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Weather

AIR AND SPACE WEATHER OPERATIONS

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This manual implements Air Force (AF) Policy Directive (AFPD) 15-1, *Weather Operations*. It provides guidance and procedures for weather organizations throughout the Air Force. This publication applies to the Regular Air Force, Air Force Reserve, Air National Guard (ANG), and civilian employees of the U.S. Air Force. This AF Manual (AFMAN) may be supplemented at any level, but all supplements that directly implement this publication must be routed to the office of primary responsibility (OPR) for coordination prior to certification and approval. Refer recommended changes and questions about this publication to the OPR using the AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional chain of command. The authorities to waive wing/organization level requirements in this publication are identified with a Tier ("**T-0, T-1, T-2, T-3**") number following the compliance statement. See AFI 33-360, *Publications and Forms Management*, for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to this requestor's commander for non-tiered compliance items. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Instruction 33-322, *Records Management and Information Governance Program*, and disposed of in accordance with the Air Force Records Disposition Schedule located in the Air Force Records Information

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SUMMARY OF CHANGES

This interim change revises AFMAN 15-129 by (1) incorporating applicable sections of AFI 15-114, *Weather Technical Readiness Evaluation*, into Chapter 2, Chapter 13, and **Attachment 7**, (2) updating Lead Weather Unit and Integrated Flight Management weather support designations, (3) clarifying weather systems outage reporting, (4) clarifying support assistance request procedures and (5) correcting tiering errors from the previous publication. A margin bar (|) indicates newly revised material.

Chapter 1

OVERARCHING PRINCIPLES

1.1. General. This publication provides AF weather personnel and organizations guidance on how to accomplish operations for weather forecast, observation and integration processes. Effective use of the procedures in this manual enhances the quality, timeliness, and relevance of air and space weather information, products, and services. Weather support spans the full spectrum of strategic, operational and tactical operations; given the dynamic nature of military operations, an organization is routinely supporting more than one AF core function or Army warfighting function at a time.

1.1.1. Analysis. Joint Publication (JP) 3-59, *Meteorological and Oceanographic Operations*, Air Force Doctrine Annex 3-59, *Weather Operations,* and AFPD 15-1 define the analysis process and its subordinate processes. This manual describes how to execute collection, processing, analysis and prediction, and dissemination processes. Weather analysis depends on the ability to collect accurate data, process the data, correctly analyze the resulting information, and use that information to produce a coherent picture of the present and future state of the air, land, sea, and space environments. Units may be designated with the primary responsibility for analysis of the air and space environments. Personnel in these units require the basic knowledge to understand how the information they produce is integrated and may also conduct tasks within the integration processes.

1.1.2. Integration. Integration applies to all weather organizations responsible for delivering environmental information for a military operation or national mission. Weather integration provides direct or continuing support to a mission set and determines both environmental threats and effective decision points to inject weather into the planning and execution process of the mission. This allows for development of courses of action during the planning process to mitigate these threats. The outcome of these processes is the delivery of decision-quality environmental information to decision-makers. Decision-quality environmental threat information requires mission-specific thresholds, and appropriate temporal and spatial resolution, be applied to analysis products. The timing and format of this information is coordinated with the end user to ensure its effectiveness in the decision-making process.

1.1.3. Relationship between analysis and integration. As defined in AFPD 15-1 and AFI 15-128 *Weather Force Structure*, integration focuses on mission profiles and the associated operationally significant weather parameters and values. Integration of weather information is not a reanalysis of the air and space environment. Integration always begins with analyzed data and information that is already available. A necessary step in integration may be taking strategic or operational level products, and through further analysis, refining them to the level and specification criteria of the mission.

1.2. Risk Management . Weather is inherently a risk management (RM) problem for decision-makers. AF weather personnel will systematically evaluate environmental data to identify risks and benefits, then integrate RM into operations and mission analysis to mitigate mission impacts, and enhance overall effectiveness of operations consistent with RM principles in AFI 90-802, *Risk Management*, AFMAN 90-1606, *Air Force Military Risk Assessment Framework* , and AF Pamphlet (AFPAM) 90-803, *Risk Management (RM) Guidelines and Tools*. **(T-1).**

1.3. Multi-Domain (MD) Operations . AF weather organizations conduct operations in support of Air Force and Army multi-domain command and control nodes. Multi-domain operations focus on generating offensive and defensive effects seamlessly across land, sea, air, space, and cyber environments to take advantage of an adversary's windows of vulnerability while operating at unmatched tempo to gain and exploit asymmetric advantage across the entire spectrum of conflict. Operational Weather Squadron (OWS) operations consist of distributed operations to deliver terrestrial, air, space and geophysical environmental information for user-defined operational pictures and to support combatant command planning, execution, and post-strike assessment.

Chapter 2

ROLES AND RESPONSIBILITIES

2.1. Air Force Director of Weather (AF/A3W) responsibilities.

2.1.1. AF/A3W will:

2.1.1.1. Assist in processing foreign national requests for access to Air Force weather systems and data in accordance with AFI 17-130, *Cybersecurity Program Management,* and local directives.

2.1.1.2. Direct policy and training changes to improve the weather functional community's technical performance in supporting the Air Force, Army, Space Force, Department of Defense (DoD) and joint operations.

2.1.1.3. Provide or oversee development and implementation of automated capabilities for collecting and analyzing weather metrics.

2.1.2. The U.S. Army Combined Arms Center (CAC) Staff Weather Officer (SWO) will:

2.1.2.1. Support the CAC in incorporating meteorological effects into doctrine and lessons learned.

2.1.2.2. Support Mission Command Training Program (MCTP) in developing weather scenarios and meteorological effects for Division and Corps-level joint warfighting events.

2.1.2.2.1. Provide weather effects information on friendly and enemy forces in MCTP joint warfighting events.

2.1.2.2.2. Coordinate SWO Observer Coach/Trainers for weather participation in MCTP joint warfighting events.

2.1.2.2.3. Coordinate SWO augmentee support as needed for MCTP joint warfighting events.

2.2. Major Command (MAJCOM), Component MAJCOM, Component Numbered Air Force (C-NAF), Army Service Component Command (ASCC), and Space Force Field Command weather staffs.

2.2.1. Component MAJCOM, C-NAF, ASCC, and Space Force Field Command weather staffs will:

2.2.1.1. Provide oversight of the command's operational weather support requirements.

2.2.1.2. Identify manpower and equipment needs to their parent MAJCOM weather functional for action during contingency sourcing. In the event that the C-NAF has no weather personnel assigned, the parent MAJCOM will assume these roles and responsibilities.

2.2.1.3. Provide theater-specific operational-level advice, subject matter expertise, staff support, and coordination to the C-NAF/ASCC/Field Command commander.

2.2.1.4. Coordinate with the combatant commander's (CCDR's) staff, including the senior meteorological and oceanographic (METOC) officer (SMO), the joint force commander's

(JFC) staff, including the joint METOC officer (JMO), other service component staff weather officers, and their parent MAJCOM weather functional staff to:

2.2.1.4.1. Provide weather inputs applicable to the development/revision of war, exercise, and contingency plans.

2.2.1.4.2. Monitor and assess the execution of AF weather operations supporting the CCDR and JFC.

2.2.1.4.3. Coordinate Air Force Forces, Army Forces, and Space Force Forces weather support requirements for their assigned service component forces with the theater SMO or JMO.

2.2.1.4.4. Ensure METOC capability to support weather requirements for contract mission support (government-owned/contractor operated or contractor-owned/contractor operated) is appropriately defined in contract documents in accordance with AFI 64-105, *Contingency Contracting Support*, and that METOC capabilities are used consistent with the theater weather concept of operations.

2.2.2. MAJCOM weather functional leaders will:

2.2.2.1. Collect and consolidate weather metrics data for weather organizations within their command.

2.2.2.2. Use weather metrics to monitor and assess technical performance of weather organizations within their command.

2.2.2.3. Provide AF/A3W feedback on MAJCOM-level weather metrics trends or concerns that may require policy or training changes to improve the weather functional community's technical performance.

2.2.2.4. Submit recommendations for improved verification methods or tools developed by organizations under their command to AF/A3W and other MAJCOM weather functional leaders for consideration as benchmarks and inclusion into policy.

2.2.3. Coordinate with the combatant commander's (CCDR's) staff, including the senior meteorological and oceanographic (METOC) officer (SMO), the joint force commander's (JFC) staff, including the joint METOC officer (JMO), other service component staff weather officers, and their parent MAJCOM weather functional staff to:

2.2.3.1. Provide weather inputs applicable to the development/revision of war, exercise, and contingency plans. **(T-1)**.

2.2.3.2. Monitor and assess the execution of AF weather operations supporting the CCDR and JFC. **(T-1).**

2.2.3.3. Coordinate Air Force Forces (AFFOR) /Army Forces (ARFOR) weather support requirements for their assigned service component forces with the theater SMO or JMO. **(T-1).**

2.3. 557th Weather Wing (557 WW). The 557 WW provides dedicated climatology, global terrestrial weather, and space environment data and forecasts supporting both DoD, other United States Government (USG) departments, Intelligence Community, partner nations operations, and weather operators whether in garrison or deployed. The 557 WW will:

2.3.1. Provide support for Joint/Combined Operations as tasked by supported agencies. Provide direct Combatant Command (CCMD) SMO/JMO support as tasked**. (T-1).**

2.3.2. Provide specialized Weather Products (WP) and services upon receipt of a support assistance request (SAR). **(T-1).**

2.3.3. Operate a centralized computing resource for high-resolution global Numerical Weather Prediction (NWP), specialized modeling, and automated graphics production. **(T-1).**

2.3.4. Provide weather data (observations, forecasts, and gridded forecast meteorological data files) to appropriate agencies running DoD-approved Chemical, Biological, Radiological, and Nuclear (CBRN) dispersion models for CBRN consequence assessment, consequence management, and contamination avoidance in accordance with AFI 10-2501, *Air Force Emergency Management Program*, AFMAN 10-2503, *Operations in a Chemical, Biological, Radiological, and Nuclear (CBRN) Environment,* and equivalent joint guidance. **(T-1).**

2.3.5. Provide backup capability to Space Weather Prediction Center and Washington Volcanic Ash Advisory Center (W-VAAC) in accordance with FCM-P14-2018, *Federal Plan for Cooperative Support and Outage Mitigation Among Operational Processing Centers*. **(T-0).**

2.3.6. Provide backup capability for the National Weather Service's (NWS) Storm Prediction Center and Aviation Weather Center in accordance with established support agreements. **(T-0).**

2.3.7. Be prepared to continue mission-essential functions without significant interruption during a national security emergency or other disruptive conditions, such as major equipment or communications outages or evacuations. **(T-1).** To ensure continuity of operations during these situations, develop processes to use alternate equipment/systems, operate from alternate locations, or arrange transfer of critical functions to other organizations. **(T-1).** Units aligned to provide continuity of operations support for another unit must be capable of providing the support and be fully prepared to assume the responsibility in accordance with criteria and timelines established in the documented Continuity of Operations Program (COOP) agreements and plans. **(T-1).**

2.3.7.1. Establish and formally document continuity of operations processes and procedures in accordance with AFI 10-208, in order to preserve the capability to support 557 WW and supported units' mission essential functions during emergency operations. **(T-1).**

2.3.7.2. Provide a copy of the 557 WW COOP plan to all supporting and supported organizations. **(T-1).**

2.3.7.3. Make continuity of operations documents available to supported units upon request consistent with parent MAJCOM policies and procedures. **(T-1).**

2.3.7.4. Review and update continuity of operations processes and procedures, consistent with MAJCOM continuity of operations policies or as necessary, to reflect substantive changes in operations. **(T-1).**

2.3.7.5. Exercise continuity of operations processes quarterly. **(T-3).** Real world events meet this requirement if properly evaluated and documented, to include lessons learned.

2.4. 1st Weather Group (1 WXG). The 1 WXG directs activities of the 15th, 17th, 21st, 25th, 26th, and 28th Operational Weather Squadrons (OWS). OWSs are consolidated within 1 WXG to provide a centralized weather analysis and forecasting capability for weather support to global combatant commanders. The 1 WXG provides value-added forecaster-in-the-loop (FITL) weather and environmental products to operational and tactical weather users.

2.4.1. Operational Weather Squadrons (OWS) are assigned primary areas of interest aligned with geographic and functional combatant commands. AFVA 15-137, *Operational Weather Squadron Areas of Responsibility*, guides end users to the appropriate first point of contact when seeking weather support. OWSs are regional centers of expertise providing theater support, aviation services, and overwatch functions supporting WF/Dets in the primary area of interest. OWSs conduct operations as distributed nodes in the production enterprise and provide weather analyses and forecasts for AF, Army, Joint, Coalition and Allied partners operations within the geographical combatant commands.

2.4.2. For locations where the Air Force, or Army is the Senior Airfield Authority (SAA), OWSs will issue or amend terminal aerodrome forecasts (TAFs) and weather watches, warnings, and advisories (WWAs) (for locations requiring them) where there is no Air Force weather unit assigned or designated to provide airfield services and where no other qualified forecast is provided by a competent authority (e.g., NWS or overseas/international equivalent or ANG managed U.S.C. Title 5 and contract observing sites which only perform observations, eyes-forward and observed WWA functions)). **(T-1).**

2.4.3. Special Weather Statements (SWS). OWSs communicate potential of significant weather events and provide threat assessments via SWSs. Weather Flights and Detachments (WF/Det) use this information to inform METWATCH and Mission Watch activities and to alert aligned commanders and units of significant weather which may impact operations, planning, resources, personnel, or infrastructure.

