75**

MET CAS RESULT, FORECASTERS, 2022 – TOOL FCT-A

STT	Name of Assessee	Work position	MET Unit	CA date	TOOL FCT-A											
					1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.3
1	Đặng Lê Phong Lan	Forecaster	TSN	9/26/2022	3	3	3	4	3	-	3	3	4	4	4	4
2	Phạm Quốc Hải	MET Shift Supervisor	TSN	9/27/2022	4	4	4	4	4	4	4	3	4	4	4	4
3	Đoàn Minh Tuấn	MET Shift Supervisor	ĐN	10/13/2022	4	4	4	4	4	4	4	3	4	4	4	4
4	Nguyễn Đức Dũng	MET Shift Supervisor	ĐN	10/14/2022	4	4	4	4	4	4	4	3	4	4	4	4
5	Cao Thùy Linh	Forecaster	ĐN	10/14/2022	4	4	4	4	4	4	4	3	4	4	4	4
6	Đặng Đức Anh	MET Shift Supervisor	MWO	10/26/2022	4	4	4	4	4	4	4	4	4	4	4	4
7	Nguyễn Thị Hồng Hạnh	Forecaster	MWO	10/27/2022	4	4	4	4	4	4	4	4	4	4	4	4
8	Nguyễn Thị Thu Hà	MET Shift Supervisor	MWO	10/27/2022	4	4	4	4	4	4	4	4	4	4	4	4
9	Nguyễn Thi Sỹ	Forecaster	MWO	10/26/2022	4	4	4	4	4	4	4	4	4	4	4	4
10	Trần Thị Vân Anh	Forecaster	NB	9/29/2022	4	4	4	4	3		4	3	4	4	4	4
11	Nguyễn Văn Thắng	Forecaster	NB	9/30/2022	4	3	4	4	4	4	4	4	4	3	4	4
12	Nguyễn Thị Thanh Hương	Forecaster	NB	9/30/2022	4	3	4	4	4	4	4	4	4	3	4	4
				Average	**3.92**	**3.75**	**3.92**	**4.00**	**3.83**	**4.00**	**3.92**	**3.50**	**4.00**	**3.83**	**4.00**	**4.00**