2.4.3.1. OWSs issue SWSs via the local WF/Dets or directly to installation leadership (for locations without dedicated weather personnel). **(T-1).** OWSs will issue a SWS 48-72 hours in advance of a specified weather event specifically to notify military decision makers of widespread severe weather events forecast to impact military installations within the OWS's AOR. **(T-1).** OWSs will update SWSs as conditions warrant. **(T-1).**

2.4.3.2. SWSs are stand-alone alphanumeric products disseminated via common user communications describing the type, onset, duration, and area impacted by the event. SWS may also include a graphical depiction of the forecast event.

2.4.4. OWSs post appropriate theater-specific space WPs (issued by the 2d Weather Squadron) to their respective web page. **(T-1).**

2.4.5. OWSs will post appropriate theater-specific volcanic ash products on program office provided webpages. **(T-1).** The primary source is the relevant International Civil Aviation Organization (ICAO) Volcanic Ash Advisory Centers (VAACs). If responsible VAAC cannot produce the volcanic ash products, the 2 WS is the alternate source. **(T-1).** OWSs will include remarks in text forecasts horizontally consistent with the VAAC products where applicable. **(T-1).**

2.4.6. OWSs will produce forecasts and issue WWAs for all shared, high-use ranges and operating areas (e.g., air refueling routes, whiskey areas, military operating areas, drop zones, etc.) for Lead Weather Units (LWU) use in support of military operation sharing airspace and battlespace. **(T-1).**

2.4.6.1. LWUs and WF/Dets should submit SARs as required to their supporting OWS to add forecasts for areas/routes that are not routinely available. **(T-1).**

2.4.6.2. Weather flights and detachments may retain forecast and WWA authority for special/limited-use ranges and operating areas (e.g., missile fields, launch ranges, special operations ranges/operating areas). See **Chapter 6** for further guidance.

2.4.7. OWSs may produce additional products to meet WF/Det requirements based on specific operational necessities in accordance with a SAR.

2.4.8. OWSs may leverage unique products produced by other authoritative DoD and US government (USG); allied, coalition and foreign military or government weather organizations. These products may be displayed directly to the program office provided web pages or exist as links to the operational products hosted elsewhere.

2.4.9. When disseminating WPs, OWSs will:

2.4.9.1. Post all OWS products and those made available from other sources (e.g., Space products, leveraged products, etc.) on program office provided Non-Classified Internet Protocol Router Network (NIPRNet) webpages, and post mission-essential products on program office provided Secret Internet Protocol Router Network (SIPRNet) and Joint Worldwide Intelligence Communication System (JWICS) (if available) webpages as needed to meet supported user requirements. **(T-1).**

2.4.9.2. Transmit required products and data via common-user communication and satellite common communication networks, as well as leverage alternate data transmission options to mitigate communication outages, as required for supported operations in their AOR. **(T-1).**

2.4.9.3. Disseminate TAFs to supported users (if applicable) using AF dissemination systems, to include MAJCOM-approved theater specific or joint dissemination systems, as required. **(T-1).**

2.4.9.4. Post a summary of current WWAs to its unclassified and classified webpages. **(T-1).**

2.5. 2d Weather Group (2 WXG). 2 WXG provides technology and global data to support geographic combatant commands (CCMD), DoD, other USG departments, Intelligence Community, and partner nations operations, and weather operators whether in garrison or deployed. 2 WXG directs activities of the 14th Weather Squadron (WS), 16th WS, 2nd Combat Weather Systems Squadron (CWSS), 2nd Systems Operations Squadron (SYOS), 2nd WS, and 2nd Weather Support Squadron (WSS) to provide strategic-level, climatology, global terrestrial weather, space environment data and weather services for supported AF, Army, Navy and joint missions conducted across the globe.

2.6. 2d Systems Operations Squadron (2 SYOS). 2 SYOS delivers reliable and timely global environmental intelligence products and services for DoD and its global interests through the continuous operation of Air Force Weather's (AFW) computer complex, production network, and applications. 2 SYOS will maintain KQ temporary location identifier lists, provide KQ temporary location identifiers, and recall KQ temporary location identifiers in support of field users. **(T-1).** The 2 SYOS is the primary agency responsible for weather enterprise collection and dissemination activities. 2 SYOS operates and maintains enterprise transmission and storage systems operating at multiple levels of security classification.

2.7. 2d Combat Weather Systems Squadron (2 CWSS). 2 CWSS provides maintenance and logistical support for deployable weather equipment within any theater. 2 CWSS trains weather personnel and directs operational test and evaluation activities on new fixed and deployable weather equipment, technologies, and capabilities. The 2 CWSS supports Air and Space Expeditionary Force (AEF) operations as the force provider for the Weather Systems Support Cadre (WSSC) mission and assists with deployable weather system maintenance troubleshooting and repair that is beyond the scope of the local operator.

2.8. 2d Weather Squadron (2 WS). The 2 WS delivers specialized, secure, and DoD-unique environmental capabilities to the joint force, defense agencies, and the intelligence community to enable senior leader decisions. The 2 WS will:

2.8.1. Operate the Solar Electro-Optical Network, which includes the oversight and management of sites at Learmonth, Australia; Sagamore Hill, Massachusetts; Holloman AFB, New Mexico; Hawaii; and San Vito, Italy. **(T-1).**

2.8.2. Serve as the DoD focal point for surveillance, analyses and forecasts of volcanic ash hazards. **(T-1).** Produce the official forecast for AFW organizations in the event the regional VAAC's products are unavailable. **(T-1).**

2.8.3. Produce tailored terrestrial and space environmental products to meet documented requirements of regional commanders, planners, or operators. **(T-3).**

2.8.4. Provide hourly world-wide merged cloud analysis for the Intelligence Community. **(T-1).**

2.8.5. Provide mission-tailored terrestrial and space weather analyses and forecasts to meet documented requirements of regional commanders, planners, or operators and the Intelligence Community (IC). **(T-3).**

2.8.6. Provide mission-tailored environmental analyses and forecasts, for terrestrial and space weather, in support of resource allocation, situational space domain awareness, and mission optimization for DoD and Intelligence Community operations. **(T-1).**

2.8.7. Provide unclassified worldwide broadcast-quality public weather services and planning forecasts to Stars and Stripes newspaper in accordance with current support agreement. **(T-1).**

2.9. 2d Weather Support Squadron (2 WSS). 2 WSS monitors and maintains 557 WW system readiness and provides the 557 WW Commander optimized command and control.

2.10. 14th Weather Squadron (14 WS). 14 WS collects, protects, and exploits authoritative weather and climate data in support of DoD and intelligence community operations and planning. This support empowers and informs intelligence preparation of the operational environment, strategic plans, first-look weather forecasts, risk assessments, and forensic meteorological analyses, for a range of strategic, operational, and tactical users. The 14 WS will:

2.10.1. Collect, quality control, and archive terrestrial weather and climate data to power the unit's applied climatology mission that spans the past, present, and future climate system. **(T-1).**

2.10.2. Develop and provide decision-grade climate services via an unclassified and classified web presence and a support analysis request process. **(T-1).**

2.10.3. Provide climate monitoring, analysis, and subseasonal-to-seasonal prediction tools, analyst-in-the-loop services, and subject matter expertise. **(T-1).**

2.11. 16th Weather Squadron (16 WS). The 16 WS rapidly innovates, operates, and exploits cutting-edge environmental analysis and forecast applications to support DoD, Intelligence Community, and National Agency missions. The 16 WS is the Air Force's combat ready provider of automated, accurate, timely, relevant, and accessible environmental intelligence. In addition, 16 WS will:

2.11.1. Generate automated environmental guidance for mission execution decisions. **(T-3).**

2.11.2. Generate environmental forecasts for mission rehearsal or planning decisions. **(T-2).**

2.11.3. Tailor environmental effects for warfighter integration. **(T-2).**

2.11.4. Monitor analyses, forecasts, and tailored warfighter effects for quality, ensuring modeling and software applications and environmental products meet warfighter and intelligence community requirements through running MODVER program. **(T-3).**

2.11.5. Exploit data analytics, machine learning, and artificial intelligence tools and techniques. **(T-3).**

2.11.6. Provide operational modeling and simulation (M&S) support for training, acquisition and testing as required by DoD and act as the subject matter expert for operational M&S support. **(T-1).**

2.11.7. Respond to support analysis requests, submitted through proper channels, through algorithms development, rules-of-thumb review, forecast reviews, and similar activities. **(T-3).**

2.12. Weather Organizations supporting Space Launch, Missile, and Test Operations. Provide weather observations, forecasts, watches, observed weather warnings/advisories, specialized weather information for launch sites, specified ranges, and abort landing sites. **(T-1).** These organizations also provide or relay relevant space weather data, prepare and disseminate WPs, and provide staff support (as required) for DoD and civilian space launch, landing, recovery, ballistic missile tests, and aircraft operations. **(T-1).**

2.12.1. Provide operational, mission specific, and Launch Weather Officer (LWO) support to DoD, NASA, and commercial customers performing space launch, landing, recovery, or ballistic missile test operations at the Eastern or Western Range, to include generating and disseminating customer-specific WPs. **(T-0).**

2.12.2. Provide the above through all phases of launch (Generation, Execution, and Recovery) for public safety and mission assurance. **(T-0).**

2.12.3. Train and maintain currency of Launch Weather Team members; formally document training and currency in the Air Force Weather approved digital training record database or other approved method such as a six-part folder. **(T-0).**

2.12.4. Coordinate with Program Support Managers (PSM), Range Safety, and Range Coordinators (RC), at a minimum, for determination of weather requirements for all phases of launch. **(T-0).**

2.12.5. Evaluate Launch Commit Criteria and provide weather "GO/NO GO" determinations for Launch Agency constraints and Lightning Launch Commit Criteria per United States Space Force Manual (USSFMAN) 91-710V6 Attachment 4 Range Safety Launch Commit Criteria and NASA Standard for Lightning Launch Commit Criteria for Space Flight (NASA-STD-4010) for each launch/test mission. **(T-0).**

2.12.6. Provide METOC support to Human Space Flight (HSF) operations per applicable Operation Orders (OPORDs) and in coordination with the HSF JMO and United States Space Force Command (USSPACECOM) SMO as required. **(T-0).**

2.12.7. Provide Weather Flight services (weather observations, forecasts, watches, warnings, advisories, and specialized weather information to include space weather data) as defined in paragraphs **2.22 and 2.23** for the Eastern and Western Ranges, supported Space Wings, and local and deployed units. **(T-0).**

2.13. Weather Squadrons Supporting Army Operations. These squadrons, (to include Expeditionary Weather Squadrons (EWXS) where applicable) will:

2.13.1. Provide operational and Staff Weather Officer (SWO) support to habitually aligned Army Service Component Command, supported land force commander(s) and aligned units, both in garrison and in tactical environments. **(T-1).** AR 115-10/AFI 15-157, *Weather Support for the US Army* defines supported/supporting relationships.

2.13.2. Take observations, prepare and disseminate WPs, provide resource protection through observed and forecasted advisories and warnings. **(T-1).**

2.13.3. Provide Pilot-to-Metro Service (PMSV) support and prepare and disseminate pilot reports (PIREPS) in accordance with AFMAN 15-124, *Meteorological Codes*, as required and equipped by parent/host unit. **(T-1).**

2.13.4. Review weather support documents, Memorandums of Agreement (MOAs), and other service support agreements established by subordinate detachments and operating locations. **(T-1).**

2.13.5. Coordinate with their habitually aligned Army units and their parent chain of command to train and posture forces and equipment for subordinate detachments and operating locations to satisfy deployed and home station Army weather support requirements. **(T-1).**

2.13.5.1. Train and maintain worldwide deployment readiness to integrate weather into the Army's full-spectrum operations to include: intelligence preparation of the operational environment (IPOE), military decision-making processes (MDMP), command, control, communications, computer, intelligence, surveillance, and reconnaissance (ISR) systems, and the common operating picture (COP) in support of the Army's full-spectrum operations. **(T-1).**

2.13.5.2. Develop, maintain, and distribute lesson plans to support completion of unit training requirements, as required. **(T-1).**

2.13.6. Author, coordinate, and take staffing actions to publish an installation regulation for weather operations that describes weather support and products provided for all facets of aviation, ground, resource protection, and other installation operations. **(T-3).**

2.13.7. Task organize to support habitually aligned units and associated CCMD operational plans. **(T-1).** Posture and maintain unit readiness consistent with mobility readiness training and deployment in accordance with AFI 10-401, *Air Force Operations Planning and Execution,* AFI 10-403, *Deployment Planning and Execution,* AFI 10-405, *Expeditionary Readiness Training Program,* the Weather Functional Area Prioritization and Sequencing Guidance, and the weather supplement to the War Mobilization Plan. **(T-1).** As appropriate, assist subordinate weather organizations with overall management of their respective readiness programs. **(T-1).**

2.13.8. Develop, coordinate, and provide weather inputs/annexes to war, exercise, contingency, and installation plans for appropriate levels of supported Army unit operations. **(T-1).**

2.13.9. As applicable, perform Personnel Parachute Program Management duties for completion and documentation of personnel parachute/airborne training in accordance with AFI 10-3503, *Personnel Parachute Operations*. **(T-3).**

2.13.10. Assist with creation of training materials and administration of weather training and certification for Army air traffic control personnel in accordance with interservice publication AR115-10/AFI 15-157, *Weather Support and Services for the U.S. Army*. **(T-1).**

2.13.11. Advise subordinate organizations on optimal weather operations tactics, techniques, and procedures and equipment for tailoring and integrating weather and weather effects information into supported unit mission planning and execution processes. **(T-3).**

2.13.12. Coordinate with parent chain of command (e.g., air ground operations wing, C-NAF) to ensure weather personnel comply with the training, deployment, redeployment, and readiness requirements in accordance with AFI 10-401; AFI 10-403; and applicable host Army installation and supported unit training and deployment requirements. **(T-1).**

2.13.13. Synchronize unit training schedules with applicable AEF and Army Sustainment Readiness Model (SRM) spin-up activities. **(T-1).**

2.13.13.1. Coordinate planning, development, and execution of applicable supported Army units' weather intelligence training objectives throughout the SRM process. **(T-1).**

2.13.13.2. Coordinate and schedule field training exercises with host Army installation(s), as required. **(T-1).**

2.13.14. Manage Army unit supply accounts, MTOE, and ammunition in accordance with AR115-10/AFI 15-157. **(T-1).**

2.13.15. Coordinate with host installation's Army Central Issue Facility (CIF) and Rapid Fielding Initiative (RFI) provider to equip unit personnel with personal tactical/deployment equipment. **(T-1).**

2.14. 23rd Special Operations Weather Squadron (23 SOWS). The 23 SOWS is capable of providing point and area WPs precisely tailored to meet special operations mission requirements. 23 SOWS provides support for Special Operations Forces (SOF) deployed across all Geographic Combatant Commands (GCCs) and closely coordinates product development with geographically aligned OWSs to ensure horizontal consistency within the GCC Area of Operations. In the event that a Joint exercise, mission, or operation is predominately special operations forces, the 23 SOWS is capable of functioning as the lead meteorological and oceanographic production unit (LMPU) consistent with JP 3-59 when requested by the Senior METOC Officer (SMO) or Joint METOC Officer (JMO), through United States Special Operations Command (USSOCOM) for GCCs, and coordinated with the appropriate OWS. The 23 SOWS will:

2.14.1. Provide a centralized weather analysis and forecasting center for METOC products and data in support of all SOF training and operations worldwide. **(T-1).**

2.14.2. Support the OWS by assuming responsibility for development of high-fidelity products for SOF operating within the OWS's geographic area of responsibility. **(T-2).**

2.14.3. Provide mission planning and WPs to deployed SOF operators without direct support weather personnel. **(T-2).**

2.14.4. Provide point-specific weather products, to include TAF and resource protection products, for SOF-controlled deployed airfields and operations bases. **(T-2).** When designated as the LMPU, provide Joint Operations Area Forecasts/Mission Control Forecasts, in coordination with appropriate OWSs, for SOF training and operations. **(T-2).**

2.15. 53rd Weather Reconnaissance Squadron (WRS). The 53rd WRS (AFRC) executes weather reconnaissance operations for the Departments of Defense and Commerce. Tropical and winter storm aerial reconnaissance operations in support of the FCM-P12-2019, *National Hurricane Operations Plan* (NHOP) and the FCM-P13-2019, *National Winter Season Operations Plan* (NWSOP) are conducted in accordance with CJCS Defense Support to Civil Authorities Execution Order (EXORD). The weather data collection platform is a WC-130J aircraft which employs a variety of equipment to include systems native to aircraft operation and specialized environmental sensing equipment to include the use of dropsondes, buoys, and radiometers to directly measure and disseminate weather data from in and around targeted weather phenomena.

2.15.1. Chief, Aerial Reconnaissance Coordination, All Hurricanes (CARCAH), 53rd WRS OL-A, Miami, FL. Coordinates all NHOP reconnaissance flight requirements with the National Hurricane Center and the Central Pacific Hurricane Center. **(T-2).** During the winter, CARCAH coordinates all Atlantic and Pacific NWSOP reconnaissance requirements with the National Center for Environmental Prediction. **(T-2).**

2.15.2. Provides subject matter expertise input to the Office of the Federal Coordinator for Meteorology (OFCM) on weather reconnaissance integration into related interdepartmental strategic initiatives. **(T-2).**

2.16. Weather Specialty Teams (WST). WSTs integrate into the full spectrum of operations and intelligence, providing environmental situational awareness and enabling decision superiority for commanders. WSTs use the analyzed weather information and data provided by other weather organizations (e.g., OWSs, other Weather Squadrons etc.) to build a 3-D picture of the battlespace and the environmental threats affecting it.

2.16.1. Air Operations Centers (AOC) WSTs will:

2.16.1.1. Provide tailored environmental assessments and impacts for integration into each of the AOC divisions/specialty teams and support functions processes to meet the short-, medium-, and long-range objectives of the Combined/Joint Forces Air Component Commander (C/JFACC). **(T-1).**

2.16.1.2. Evaluate the impact of METOC and space environmental effects on weapons systems and operations of both friendly and enemy forces across the spectrum of mission profiles. **(T-1).**

2.16.1.3. Execute processes and procedures identified in AFI 13-1AOC Vol 3, *Operational Procedures-Air Operations Center (AOC)*. **(T-1).**

2.16.1.4. Coordinate and document Joint Environmental Toolkit data requirements with the supporting OWS. **(T-3).**

2.16.1.5. The 603 AOC, 613 AOC, and 618 AOC WSTs will provide or arrange for weather information and products to AOC Flight Managers to assist them in meeting their responsibilities in accordance with AFMAN 11-255V3, *Flight Manager Responsibilities and Procedures*. **(T-2).**

2.17. Air Combat Command Air Operations Squadron (ACC AOS/AOSW). The ACC AOS/AOSW provides tailored weather support to AOS-controlled missions and may also be called upon to support other non-AOS controlled missions as required (e.g., ACC GLOBAL POWER, E-3 AWACS/E-8 JSTARS). ACC AOS/AOSW will:

2.17.1. Determine and document weather support requirements for all aircraft movements under control of the ACC AOS. **(T-1).**

2.17.2. Assume lead weather unit role and inherent responsibilities for all AOS-controlled missions, including all CORONET movements. **(T-1).**

2.18. Air Force Operations Group (AFOG) Weather Division (AF/A3OW). In accordance with Air Force Mission Directive 23 (AFMD23), *Air Force Operations Group*, the AFOG Weather Division provides or arranges global weather support to members of Congress, USAF and Army Service Watch Cells in the National Military Command Center (NMCC), HQ USAF, HQ Department of the Army (HQDA), and the HQ USAF and HQDA Crisis Action Teams. AF/A3OW will:

2.18.1. Tailor and integrate air, space, land, and oceanographic environmental information into situational awareness products in support of HQ USAF, HQDA, NMCC, and other senior Pentagon staff organizations as required. **(T-1).**

2.18.2. Provide staff weather support to the Air Force Crisis Actions Team and Army Crisis Action Team during contingencies, emergencies and exercises. **(T-1).**

2.18.3. Provide climatology reports, planning weather and other staff weather support as required.

2.18.4. Coordinate with and assist 15 OWS with weather watch, warning, and advisory support as required for the Pentagon. **(T-1).**

2.18.5. Arrange for dissemination of local weather alerts for the Pentagon Reservation and the National Capital Region in support of HQ USAF, HQDA, and Pentagon Building Management Office. **(T-1).**

2.19. Contingency Response Force (CRF). CRF weather personnel perform functions and responsibilities consistent with AFI 10-202, *Contingency Response Forces*. When deployed with the Contingency Response Group (CRG), CRG weather personnel will provide observed weather warnings and advisories (WWAs) during duty hours. **(T-3).**

2.20. Remotely Piloted Aircraft (RPA) support. For the purpose of this publication RPA and Unmanned Aircraft System (UAS) are synonymous. Weather organizations that support RPAs will:

2.20.1. Coordinate requested support for Air Force RPA, controlled via remote split operations (RSO), with the WST directly supporting the RSO command and control (C2) center (e.g., Persistent Attack and Reconnaissance Operations Center (PAROC), Global Hawk Operations Center (GHOC), 3d Special Operations Squadron). **(T-1).**

2.20.1.1. Defer to the WST directly supporting the RSO C2 center for Criteria Event/No Criteria Event weather recommendations affecting the RSO phase of a mission (e.g., pre-mission planning, weather recall or dynamic re-tasking of an airborne RPA). **(T-1).**

2.20.1.2. Include critical RPA mission-limiting weather thresholds as determined by the C2 element responsible for RPA operations on all WPs for launch and recovery element (LRE) and divert locations. **(T-1).**

2.20.1.3. The WST supporting the RSO C2 element will inform other weather elements involved in the mission [e.g., WF collocated with a LRE, WF providing tactical support, AOC WST, BCT, Division, Joint Operations Center (JOC), etc.] when RPA operations are affected by weather as soon as practical to ensure combat forces at all echelons receive consistent information. **(T-1).**

2.20.2. Provide or arrange for weather support to deployed RPA units without organic support. **(T-1).** This support is usually provided by weather team responsible for the Airfield Weather Services function at the deployed location**.** Include and address critical RPA environmental sensitivity thresholds as determined by the C2 entity responsible for the RPA for all WPs for launch/recovery (L/R) locations, whether provided by a collocated WF or OWS via reach back. **(T-1). Note:** Refer to *Strategic Concept of Employment for Unmanned Aircraft Systems* (January, 2010) for definitions of RPA Groups.

2.20.2.1. Group 3 or larger RPA (e.g., RQ-7B Shadow, MQ-5B Hunter, MQ-1C Grey Eagle) receive mission-specific aviation weather support (e.g., similar to a UH-60, AH-64, etc.). **(T-1)**

2.20.2.2. Group 2 or smaller RPA (e.g., RQ-11B Raven, Scan Eagle) receive, at a minimum, general weather support, as defined in AR 115-10/AFI 15-157. **(T-1).**

2.20.3. Provide weather support consistent with **Paragraph 2.20.2** for contract RPAs flying within their AOR/theater as directed by the commander, Air Forces, the Joint Forces Air Component Commander, or as outlined in the Joint Air Operations Plan. **(T-2).**

2.21. Joint Typhoon Warning Center. The Joint Typhoon Warning Center (JTWC) is a joint United States Navy - United States Air Force weather forecast organization located in Pearl Harbor, Hawaii. The JTWC issues tropical cyclone warnings in the North-West Pacific Ocean, South Pacific Ocean, and Indian Ocean for the DoD and other U.S. government agencies. JTWC tropical cyclone warnings are the authoritative data for Air Force weather Airmen operating in the Pacific AOR.

2.22. Weather Flights (WF)/Detachments (Det). WFs/Dets is the generic term used in this document to describe WFs, detachments, and operating locations whose primary purpose is to facilitate weather effects of the environment through integration into every phase of operations-planning and execution processes. WFs/Dets assess the mission environment to determine environmental threats, and where possible, find alternatives to mitigate those threats. Though each unit has unique characteristics and functions based on its parent/host unit's mission, geographic location and level of command, core roles, responsibilities, processes and procedures are largely the same. WFs/Dets support the entire spectrum of Air Force, Army, and Special Operations', Regular Air Force (RegAF) and Reserve Component mission types including but not limited to: aviation and ground operations conducted at home station and deployed locations. WFs/Dets are also responsible to support other parent/host unit operations where success may depend on mitigation of environmental threats (Civil Engineering, Logistics, Communications, etc.). WF/Det functions include Staff Integration, Mission Integration and Airfield Weather Services. WFs/Dets will:

2.22.1. Provide direct staff, mission planning and execution weather support in garrison and at deployed locations. **(T-3).**

2.22.1.1. When possible, deploy with parent/host units to provide seamless support (e.g., contingency, exercise, off-station employment, etc.).

2.22.1.2. Accomplish support via reach back to home station if unable to support deployed parent/host unit directly. **(T-1). Note:** When parent/host unit assets are allocated to another CCMD (e.g., a Combat Aviation Brigade or F-16 Squadron deploys to Iraq from the continental United States), reachback support is not required from the parent/host WF/Det.

2.22.1.2.1. Daily weather support to deployed unit(s) is provided through the respective CCMD WFs or weather personnel deployed under mission design series (MDS) unit type codes (UTCs).

2.22.1.2.2. Arrange for support by the geographically aligned OWS or the weather organization in-place at the operating location if unable to support deployed parent/host unit via reachback. **(T-2).**

2.22.1.2.3. If requesting Flight Weather Briefing (FWB) support from an OWS, WF/Det personnel may enter mission data into the OWS's briefing system [e.g., Joint Environmental Toolkit (JET) Mission Management, Global Decision Support System (GDSS)] and relay contact information and briefing number assigned by the briefing system to the aircrew. If follow-on mission data is not known at execution from home station, provide the appropriate OWS website or telephone information to the departing aircrew.

2.22.2. Forward requests from foreign nations for DoD weather data, imagery, technical information, and software tools to AF/A3W for routing to the appropriate Foreign Disclosure Officer and Scientific and Technical Information Officer or respective MAJCOM weather functional. **(T-1).**

2.22.3. Support U.S. Navy and U.S. Marine missions on Joint Bases where the AF has the lead for base operations and sustainment support provided those missions do not require specialized support and are comparable to support normally provided for AF and Army units. **(T-1). Exception:** Per the Joint Basing MOA, any Army, Navy, Marine units can be briefed by the Services' respective central briefing facilities. This support will not drive additional manpower or other costs to the AF without an interservice agreement coordinated at AF/A3W **(T-1).**

2.22.4. Provide or arrange service for walk-in requests from transient aircrews in accordance with duty priorities. **(T-1).** Under no circumstances will an organization deny assistance to an aircrew seeking a weather briefing when transient or staged aircrews request briefing support. **(T-1).**

2.22.4.1. Provide or arrange for a briefing or update to an existing briefing form in accordance with posted duty priorities. **(T-1).**

2.22.4.2. Provide aircrews access to meteorological satellite imagery, take off data, and other perishable weather data. **(T-3).**

2.22.4.3. Refer flight weather briefing requests for Air Mobility Command (AMC), United States Air Forces Europe & Air Forces Africa (USAFE-AFAFRICA), and Pacific Air Force (PACAF) integrated flight-management (IFM) missions to the appropriate IFM weather support agency as indicated in **Table 3.4**. **(T-1).**

2.22.5. Identify local or fine scale influences on weather parameters yielding empirical evidence that may support establishment of a rule of thumb (ROT) for the installation and military operating areas. **(T-1).** Integrate applicable ROTs into the forecast process. **(T-1).**

2.22.6. Comply with AR 115-10/AFI 15-157 when providing support to Army units. **(T-1).**

2.22.7. Establish daily hours of operation and flex or surge to meet the operational mission needs of the parent/host unit to the maximum extent possible. **(T-3). Note:** Reach back to the OWS should be limited to emergency/continuity of operations procedures (COOP) and is not a substitute for sustained direct support by the local WF/Det except where the WF/Det meets the criteria in **Paragraph 2.22.7.1**. **(T-3).**

2.22.7.1. Maintain weather personnel on duty during controlled airfield hours. **(T-3).** Weather units which close during non-controlled airfield hours will establish and employ procedures to recall a standby forecaster to provide operational or resource protection weather support when required. **(T-1).** OWS reachback is not a substitute for WF/Det standby procedures except for those WF/Dets comprised exclusively of civilian or contract weather personnel and are not manned to maintain continuous operations.

2.22.7.2. Maintain personnel on duty during severe weather action plan (SWAP) activation/implementation or when support to parent/host unit operational mission dictates (does not apply to all ANG managed U.S.C. Title 5 and contract observing sites which only perform observations, eyes-forward and observed WWA functions). **(T-1).** Flight or Detachment leadership should be present during SWAP activation to direct SWAP operations. Refer to **Table 6.2** for mandatory SWAP activation criteria.

2.22.8. Provide flight weather briefings to Aero Club members performing official Air Force operational duties (e.g., Civil Air Patrol and Initial Flying Training Programs). **(T-3).** Advise aero Club members performing official flight duties outside of normal operating hours of remote and self-briefing capabilities. **Note:** WFs/Dets are not required to have personnel on duty solely to provide briefings for Aero Club flying activities.

2.22.9. Provide PMSV support when contacted by aircrew. **(T-1).**

2.22.10. Provide upper air observations in accordance with FMH 3, *Rawinsonde and Pibal Observations*, as required to support garrison/deployed operations, if equipped with upper air observing equipment. **(T-1).** Disseminate observations to 557 WW and the appropriate OWS to supplement other upper air observations or provide observations in data-sparse regions. **(T-1).**

2.22.11. Issue or amend a TAF for assigned locations (does not apply all ANG managed U.S.C. Title 5 and contract observing sites which only perform observations, eyes-forward and observed WWA functions). **(T-1).**

2.22.11.1. Coordinate back up TAF production and dissemination with geographically aligned OWS during communications disruptions or during transition to or from an Alternate Operating Location (AOL) or other unforeseen circumstance which precludes the local weather unit from performing its assigned duties. **(T-3).**

2.22.11.2. WFs/Dets will use the mission execution forecast process (MEFP) to tailor WPs and provide decision-quality environmental information for mission planning and execution for their supported unit(s). **(T-1).**

2.23. Weather Flight/Detachment Leadership. For the purpose of this publication, the term "WF/Det Leadership" is used in place of WF/Det Commander, WF/Det Chief, OIC and NCOIC unless duties specific to individual positions apply. One of the essential responsibilities of WF leadership is to gain an intimate knowledge of the various missions their parent/host unit is tasked with supporting or executing. WF/Det leadership identifies and understands specific impacts of the environment on those missions, and imparts this to subordinates through enduring processes and procedures. This is accomplished through cultivating relationships with key decision makers in the supported agencies based on leadership engagement, frequent interactions, and open communication. WF/Det leadership is proactively involved with these agencies, building trust through the consistent application of weather skills and mission-based knowledge to enhance and

achieve mission success. WF/Det leadership engages with base/post agencies to determine support requirements. WF/Det leadership will:

2.23.1. Determine parent/host and tenant organization aviation selected special weather report (SPECI)/amendment criteria, WWA criteria, required lead-times, and notification requirements. **(T-2).** This information is documented in local weather support agreements, weather support documents or on the installation data page. **(T-3).**

2.23.2. Assist parent/host unit in creation of a dissemination plan for WWA information to ensure base/post agencies consistently receive timely notification of potential or forecast significant weather events that may impact local operations, pose potential risk to life, or damage base/post resources. **(T-3).**

2.23.3. Develop and implement SWAP operations to ensure sufficient personnel are available during potential/actual severe weather events or during meteorological/operational events critical to mission success (does not apply all ANG managed U.S.C. Title 5 and contract observing sites which only perform observations, eyes-forward and observed WWA functions). **(T-3).** The Senior Airfield Authority, with advice of the WF/Det leadership, determines which environmental conditions require SWAP. **(T-3).** For garrison operations, SWAP may be linked to watch/warning products. At expeditionary locations, SWAP is integral to resource protection; exact processes and procedures may be limited at austere locations or during combat/maneuver phases of military operations.

2.23.4. Assist, as applicable, in creation of the Installation Emergency Management Plan 10-2 in accordance with AFI 10-2501. **(T-3).**

2.23.5. Develop procedures to provide appropriate information to the installation agency that prepares Operational Report 3 (OPREP-3) or Commander's Situational Reports (SITREPs) when requested, in accordance with AFMAN 10-206, *Operational Reporting*. **(T-1).** Ensure the OWS and the parent MAJCOM weather functional (or equivalent) are aware of any OPREP-3 or SITREP due to weather. **(T-1).** Army support detachments and operating locations follow procedures coordinated with the local garrison and the parent chain of command. **(T-1).**

2.23.6. Develop an evacuation/relocation plan that provides continuity of operations in the event normal work centers are unavailable. **(T-2).** Use parent/host unit plans where possible, and coordinate actions with other agency evacuation plans (Air Traffic Control, Airfield Operations, Command Post, Emergency Management, Flying Squadrons, etc.). **(T-3).**

2.23.7. Where applicable, coordinate with ATC agencies to develop ATC local procedures to ensure weather technicians receive all relayed pilot reports (PIREPs). Include timeliness requirements [e.g., ATC or supervisor of flying will relay PIREP information to weather technicians no later than 5 minutes after receipt] in local procedures. **(T-3)**

2.23.8. Coordinate, train, and document newly assigned ATC personnel on basic tower visibility observing, cooperative weather watch, and information reporting processes in accordance with AFMAN 15-111, *Surface Weather Operations*. **(T-1).**

2.23.9. Document weather support in appropriate existing parent/host unit plans and directives (e.g., Installation Emergency Management Plan 10-2 and any other applicable plans containing an Annex H or weather appendix). **(T-3).** Army weather detachments will publish a local regulation documenting weather support in accordance with AR115-10. **(T-3).** Stand-alone weather support documents covering specific support, unable to be documented elsewhere, are allowed but should be kept to a minimum.

2.23.10. Establish outage reporting procedures for weather equipment and communications systems with the appropriate garrison/deployed maintenance unit. **(T-3).**

2.23.11. Coordinate with parent/host command structure to ensure WF personnel have appropriate security clearance for, and are granted access to, mission planning and execution information required to properly exploit air and space environmental information and mitigate environmental threats to mission success. **(T-3).**

2.23.12. Document supported unit mission profiles, planning and execution phases, and environmental sensitivities and train all personnel on them. **(T-3).**

2.23.13. Complete all AF-directed and locally determined training and certification requirements for all local WF/Det duty positions in accordance with AFI 15-127, *Weather Training* and respective Career Field Education and Training Plan (CFETP). **(T-1).**

2.23.14. Coordinate deployment posturing and logistic requirements through appropriate channels (e.g., MAJCOM Functional Area Manager (FAM), Unit Deployment Manager, Logistics Squadron, Army G-4/S-4 or G-2/S-2) and in accordance with the Weather Functional Area Prioritization and Sequencing Guide. **(T-1).**

2.23.15. Ensure WF/Dets meet the operational requirements of the installation supervisor of flying program or Army equivalent. **(T-3).**

2.23.16. Ensure newly assigned WF/Det personnel are given a thorough orientation. **(T-3).** Include at a minimum:

2.23.16.1. Physically visit all meteorological sensors on the airfield and discuss site limitations and their effects on operations.

2.23.16.2. Tour ATC facilities (tower and radar facility) and a discussion on cooperative weather watch procedures and how local weather impacts flight operations.

2.23.16.3. Visit supported agencies and discussion of mission and weather sensitivities. **Note:** Include flying squadrons, aviation operation centers, command posts, Emergency Operations Centers (EOC), CBRN Control Centers, Brigade Combat Teams (BCT), Support Brigades, Divisions and Corps.

2.23.16.4. Visit the supervisor of flying or flight safety duty section(s) to discuss supervisor of flying or flight safety processes and how timely and accurate weather information enhances flight safety.

2.23.17. Using the Air Force *Severe Weather/Climate Hazard Screening and Risk Assessment Playbook* (**https://cs2.eis.af.mil/sites/10041/CEPlaybooks/SevereWeather/Pages/default.aspx**) or Army *Climate Resilience Handbook* **https://www.asaie.army.mil/Public/ES/doc/Army_Climate_Resilience_Handbook_Change_1.pdf** as applicable, assist installation commanders in assessing the effects of severe weather and a changing climate on built and natural infrastructure. **(T-3).**

2.24. Units assigned weather equipment. Establish outage reporting procedures for weather equipment and communications systems with the appropriate garrison/deployed maintenance unit. **(T-3).** When performing maintenance, report outages in accordance with AFI 21-103, *Equipment Inventory, Status and Utilization Reporting*, Attachment 15 and Attachment 16.

Chapter 3

STAFF INTEGRATION

3.1. General. WFs/Dets tailor WPs and provide decision-quality environmental information for mission planning and execution for their supported unit(s). Personnel need to understand their supported unit's mission and tactics, along with OWS capabilities in order to better anticipate, exploit and integrate weather information. They also utilize weather observing, meteorological watch (METWATCH), and resource protection roles; in an effort to keep supported unit's informed of mission-limiting weather.

3.1.1. Unit leadership will establish a duty priority list. **(T-1).** When developing the duty priority list, leadership will include the principles and processes of risk management (RM) found in AFI 90-802 consistent with the RM processes of operational units and unique mission needs of their organization. **(T-1).** **Table 3.1** provides an example for unit leadership to incorporate RM in unit activities. This is only an example and actual duty priorities often differ by location. Weather personnel will apply the principles of RM while managing weather analysis and integration activities in the following areas in accordance with their posted duty priorities, to include but not limited to METWATCH processes and procedures, resource protection processes and procedures (e.g. SWAP), and backup plans and procedures. **(T-1).**

Table 3.1. Example Duty Priority List.

Priority	Duty
1	Wartime defense of the duty site/location
2	Perform Emergency War Order Tasks (e.g., Deploy Personnel)
3	Execute Evacuation / Continuity of Operations Plan
4	Issue/Disseminate Imminent Hazardous Weather Warnings
5	Respond to Aircraft/Ground Emergencies
6	Issue/Disseminate Imminent Weather Advisories
7	Respond to PMSV calls supplementation/backup
8	Disseminate weather observation
9	Disseminate Urgent PIREPs (UUAs)
10	Disseminate Terminal Aerodrome Forecasts
11	Provide Flight Weather Briefings
12	Collaborate WPs with Supported Units
13	METWATCH/Amend Weather Products
14	Respond to Support Assistance Request (SAR) or Request for Information
15	Provide Staff Briefings / Non-Standard WPs
16	Accomplish Weather Functional Training
17	Accomplish Administrative Tasks

3.2. Staff Integration Function. WF/Det leadership functions as a direct interface with the supported unit commander and staff, provides direct support to command, control and planning throughout the command chain. They engage with supervisors of flying, ATC, Operations Centers, the regional OWS, and other operational users in the supported unit. Optimum integration incorporates the continuous feed of information into the planning and execution processes. Organizations that are fully integrated seamlessly operate with their supported unit(s) by operating and training with them to conduct full-spectrum operations and provide continuous weather information into the decision-making process. WF/Det leadership will:

3.2.1. Develop standard operating procedures to incorporate weather information into the daily operations of their supported unit(s). **(T-3).**

3.2.2. Develop, conduct and participate in training that incorporates supported unit(s) mission and tactics. **(T-3).**

3.2.3. Integrate into warfighting headquarters, AOCs, JOCs, Tactical Operation Centers (TOCs), and flying units' mission planning cells and operations centers to enable warfighters to fully exploit weather and space environmental information. **(T-3).**

3.2.3.1. Advocate with supported commanders to integrate weather forces in operational combat training exercises with aircrews and ground forces in order to cultivate realistic training scenarios. **(T-3).** In essence, enforcing the "Train like we fight" theory.

3.2.3.2. Complete after action reports (AAR) following major exercises and deployments and forward all AARs to the lead MAJCOM weather functional (for exercises) or component Senior METOC Officer (for deployments). **(T-3).**

3.2.4. For units conducting Army operations, integrate with the intelligence, operations, and planning cells (e.g., S2, S3, S5) of their aligned warfighting unit. **(T-1).** The weather unit provides appropriate weather representation to their aligned Army unit and assists the Commander Air Force Forces (COMAFFOR) SWO in employing AFW forces conducting Army operations, as required.

3.2.5. Establish a systematic approach to the daily shift change(s) to ensure a thorough understanding of the state of the atmosphere and how it impacts the mission. **(T-3).** Include a review of relevant analysis and forecast products, any collaboration done with other weather organizations, the forecast challenge(s), and significant weather impacts on the current and planned missions. **(T-3).**

3.3. Documentation. WF/Det leadership will ensure that information on weather services is documented in respective supported unit operations plans, contingency plans, memoranda of understanding, host-tenant support agreements, EM plan(s), airfield local operating procedures, or the installation weather support plan. **(T-3).**

3.3.1. Review weather annexes and plans at least every two years, or in accordance with host/parent unit procedures. **(T-3).** If updates are required to reflect changed capabilities/requirements, initiate an out-of-cycle formal review with the annex plan/owner to accurately reflect operational changes resulting from supported unit mission changes, equipment upgrades or significant changes in overarching guidance. **(T-3).**

3.3.2. Ensure weather operations information in operations plan (OPLAN) annexes is in agreement with other prescribing directives. Where technical terms are necessary, ensure they are defined. Normally, weather information included in another document is not repeated and a reference to that document is sufficient. However, if the supported unit does not have access to the referenced material, include pertinent elements of the information in the annex. Attachments and appendices are acceptable methods of documenting information such as SPECI observation criteria and weather product formats**.**

3.3.3. WFs/Dets will formally document information and procedures pertaining to the following when applicable:

3.3.3.1. Duty priorities as determined by mission requirements (see examples of duty priorities in **Table 3.1**), hours of operations and contact information. **(T-3).**

3.3.3.2. Limitations of airfield weather sensors (e.g., blocked wind sensors). **(T-3).**

3.3.3.3. Resource protection and emergency actions resultingfrom weather events/natural disasters. **(T-3).**

3.3.3.4. Watch, warning, and advisory criteria, lead times and areas of coverage. **(T-3).**

3.3.3.5. Dissemination processes (e.g., Pyramid alert scheme, both primary and backup) and watch/warning numbering. **(T-3).**

3.3.3.6. Tropical weather support and tropical storm notification procedures. **(T-3).**

3.3.3.7. Weather services provided to supported unit(s) and all tenant/associate units on the installation. **(T-3).**

3.3.3.8. Flying, non-flying, and space mission weather support. **(T-3).**

3.3.3.9. Weather forecast information and WP descriptions (e.g., sample products, formats, delivery methods, decoding). **(T-3).**

3.3.3.10. Tactical decision aid (TDA) information. **(T-3).**

3.3.3.11. Bio-environmental weather information (e.g., wind chill, heat stress, FITS). **(T-3).**

3.3.3.12. MISSIONWATCH (e.g., WP amendment criteria, dissemination of WP amendments). **(T-3).**

3.3.3.13. Pilot-to-metro service (e.g., radio frequency, number for phone patches, limitations, and outage procedures). **(T-3).**

3.3.3.14. Eyes forward and WF/Det and OWS collaboration procedures. **(T-3).**

3.3.3.15. Staff meteorological functions. **(T-3).**

3.3.3.16. Emergency/crisis action response. **(T-3).**

3.3.3.17. Climatology services. **(T-3).**

3.3.3.18. Instrument refresher course briefings. **(T-3).**

3.3.3.19. ATC limited observation program. **(T-3).**

3.3.3.20. Pre-deployment planning. **(T-3).**

3.3.3.21. Installation data page. **(T-3).**

3.3.3.22. Continuity of operations (COOP). **(T-3).**

3.3.4. Document supported unit weather sensitivities and review and update sensitivities on a frequency at least annually. **(T-3).**

3.3.5. Document additional training areas used (e.g., drop zone, landing zone). **(T-3).**

3.3.6. WFs/Dets providing lightning warnings to off-base supported units document the supported agency’s requirements in local operations plans and annexes or the installation data page. **(T-3).**

3.3.7. Develop and maintain the most current forecast reference materials (FRM). Weather organizations will submit material for deactivated units for archive and historical reference to the Air Force Weather Technical Library (AFWTL). **(T-3).**

3.3.8. Forecast techniques and rules of thumb (ROT). ROT are locally developed forecast and product tailoring tools. When under development, ROT are designated as experimental in local procedures until validated. Units document, evaluate and review biennially, all forecast techniques and ROT. Units integrate validated forecast techniques and ROT into forecast processes. Air Force Handbook 15-101, *Meteorological Techniques*, provides additional guidance on effective employment of meteorological techniques.

3.3.8.1. Validate ROTs by using them with other forecast tools and techniques for at least one season to determine forecast accuracy. **(T-3).** Integrate validated ROTs into unit processes and procedures. **(T-3).**

3.3.8.2. Determine which forecast techniques and ROTs are applicable and integrate them into the forecast process. **(T-3).**

3.3.8.3. Incorporate validated ROTs into FRM. **(T-3).**

3.3.8.4. Weather organizations will forward validated ROTs through MAJCOM functional staff to the AF/A3W Chief Scientist and the 557 WW, who will evaluate the ROT for integration into the AFWTL, models, and TTPs. **(T-1).**

3.3.9. Document important elements of operations within formal written documentation SOP or Operational Instructions (OI). **(T-3).**

3.3.9.1. WF/Det leadership will review SOPs for accuracy within 90 days of a change in leadership, when mandated changes occur within the organization, or at a frequency not to exceed one year. **(T-3).** Ensure SOPs are horizontally consistent with other weather documents (e.g., plans and annexes, installation weather support document, airfield local operating procedures, installation data page). **(T-3).**

3.3.9.2. All weather personnel will review SOPs applicable to the areas for which they are position-qualified at least annually. **(T-3).** Leadership will ensure this review is documented. **(T-3).**

3.3.9.3. WFs/Dets will develop and maintain SOPs for the following areas when applicable:

3.3.9.3.1. Open/close procedures (may be in a checklist form). **(T-3).**

3.3.9.3.2. SWAP procedures. **(T-3).**

3.3.9.3.3. Take/augment/disseminate observations using fixed base weather observing systems. **(T-3).**

3.3.9.3.4. Manual observing and dissemination procedures. **(T-3).**

3.3.9.3.5. SPECI and LOCAL criteria. **(T-3).**

3.3.9.3.6. ATC cooperative weather watch procedures. **(T-3).**

3.3.9.3.7. PIREP procedures. **(T-3).**

3.3.9.3.8. WP procedures. **(T-3).**

3.3.9.3.9. Disseminating weather decision aids/forecast products procedures. **(T-3).**

3.3.9.3.10. MISSIONWATCH procedures. **(T-3).**

3.3.9.3.11. Post-mission analysis, including space anomaly assessments, if required. **(T-3).**

3.3.9.3.12. LWU procedures. **(T-3).**

3.3.9.3.13. Arranging weather support operations for supported unit(s) from another weather unit. **(T-3).**

3.3.9.3.14. Continuity of operations procedures (COOP)/AOL procedures to include:

3.3.9.3.14.1. Weather equipment outage and backup procedures. **(T-3).**

3.3.9.3.14.2. Communications outage and backup procedures. **(T-3).**

3.3.9.3.14.3. COOP procedures as identified in the wing/post COOP plan. **(T-3).**

3.3.9.3.15. Aircraft/ground mishap, including space-lift or on-orbit space-craft mishap, if required. **(T-3).**

3.3.9.3.16. CBRN support. **(T-3).**

3.3.9.3.17. Before and after-the-fact quality assurance for non-automated products. **(T-3).**

3.4. Expeditionary Operations. Expeditionary operations outlined below are for units that are preparing for new or emerging requirements (e.g., non-sustainment operations) and deploy with their supported or army unit. Individual weather personnel deploy in accordance with pre-deployment checklists and procedures outlined by their supported unit.

3.4.1. Pre-deployment Activities. Prior to deployment, weather organizations follow procedures outlined in AFI 15-127 and the following:

3.4.1.1. Collect criteria event/no criteria event thresholds for the deployed location using deployed mission and operational requirements, rules of engagement, and theater specific environmental impacts of the supported unit. **(T-1).**

3.4.1.2. Participate in pre-deployment planning to ensure theater-specific environmental impacts are factored into supported unit deployment activities. **(T-1).**

3.4.1.3. Develop tactical SOPs that incorporate major functions of daily supported activities m(e.g., duty priorities, manual observing and augmentation of automated sensors). **(T-1).** Duty priorities will be coordinated with the supported unit. **(T-3).** **Table 3.2** provides examples of duty priorities.

Table 3.2. Example Deployed/Expeditionary Duty Priorities.

Movement/Location of POTUS/VPOTUS/FLOTUS and other designated White House persons. *Designated LWU = WHMO Joint Presidential Support Unit*
Wartime defense of the duty site and location, including CBRNE defense measures.
Wartime support of the principal staff elements.
PMSV calls.
Prepare and disseminate Weather Watches, Warnings, and Advisories.
Augment Fixed Base Weather Observing System and Take and record manual surface weather observations.
Maintain/restore primary communications.
Prepare/issue WPs.
Other briefings and staff functions.
Note: Based on the judgment of the OIC, NCOIC, or the technician on duty, these priorities may be changed, especially if there is danger to life or property.

3.4.2. Deployed equipment.

3.4.2.1. Units deploy with UTC tasked equipment. Units will request additional equipment through MAJCOM functional channels (while in garrison) or through the JMO or the component SMO in a deployed theater. **(T-1).**

3.4.2.2. Unit personnel will inventory and ensure operational functionality of tasked equipment before deployment and upon arrival. **(T-1).**

3.4.3. Members deploying to a contingency theater must follow reporting instructions listed on their orders and other applicable guidance provided by the JMO, special instructions, fragmentary orders, letter(s) of instruction, or deployed unit guidance. **(T-1).**

3.5. Coordinated Weather Operations. Weather organizations coordinate weather information with associated weather units for missions involving more than one unit or service. **(T-1).** Coordinated weather operations ensure decision-makers at every level receive consistent and relevant weather information. It also ensures a comprehensive and standardized set of decision-grade weather information is used and available across all command levels.

3.5.1. When two or more military units operate together and share the same airspace/battlespace (e.g., air refueling routes, military operating areas, drop zones), the LWU, identified using the rules in **Table 3.3,** coordinates overall weather services for the supported mission(s) and is the liaison between the aligned OWS and supporting weather units. **(T-1).** The LWU for a given supported mission is sometimes identified in an applicable joint/Air Force letter of instruction (LOI), OPLAN or execution order (EXORD). In general, LWU responsibilities lie with the weather unit providing weather support to the C2 element with tactical control (TACON) of the supported asset.

3.5.2. Control weather products (CWPs) are for common operations area(s) used by multiple units/missions operating together in a shared airspace/battlespace. Regardless of designated LWU, available OWS forecast products for common operations area(s) will be used in development of CWPs. **(T-1).** Supporting units will not deviate from the mission-critical weather thresholds specified in CWPs without prior coordination with the responsible LWU. **(T-1).**

3.5.3. The OWS aligned to a geographic region or CCMD AOR is responsible for developing the suite of operational and theater-scale products for its AOR. The OWS will provide model output and manually generated (forecaster-in-the-loop) forecast products for military operating areas (e.g., air refueling routes, training area/ranges, drop zones, etc.) for use by forecasters supporting two or more units operating together in a shared battlespace. **(T-1).**

Table 3.3. Prioritized Rules for Determining the LWU.

Rule	*Type of Mission*	*Designated LWU*
1.	Joint Missions	JMO-designated LWU for a Joint Operation in an OPORD/EXORD, support message.
2.	GLOBAL POWER	Weather unit providing the Combat Air Force C2 element with weather information. **Note:** The C2 element for GLOBAL POWER mission is typically delegated to the wing-level.
3.	CORONET	Weather unit providing the ACC C2 element with weather information. **Note:** Normally the ACC AOS/AOSW
4.	GLOBAL REACH	Weather unit integrated with the AMC C2 Element **Note**: Normally the 618 AOC (TACC)/XOW
5.	Air Refueling	Weather unit servicing the lead receiving aircraft unit. **Note:** The geographically aligned OWS will produce AR track forecasts for common AR tracks which are the basis for the CWP.
6.	Unmanned Aircraft	Weather unit assigned to the Unmanned Aircraft Operational-Level C2 element (e.g., 432d Wing Operations Center, Global Hawk Operations Center).
7.	Joint Airborne/Air Transportability Training (JA/ATTs) & Drop Zone (DZ)	Weather unit servicing the lead airlift aircraft unit.
8.	Landing Zones (LZ) & Land Maneuver	Weather unit attached to the lead Army unit.
9.	Special Operations	LWU depends on nature of the operation. **Note:** When Special Operations Forces operate solely in their own channels, the Special Operations Forces WF/Det or 23 SOWS is the LWU.

3.5.4. The LWU:

3.5.4.1. Coordinates with all units involved in the supported mission(s) to identify and obtain POC information (e.g., secure/non-secure telephone numbers, fax numbers, email addresses) for each organization. **(T-1).**

3.5.4.2. Collects information to define supported mission schedule(s), types (e.g., aerial refueling, airdrops, combat sorties and ground tactics), weapon systems and critical weather thresholds from the supported C2 element and supporting unit POCs. **(T-1).**

3.5.4.3. Determines WPs, data and service requirements for the supported mission(s). **(T-1).**

3.5.4.4. Liaises with the OWS and supporting units to request any specialized forecast products (e.g., JOAF, charts) needed to develop the CWP. **(T-1).**

3.5.4.5. Determines the CWP format (e.g., text, graphics), content, delivery method/times and amendment criteria. **(T-1).**

3.5.4.6. Coordinates CWP issue times and delivery methods with the supported C2 element and supporting weather organizations involved in the mission(s). **(T-1).**

3.5.4.7. Uses all applicable OWS forecast products and weather data to develop CWPs for supported missions. **(T-1).**

3.5.4.8. Coordinates with OWS and supporting weather organizations to MISSIONWATCH the CWP and amend it as required based on mission critical weather thresholds. **(T-1).**

3.6. Integrated Flight Management (IFM) Missions. IFM is a Mobility Air Force (MAF) core process designed to provide dynamic, proactive mission management and near real-time C2. Flight Managers act as virtual crewmembers, using electronic flight planning/filing, flight following, maintenance, transportation and weather resources to centrally plan and aid aircrews in the execution of MAF sorties/missions. Fused flight management information, shared situational awareness, collaborative decision making and dynamic planning/adjustment enable the Flight Manager to act as the primary POC for real-time weather operations for global mobility forces, regardless of location.

3.6.1. Flight Managers interact with weather agencies much as the flying crewmembers do. They review enroute hazards, takeoff, arrival and alternate weather, significant meteorological information (SIGMETs), etc., and often act as the conduit to pass weather information to the flying crewmembers.

3.6.2. Designated weather support units for IFM missions are in **Table 3.4** Specific duties and responsibilities of the PACAF and USAFE-AFAFRICA weather units providing weather information to theater AOC Air Mobility Division-controlled IFM missions should be documented in MAJCOM level instructions as required.

Table 3.4. Designated Weather Support Units for IFM missions.

MAF C2 Agency	*Weather Support Unit*	*Mission Type / Location*
618 AOC (TACC)	618 AOC (TACC)/WXD	Strategic Airlift / Air Refueling Global
603 AOC/AMD (USAFE-AFAFRICA)	21 OWS/FWB	Theater Airlift / Air Refueling EUCOM / AFRICOM
613 AOC/AMC (PACAF)	17 OWS/FWB	Theater Airlift / Air Refueling PACOM

Chapter 4

MISSION INTEGRATION

4.1. General. Mission integration requires in-depth knowledge of supported units' missions. Understanding operational tactics, weapons platforms capabilities and sensitivities is pivotal to injecting timely, accurate, and relevant environmental intelligence at every decision point in the mission planning and execution process. WF/Det leadership will:

4.1.1. Configure personnel/operations in a manner which maximizes the unit's ability to reliably inject the right information at the right time every time into their supported organizations' mission planning, execution and assessment processes. **(T-3).** To ensure consistent support, unit leadership will ensure support in garrison closely mirrors that of deployed operations and that both are structured in accordance with established UTCs. **(T-3).** To gain better knowledge of these concepts, weather unit leadership will familiarize themselves with the weather functional community prioritization and sequencing guidance and the weather annex to the war mobilization plan. **(T-1).**

4.1.2. Establish and actively maintain working relationships with supported organizations' key operational decision makers, operators, intelligence specialists, tactical-level mission planners, schedulers, and weapons and tactics experts. **(T-3).** Once established, WF/Det personnel can quickly adapt to process or mission changes.

4.1.2.1. Maintain operational situational awareness through active participation in supported units' battle rhythms which include, but are not limited to, joint planning group(s), threat working group(s), ISR synchronization, mission planning, rehearsals, mission execution, battle update briefs, commanders update briefs, and operations updates. **(T-3).**

4.1.2.2. Pass information on operations schedule, sensitivity thresholds, or support requirement changes to unit leadership. **(T-3).**

4.1.3. Understand supported unit(s) tactics/techniques/procedures (TTPs), mission essential tasks (MET), and environmental sensitivities of weapon systems and their associated mission. **(T-3).**

4.1.3.1. Leverage knowledge of past, current and forecast state of the environment to provide operators with the capability to exploit favorable environmental windows of opportunity for mission execution. **(T-3).** Inject environmental subject matter expertise, as appropriate, throughout the planning, execution, and assessment phases of the continuous operations cycle. **(T-3).**

4.1.3.2. Provide environmental estimates based on combat critical environmental thresholds to assess feasibility of missions as well as anticipate effectiveness of air and ground combat systems, platforms, weapon systems, and munitions. **(T-3).**

4.1.3.3. Focus on mitigation of environmental threats, offering weather-optimized alternatives to existing courses of action that help shape the mission profile and increase the likelihood of mission success. **(T-3).**

4.1.4. Provide WPs as coordinated with supported units, including tenant organizations. **(T-3).** WPs include MEFs, intelligence preparation of the battlefield (IPB) products, mission planning products, environmental inputs to mission analysis, environmental staff estimates, and any other WP prepared to meet the needs of a supported unit.

4.1.5. Use an established, repeatable process to create deliverable WPs and provide decision-quality environmental information for all stages of the planning and execution phases of operations. **(T-3).** Multiple WPs may be created to support the needs of different mission profiles (air, ground maneuver, fixed sensor, EOC and Civil Engineering CBRN Control Center operations, Civil Engineering Fire Emergency Services, etc.).

4.1.6. Interpret and apply space weather data and forecasts to support applicable unit missions. **(T-3).** This includes alerting the supported unit to the impacts of space weather on their operations, weapons, and communication systems.

4.1.7. Provide weather input to TDA's as coordinated with the host/parent unit. **(T-3).** This includes working proactively with the installation Civil Engineering Squadrons to ensure that the most accurate and representative meteorological data type is input correctly into the CBRN models as well as area locations of hazardous atmospheres (ALOHA) and computer- aided management of emergency operations (CAMEO) to produce CBRN Control Center or EOC hazard plume decision aids that are consistent with the DoD-approved installation TAF. **(T-3).**

4.1.8. Apply sound RM practices to processes covering MISSIONWATCH within designated areas of operations across the spectrum of air and ground mission profiles and for the duration of those missions. **(T-0).** This includes:

4.1.8.1. Developing procedures to determine critical thresholds requiring intensified MISSIONWATCH and updating parent/host unit on changes to environmental conditions critical to the mission.

4.1.8.2. Maintaining a MISSIONWATCH tailored to the mission(s) of the day.

4.1.8.3. Assigning risk, allocating resources and directing activities to conduct MISSIONWATCH for parent/host unit missions.

4.1.8.4. Conducting MISSIONWATCH on all assigned missions. Focus on critical portions of missions placed at risk due to environmental threats.

4.1.8.5. Informing the geographically aligned OWS their WPs do not accurately reflect observed conditions, particularly when conditions impact safety of flight.

4.2. Weather products (WP). WPs fuse theater scale products with local mission requirements enabling the direct inject of weather impacts into warfighter planning or execution. WPs are living documents and any/all feedback is applied to internal MISSIONWATCH/METWATCH processes to enhance training, forecast proficiency, and product accuracy. WPs include flight weather briefings, IPOE products, mission planning briefs, environmental inputs to mission analysis, environmental staff estimates, and any other WP prepared to meet the needs of a supported unit.

4.2.1. WPs are primarily developed by WFs/Dets utilizing the MEFP.

4.2.2. Organization leadership ensures environmental information is integrated into all phases of supported operations by developing, documenting, and applying the following procedures:

4.2.2.1. Exploit opportunities to inject decision-quality weather information during each phase of the operation cycle (e.g., assessment, planning, MDMP, IPOE). **(T-3).**

4.2.2.2. Use information obtained from supported units or derived from authoritative sources such as AFPD 11-2, *Aircrew Operations*, technical orders, 11-series AFI V3 on the mission design series (MDS) specific aircraft operations procedures, AFI 11-202V3, *General Flight Rules* and AR 95-1, *Aviation Flight Regulations* including any supplements to:

4.2.2.2.1. Identify critical criteria event/no criteria event mission-limiting environmental thresholds applicable to supported unit operations. **(T-1).** Leadership develops a logical, repeatable process to ensure the MEFP flexibly responds to temporary restrictions, changes to rules of engagement, and other transitory mission-limiting environmental factors. **(T-1).**

4.2.2.2.2. Tailor WPs to include forecasts for all critical Criteria Event/No Criteria Event mission limiting environmental thresholds applicable to supported unit operations. **(T-1).**

4.2.2.3. Use access to locally available command and control (C2)/mission planning systems and integrate into supported unit(s) to the maximum extent possible (personnel tempo and operational tempo permitting). **(T-3).** This is done in order to:

4.2.2.3.1. Collect relevant information about mission planning and execution.

4.2.2.3.2. Provide timely, accurate, and relevant environmental information for planning and execution.

4.2.2.3.3. Obtain feedback from users on forecast and observed environmental conditions applicable to their respective missions.

4.3. Mission execution forecast process (MEFP). The MEFP is an organized and systematic process to provide decision-quality environmental information to mitigate risks and exploit asymmetric capabilities in the MDMP. The MEFP specifies how to apply environmental intelligence to mitigate mission limitations and meet operational requirements. WFs/Dets develop processes and procedures to establish meteorological situational awareness and apply environmental weather for the parent/host unit's decision cycle.

4.3.1. The MEFP is a continuous cycle that adapts as supported unit needs change. WFs/Dets develop internal processes to improve the MEFP based on feedback from the supported unit(s). **(T-1).**

4.3.1.1. WF/Dets will focus the MEFP to identify mission impacting environmental conditions. **(T-1).**

4.3.1.2. WFs/Dets will coordinate with the supported unit(s) to determine WP content and format to ensure it contains relevant decision-grade information applicable to the mission. **(T-1).**

4.3.2. The complete MEFP is detailed in SOPs, checklists, flowcharts or other decision aids.

4.3.3. The MEFP consists of two primary components, Administrative and Operational:

4.3.3.1. Administrative Process. These are steps within the MEFP which are accomplished by WF/Det leadership to maximize the effectiveness of military operations. These steps must be reviewed annually. **(T-1).** **Table 4.1** details administrative processes.

4.3.3.1.1. The format, timing and dissemination of the WP from the MEFP is driven by the supported unit requirements.

4.3.3.1.2. WFs/Dets may use criteria event/no criteria event products to convey environmental information. These products are effective in the planning and allocation phases of an operational decision cycle and easily convey information to multiple users.

4.3.3.1.3. Enterprise-sustained software programs that present the forecast in a format highlighting direct impacts to the supported unit (e.g., target acquisition weapons software (TAWS)) may be used in the operational decision cycle and will be specific to a particular mission. Accredited organizations must sustain or maintain software programs. **(T-1).**

Table 4.1. MEFP Administrative Process.

1. Define Weather Thresholds
a. Identify critical Criteria Event/No Criteria Event terrestrial and space weather threshold values (e.g., airframe, mission types, weapon systems, decision timelines).
b. Identify critical resource protection thresholds (e.g., maintenance, security forces, logistics, emergency response).
c. Know where these parameters are applied (e.g., airfields, ranges, DZs, ARs, low-fly routes).
d. Identify training requirements to ensure all assigned weather Airmen are able to mitigate mission-impacting environmental hazards.
2. Attain and Maintain Situational Awareness
a. Identify logical process for obtaining situational awareness to identify trends and state of the atmosphere to others (e.g., shift change, shift duty checklist).
b. Leverage analysis products from DoD, U.S. Government (USG) and coalition sources. Utilize analysis products from academic or commercial sources only when suitable DoD, USG, or coalition products are unavailable.
c. Determine best products to use (primary and back-up) for each step including purpose of the product utilized and value to the MEFP (e.g., ROTs, climatology, space, topography).
d. Include OWS collaboration and communications.
e. Include review of centrally or locally established C2 systems (e.g., Global Decision Support System (GDSS), unit flying schedules).
3. Coordinate Operations
a. Identify times, criteria, and delivery format of environmental information for established supported units (e.g., LAN/webpage, mass briefing, flight weather briefing, crisis action briefing).
b. Provide or arrange for support for units when away from home station.
c. Request special terrestrial, climatic, and space WPs via SAR, if required.

4. Mission Verification/MISSIONWATCH a. Determine parameters, timelines, and critical thresholds for MISSIONWATCH. b. Standardize mission/products utilized in order to report WP MEF Verification (MEFVER) in accordance with MAJCOM and AF guidance. c. Identify products, frequency, and communication in the MISSIONWATCH process. d. Establish parameters for forecast reviews. Develop feedback performance mechanisms to incorporate seasonal training or specific forecast parameter improvement

4.3.3.2. Operational process. This is the executable phase of the MEFP. **Table 4.2.** details the operational processes.

4.3.3.2.1. Define a methodology to incorporate analysis products, forecast techniques, and a logical, verifiable process to conduct weather operations. The process identifies data sources, documents forecast methods, and describe methods of obtaining weather situational awareness.

4.3.3.2.2. Ensure all processes and procedures for meteorological information and refining WPs are derived from DoD, U.S. government sources, coalition/allied military/government sources, educational sources, then non-government civilian sources, in that order. **(T-1).** Incorporate Air Force Handbook 15-101 and validated local area rules of thumb into the MEFP. **(T-3).**

4.3.3.2.2.1. WF/Dets will alert the OWS to locally developing situations not coded in meteorological reports that potentially drive amendments to OWS forecast products or pose a risk to flight safety. **(T-1).**

4.3.3.2.2.2. Maintain consistency with LMPU guidance during joint/combined operations, as required. **(T-1).**

Table 4.2. MEFP Operational Process

1. Obtain Situational Awareness
a. Identify mission types (e.g., air, ground, change of command, maintenance).
b. Utilize pre-established procedures (e.g., shift change, shift duty checklist, open/close procedures).
c. Review relevant operational weather products.
2. Determine Weather Threat(s) of the Day
a. Identify potential threats to mission execution.
b. Prioritize support based on mission priority and threat to mission execution.
c. Identify WPs best utilized to mitigate weather impacts.
3. WP Generation/Dissemination
a. Conduct appropriate-scale review of global and theater-level products to identify state of the atmosphere affecting a particular mission.
b. Apply real-time data (e.g., PIREPs, radar, satellite imagery, surface observations).
c. Apply specific forecast techniques (e.g., icing, turbulence, contrails, ROT).
d. Integrate geographic, terrain, and vegetation influences on the weather and the mission.
e. Review space weather conditions and effects on the mission.
f. Generate forecast in proper format employing critical Criteria Event/No Criteria Event (or Go/No-Go) thresholds. Generate tactical decision aid (TDA) output, as required.
g. Evaluate product for accuracy and disseminate in accordance with established guidelines (e.g., C2 system, LAN/webpage) to appropriate customers, decision-makers, and other weather units.
h. Retain WPs in accordance with AFI 33-322, *Records Management and Information Governance Program*.
4. MISSIONWATCH/Mission Verification
a. Conduct MISSIONWATCH utilizing real-time WPs at established intervals.
b. If capability exists, communicate with established POC if thresholds cross critical Criteria Event/No Criteria Event parameters.
c. Gather feedback from supported units and review weather products as necessary to verify WP MEF.
d. Develop weather product review based on established guidelines if necessary.

4.4. Flight Weather Briefings . Weather units preparing and presenting briefings:

4.4.1. Use AF-approved briefing systems (JET Mission Management, GDSS, Flight Weather Briefer, etc.), DD Form 175-1, *Flight Weather Briefing*, MAJCOM form, computerized equivalent, or verbal briefings as the standard tool for delivering flight weather briefings. DD Form 175-1, *Flight Weather Briefing* is accomplished in accordance with procedures outlined in **Attachment 2** of this manual. Technicians presenting flight weather briefings focus on supported unit needs and tailor briefings to the mission. At a minimum, briefings include the following:

4.4.1.1. General meteorological situation for the mission area. **(T-1).**

4.4.1.2. Current and forecast weather (including flight hazards and significant meteorological information (SIGMETs)/airmen's meteorological information (AIRMETs)) for takeoff. **(T-1).**

4.4.1.3. Forecast en-route weather (including flight hazards and SIGMETs/AIRMETs). **Note:** At a minimum, brief flight hazards within 25 miles either side of the route and within 5,000 feet above and below the planned flight level. **(T-1).**

4.4.1.4. Forecast conditions at destinations and alternate airfields. **Note:** At a minimum, brief destination/alternate hazards within a 25 mile radius of the airfield and from the surface to 5,000 feet above the planned flight level for take-off and landing. **(T-1).**

4.4.1.5. When producing any mission execution weather product, such as a verbal brief, MEF, or FWB, clearly annotate the type of altitude used, above ground level (AGL) or mean sea level (MSL). If only one type of altitude is used, clearly state "All heights in AGL (or MSL)". If using AGL for ceilings and MSL for hazards, clearly state "AGL" or "MSL" as appropriate next to the height given or in each applicable section of the product or brief. **(T-1).**

4.4.2. Evaluate, interpret, and apply the contents from watches, warnings, advisories and forecasts. Relay the complete text of weather watches, warnings, and advisories for departure location, destination(s), and alternate airfield(s). **(T-1).**

Table 4.3. Flight Weather Briefing References.

AFI 11-202V3, *General Flight Rules* and MAJCOM Supplement (if published)
AFH 11-203V1 *Weather for Aircrews*
AFH 11-203V2 *Weather for Aircrews-Products and Services*
AFI 11-2 MDS (e.g., AFI 11-2F-15EV3 for the F-15E, AFI 11-2F-16V3 for the F-16)
AR 95-1, *Aviation Flight Regulations*
AR 95-23, *Unmanned Aircraft Systems*
CNAF M-3710.7 series, *NATOPS General Flight and Operating Instructions Manual*
FAA *Aeronautical Information Manual* (NWS In-Flight Weather Advisories)
FAA JO Order 7340.2J series, *Contractions*
FAA JO Order 7350.9S, *Location Identifiers*

4.4.3. Use the term thunderstorms rather than cumulonimbus or CBs when briefing aircrews. **(T-1).**

4.4.4. Request aircrews provide PIREPs during takeoff/landing, and en-route, and indicate the means of providing them (e.g., PMSV, ATC, phone patch). **(T-1).**

4.4.5. Have paper or electronic copy of current applicable Flight Information Publication (FLIPs) and other flight weather briefing references listed in **Table 4.3**. **(T-1).**

4.4.6. Give the briefing to the aircrew and retain a duplicate copy, in either electronic or paper hardcopy format. **(T-1).** The briefing may also be sent to the aircrew via encrypted DoD e-mail, fax, or posted to a secure webpage. **(T-1).**

4.4.7. Develop MISSIONWATCH procedures to include amend and update criteria. **(T-1).**

4.5. Flight Weather Brief Documentation and Retention. All FWBs, regardless of delivery format, will be documented, maintained, and retained in accordance with the AF Records Disposition Schedule and AFMAN 33-322. **(T-1). Table 4.4.** illustrates an example of a locally developed Aircrew Briefing Log. All FWBs, regardless of format, will contain, as a minimum:

4.5.1. Briefing time. **(T-3).**

4.5.2. Briefer initials. **(T-3).**

4.5.3. Aircrew call sign or mission number. **(T-3).**

4.5.4. All information relayed to aircrew. **(T-3).**

4.5.5. Void Time (as applicable). **(T-3).**

Table 4.4. Aircrew Briefing Log.

AIRCREW BRIEFING LOG							PERIOD OF RECORD	
							FROM XX Month XXXX	TO XX Month XXXX
ACFT TYPE	ACFT IDENT	DEP POINT/ DTG ETD	FL	DEST/ DTG ETA	SIGNIFICANT/SEVERE WEATHER BRIEFED		DTG WX BRF	PILOT NAME
						BASED ON	VOID	FCSTR INIT
UH1	Huey1	OFF 01/1000Z	030	SUX 01/1030Z	LGT TURBC SFC-020	PIREPS	01/0900Z 01/1030Z	DJ AH

4.6. Web-Based Aircrew Briefings. Weather organizations publish and provide access to information and procedures to supported flying units for computer/web-based briefing applications. Procedures address how aircrews request/schedule a weather briefing and include contact information for clarification and follow-up. When the capability exists, this service is provided by an Air Force web enterprise service. Use web-based briefing applications to:

4.6.1. Provide flight weather briefings to aircrews or WFs/Dets requesting briefings for aircrews transiting multiple AORs. **(T-3).**

4.6.2. Provide flight weather briefing services to Air National Guard, Army National Guard, Air Force Reserve, and Army Reserve units without a collocated or designated weather support organization. **(T-3).**

4.7. Air Mobility Command Weather Briefings. WFs/Dets supporting AMC IFM controlled missions:

4.7.1. Update take-off weather data and notify 618 AOC (TACC)/XOW if the update includes any of the criteria listed in **Table 4.5**. **(T-1).**

4.7.2. Provide access to meteorological satellite imagery, radar imagery, and other perishable weather data to crews upon request in accordance with established duty priorities. **(T-3).**

4.7.3. Consult/coordinate with 618 AOC (TACC)/XOW as required to resolve any aircrew concerns/issues with the mission weather package. **(T-3).** Facilitate discussions between aircrew members and 618 AOC (TACC)/XOW to elaborate on weather impacts or answer aircrew questions. **(T-1).**

Table 4.5. Integrated Flight Management standard mission-limiting criteria.

Ceiling/visibility less than or equal to 200ft/1/2sm (or other published airfield limitations)
Dry runway crosswind 25kts or greater
Wet runway crosswind 20kts or greater
Forecast low-level wind shear for KC-10 operations
Observed low-level wind shear for all AMC aircraft
Predominant thunderstorms on station
Freezing precipitation
Moderate (or greater severity) turbulence/icing
Forecast or observed volcanic ash on takeoff

4.8. Air Combat Command Air Operations Squadron (ACC AOS) Controlled Missions. Units supporting launch, alternate, abort and destination bases for ACC AOS-controlled missions:

4.8.1. Brief aircrews using ACC AOS/AOSW CWPs. **(T-1).**

4.8.2. Coordinate deviations from CWPs with ACC AOS/AOSW. **(T-1).**

4.8.3. Debrief arriving aircrews at destination bases and report any deviations from the CWP (weather not as forecast) to ACC AOS/AOSW. **(T-1).**

4.9. Tactical Decision Aids (TDA). Weather organizations only use those TDAs developed, certified, and approved by DoD, AF weather, or coalition sources. **(T-1).**

4.9.1. Target Acquisition Weapons Software (TAWS). TAWS predicts the maximum detection or lock-on range of air-to-ground electro-optical and infrared guided weapons and sensor systems. TAWS may use real-time or model weather data downloaded directly from Air Force or Navy reach-back data servers. Weather personnel may use situational awareness weather products, local effects, or ROTs to adjust modeled parameters used in the TDA to improve the accuracy of the TDA output. Weather personnel may assist mission planners in incorporating TAWS into the Pilot Flight Planning System.

4.9.2. Tactical Decision Aids for Reserve Component Forces. OWSs may provide model output to provide the meteorological parameters required for tactical decision aids run for Reserve Component units without a collocated WF/Det.

4.10. Chemical, Biological, Radiological, Nuclear (CBRN). AF weather forces will serve as weather SMEs to CBRN operations in accordance with AFI 15-128, AFI 10-2501, and AFMAN 10-2503. **(T-1).** At the installation level, WF/Det staff integration function:

4.10.1. Routinely meets with installation EM, Fire Emergency Services, and Bioenvironmental Engineering (BEE) to achieve appropriate mission immersion.

4.10.2. Gains familiarization with the CBRN plume models utilized by these emergency support functions (ESF) (e.g., joint effects model (JEM), ALOHA, CAMEO, etc.), their tactical decision aid outputs, and uses in installation commanders' decision cycles.

4.10.3. Understands the variety of possible weather input options within each model for each type of chemical, biological, radiological, and nuclear event. See JEM User's Manual, for details, available on the AFWKC.

4.10.4. Recommends and provides the most appropriate weather data type for EM and other ESFs to use to run their chosen CBRN model. The staff integration function's familiarity with EM and other ESF CBRN models helps determine the optimal weather data type.

4.10.5. Provides a region-specific model data recommendation consistent with Global Air-Land Weather Exploitation Model (GALWEM). In most cases, transport models can be configured to automatically pull observed or forecast gridded model data from Defense Threat Reduction Agency (DTRA). Historical climatological data will not be used except for training or long-term planning with canned scenarios. **(T-3).**

4.10.6. Makes sure that observations and forecasts provided are representative of the location/time of the CBRN event.

4.10.7. Works closely with EM or other ESF functions to ensure the supported commander gets a consistent picture.

4.10.8. Obtains and provides chemical downwind messages/effective downwind messages upon request from installation emergency management, the installation emergency operations center or other disaster response/management personnel.

4.11. Mission-Scale Meteorological Watch (MISSIONWATCH). MISSIONWATCH is a deliberate process for monitoring terrestrial weather or the space environment for specific mission-limiting environmental factors. The MISSIONWATCH process identifies and alerts decision makers to changes affecting mission success. WFs/Dets:

4.11.1. Develop procedures to determine critical thresholds requiring intensified MISSIONWATCH and update supported unit(s) on changes to environmental conditions critical to the mission. **(T-1).**

4.11.2. Maintain a MISSIONWATCH tailored to the mission(s) of the day. **(T-1).**

4.11.3. Employ sound RM techniques to assign risk, allocate resources, and direct activities to conduct MISSIONWATCH for supported unit(s) missions. **(T-1).**

4.11.4. Conduct a MISSIONWATCH for critical portions of every mission placed at risk due to environmental conditions. **(T-1).**

4.11.5. Inform the issuing OWS when WPs issued by the OWS do not accurately reflect observed conditions and may impact flight safety. **(T-1).**

4.11.6. Structure MISSIONWATCH processes to match basic steps outlined in **Table 4.6**. **(T-1).**

4.11.7. Use the following tools in the MISSIONWATCH process:

4.11.7.1. Meteorological satellite (METSAT) imagery (e.g., Infrared, Visible, Water Vapor, Microwave).

4.11.7.2. Real-time surface and upper air data (e.g., alphanumeric products, PIREPs, and SIGMETs).

4.11.7.3. Weather radar/lightning data.

4.11.7.4. Other data sources (e.g., tower cameras, on-line weather resources, and indigenous products).

Table 4.6. Basic MISSIONWATCH Steps.

1.	Determine the mission(s) placed at risk due to terrestrial or space weather conditions.
2.	Continuously monitor at risk mission routes, areas, installation, etc., for significant changes. Spot-check low risk missions.
3.	Focus on mission-limiting weather thresholds for each specific mission.
4.	Evaluate for change in risk category and reprioritize MISSIONWATCH as appropriate. Notify operational users of weather conditions crossing mission-limiting thresholds.
5.	Integrate weather impacts into operational alternatives decision process.
6.	Update WPs as necessary.
7.	Continue to monitor missions based on MISSIONWATCH threat.

4.12. Severe Weather Action Procedures (SWAP). Conduct and document annual SWAP exercises and ensure validity of plans to respond to severe weather. **(T-3).**

4.12.1. Real world events meet this requirement if properly evaluated and documented, to include lessons learned.

4.12.2. In the event problems are identified which are not resolvable at the local level, request assistance through chain of command or OWS for assistance (e.g., severe weather forecast seminars).

4.13. Weather Product Reviews. WP reviews focus on a particular weather event at a single location or region and examine the effectiveness of forecast reasoning, tools, and methods employed. Weather organizations develop performance feedback mechanisms to incorporate seasonal training for specific forecast parameter improvement. WF/Det leadership will:

4.13.1. Determine parameters, WPs to be reviewed, monitor the quality/performance of the products, and assign the reviews as required. **(T-1).**

4.13.2. Develop a consistent approach to conduct and document WP reviews. **(T-1).** WP reviews should include pertinent input from all sources used in WP production. **(T-1).**

4.13.3. WP reviews should be short (typically three pages or less), simple to complete, and focused on a specific part of the MEFP. **(T-1).** WP reviews briefly outline the tools and reasoning used to make the forecast product and describe potential improvements to the forecast process. **(T-1).**

Chapter 5

AIRFIELD WEATHER SERVICES

5.1. General. The airfield weather services function consists of TAF generation, weather observing, meteorological watch, and resource protection.

5.1.1. Units responsible for the airfield observation evaluate conditions, prepare, and disseminate routine and special weather observations. Observations are recorded and disseminated in accordance with AFMAN 15-111, and MAJCOM supplements, as applicable.

5.1.2. WF/Det and OWS Collaboration. Units relay significant, time-sensitive meteorological information not found in coded meteorological reports to relevant OWSs to assist in analysis operations. **(T-3).** Expeditionary and deployed units relay pertinent observations from tactical or fixed radars, upper air soundings, and any other meteorological information to the OWS or another agencies as tasked in the OPLAN, EXORD, JMO LOI, etc. Units also ensure mission impacting weather information is provided to their supported units if operations occur away from main operating locations. **(T-3).**

5.2. Flight Information Publication (FLIP) Review. Units will have procedures to review each new edition of applicable DoD FLIPs as soon as possible after publication, including the Radar Instrument Approach Minimums, local Notice To Airmen (NOTAMs), and applicable directives. **(T-2).** Coordinate updates or changes to DoD FLIPs through the local airfield management office or responsible agency using the standardized procedures and formats found in the General Planning FLIP. Changes include:

5.2.1. Airfield minima affecting SPECI/LOCAL observation criteria (reference Radar Instrument Approach Minimums).

5.2.2. PMSV contact information (reference Instrument Flight Rules (IFR) Supplement).

5.2.3. OWS contact information.

5.2.4. Airfield services hours, if different from airfield hours (reference IFR Supplement).

5.3. Pilot-To-Metro-Service (PMSV). PMSV systems vary in type across both Air Force and Army locations. PMSVs provide a valuable service to aircrews but are not required for weather personnel to accomplish their mission. All contacts with airborne aircrews, including phone patches, High Frequency (HF)/Ultra High Frequency (UHF) radio contacts, aircrew generated computer messages, satellite communications equipment, and cell phones are considered PMSV contacts. Weather Airmen at units with PMSV equipment will:

5.3.1. Use proper radio discipline and standard phraseology found in FAA Order 7110.10, *Flight Service,* at all times when operating PMSV. **(T-3).**

5.3.2. Respond to all PMSV contacts in accordance with unit duty priorities (example **Table 3.1**). **(T-1).** Weather organizations monitoring common PMSV radio frequencies will respond if another weather organization does not answer an aircrew request after two contact attempts. **(T-1).**

5.3.3. Pass only current, complete, and relevant information to aircrews. **(T-1).** Warn aircrews of weather hazards along their flight route and relay the position and movement of any weather hazards to the aircrew. **(T-1).**

5.3.3.1. Not *vector* aircraft around hazards, such as thunderstorms. **(T-1).**

5.3.3.2. Solicit a PIREP at the conclusion of every airborne contact. **(T-1).**

5.3.4. Log all PMSV contacts (including phone calls). **(T-1).** **Figure 5.1** illustrates an example of a locally developed PMSV log. Log the following information, at a minimum, for each contact:

5.3.4.1. Aircraft call sign or number.

5.3.4.2. Brief summation of the information passed to the aircrew.

5.3.4.3. Date Time Group (DTG) of the contact.

Figure 5.1. Example PMSV Log

PILOT TO METRO SERVICE (PMSV) LOG					MONTH: XXX 01			
NO	**CALL SIGN**	**TIME**	**INFORMATION GIVEN AIRCREW**	**PIREPS, TURBULENCE, REMARKS**	**INIT**	**DISSEMINATION**		
----	----------	--------	----------1 XXX 01 --	----------	-------	LOCAL-	LONG-	
1	**TOWER**	**0001Z**	**RADIO CHECK – Loud/Clear**		**TM**			
2	**SMACK55**	**0640Z**	**WNDS CBI – COS 27060, FCST 0900Z COS 29010 7 SCT030 3005**	**LCK-CBI 180 LGT TURBC 220**	**RG**		**X**	
3	**JOY 31**	**0650Z**	**LCL FCST 0800Z 29010 7 SCT030 OVC050 3008**	**OVR SGF OVC CI TOP 330 LGT CAT 350 C-141**	**RG**		**X**	

5.3.5. Log one PMSV radio equipment check each day (an operational or ATC contact meets this requirement). **(T-1).**

5.3.5.1. Record any discrepancies, such as weak transmission strength, weak reception, distortion, static, etc., on the PMSV log to assist maintenance personnel in correcting the problem.

5.3.5.2. Log out PMSV contact equipment (e.g., radio, telephone) in accordance with locally developed procedures or as specified by MAJCOM/higher headquarters directives.

5.3.6. UHF/Very High Frequency (VHF) Radio Outages. Units with radio equipment will arrange with other agencies to ensure for backup options during radio outages and will notify the backup unit when the equipment is back in operation. **(T-1).** Weather units will request base/airfield operations personnel include PMSV outages in Airfield Advisories and NOTAMs. **(T-1).**

5.4. Pilot Report (PIREPS). All PIREPs, regardless of delivery format, will be documented, maintained, and retained in accordance with the AF Records Disposition Schedule and AFI 33-322. **(T-1).** WFs/Dets will:

5.4.1. Develop and implement procedures to request timely PIREPs from aircrew. **(T-1).** Collect meteorological elements of operational significance to flying or surface activities, and assist local flying operations (e.g., turbulence, icing, cloud bases or tops when departing/arriving, in-flight visibility at low levels, upper winds, valley fog, etc). **(T-1).**

5.4.2. Encode and disseminate PIREPs in accordance with AFMAN 15-124. **(T-1).**

5.4.2.1. Disseminate all urgent PIREPs locally and longline in accordance with duty priorities. **(T-1).**

5.4.2.2. Disseminate all routine PIREPs locally and longline unless two or more PIREPS have substantially the same information. **(T-1).** In this case, disseminate only the most recent. Remarks section will indicate the number of reports of the same phenomena and the time interval in which they were received (e.g., "3 RPTS last five minutes," "NUMEROUS ACFT").**(T-3).**

5.5. Aircraft/Ground Mishap Data Save. When notified of any aircraft or ground mishaps (weather-related or not) requiring OPREP-3 reporting or local reporting requirements in accordance with AFMAN 10-206, *Operational Reporting*. **(T-1).** Weather organizations will:

5.5.1. Save all applicable and available terrestrial and space weather data. **(T-1).** Coordinate with other units (e.g., OWS, TACC) to ensure required data is saved. **(T-1).**

5.5.2. Ensure all data used in the development of any weather information, product, or service provided to a supported unit are saved, including but not limited to: **(T-1).**

5.5.2.1. METSAT imagery (e.g., Visible, Infrared, Water Vapor). **(T-1).**

5.5.2.2. Radar data files or images if available (e.g., Base Reflectivity, Velocity-Azimuth Display Winds, Echo Tops, Composite Reflectivity, Base Velocity). **(T-1).**

5.5.2.3. Upper air package. **(T-1).**

5.5.2.4. Aviation hazard charts and information (e.g., thunderstorm, lower and upper level turbulence, icing, etc.). **(T-1).**

5.5.2.5. PIREPs, SIGMETs. **(T-1).**

5.5.2.6. TAFs and observations for departure point, destination, and any alternate(s). **(T-1).**

5.5.2.7. Weather warnings, watches, and advisories. **(T-1).**

5.5.2.8. Upper air soundings enroute and nearest the mishap site. **(T-1).**

5.5.2.9. Briefing material provided to the mishap aircrew (e.g., DD Form 175-1, mesoscale tailored graphics). **(T-1).**

5.5.3. Notify the OWS senior duty officer of all mishaps and submit a support assistance request as soon as possible after the mishap to ensure all relevant perishable data is saved. **(T-1).**

5.5.4. Gather and retain the saved data until requested. **(T-1).** Send the data to the valid requesting organization (accident investigation board, safety investigation board, etc.). **(T-1).**

5.5.5. Dispose of the data when the organization initiating the data save determines it is no longer needed and coordinates the disposition with all organizations involved. **(T-1).**

5.6. Collocated Weather Organizations. Airfields with multiple weather organizations assigned have one weather organization designated as responsible for airfield services. The responsible weather organization is determined by the supported organization that has Senior Airfield Authority (SAA) as directed by the Joint Force Commander. For example, if a tanker unit is the SAA for a particular base with fighters and Army aircraft, then that tanker unit and operations support squadron (OSS) weather organization is the responsible unit supporting airfield services. **(T-0).**

5.7. Airfield Operations Board (AOB). Units/WF will participate as a member of the AOB as directed in AFI 13-204, V3, *Airfield Operations Procedures and Programs*. **(T-1).**

5.8. Unit Radar Committee (URC). AF Weather organizations responsible for issuing WWAs will attend, either in person or via teleconference, the URC meetings to address requirements and operational concerns as directed in the tri-agency NEXRAD Memorandum of Agreement in accordance with the following procedures: **(T-0).**

5.8.1. For AF-owned DoD NEXRAD sites: **(T-0).**

5.8.1.1. The AF weather organization that owns the DoD NEXRAD and has responsibility for issuing host installation WWAs is the designated AF representative / voting member of the URC for the NEXRAD site. **(T-0).**

5.8.1.2. If the AF weather organizations that owns the DoD NEXRAD is not responsible for issuing host installation WWAs, then the designated AF representative / voting member of the URC for the DoD NEXRAD site is the nearest using installation-level AF Wx organization with responsibility for issuing host installation-level WWAs. **(T-0).**

5.8.1.3. If none of the above exist, then the AF representative / voting member of the URC for non-DoD NEXRADs is the OWS with WWA responsibility for AOI where the NEXRAD site is located. **(T-0).**

5.8.1.4. If the Unit also controls the Master System Control Function of an AF-owned NEXRAD, that unit will coordinate the URC meetings in accordance with the Tri-Agency NEXRAD memorandum of agreement. **(T-0).**

5.8.2. For non-DoD NEXRAD sites: **(T-0).**

5.8.2.1. The using installation-level AF weather organization that operates 24 hours, 7 days a week and has responsibility for host installation WWAs will be the designated AF representative / voting member of the URC for the NEXRAD site. **(T-0).**

5.8.2.2. If no 24/7 installation-level AF weather organization with host installation WWA responsibility exists, then AF representative / voting member of URC for non-DoD NEXRADs will be the installation-level AF Wx organization with responsibility for issuing host installation WWAs that is located nearest to the non-DoD NEXRAD site. **(T-0).**

5.8.2.3. If no installation-level AF weather organization with host installation WWA responsibility exists, then the AF representative / voting member of the URC for non-DoD NEXRAD will be the OWS with WWA responsibility for AOI where the NEXRAD site is located." **(T-0).**

5.9. Meteorological Watch (METWATCH). This is a deliberate process for monitoring terrestrial weather or the space environment in an area or region. The purpose of a METWATCH is to identify when and where observed conditions significantly diverge from forecast conditions, determine courses of action to update or amend a forecast product or group of products, and notify designated agencies. Units will:

5.9.1. Establish and maintain a prioritized threat-based METWATCH process for all locations for which it is responsible for issuing products (e.g., warnings, watches, and advisories), and employ RM steps to identify weather threats impacting products and maximize effectiveness of resources. **(T-1).**

5.9.2. Monitor and identify changes in weather conditions that cross critical weather thresholds, and evaluate forecast products/reasoning when conditions are not occurring as forecast. **(T-1).**

5.9.3. Amend forecast in accordance with product amend criteria and established procedures. **(T-1).**

5.9.4. Develop METWATCH procedures to include the following:

5.9.4.1. Identify primary METWATCH data sources, document forecast methods, and standardize methods of obtaining weather situational awareness. **(T-1).**

5.9.4.2. Identify WPs and services affected by unexpected changes to forecast conditions. At a minimum, units that have METWATCH responsibilities prioritize procedures for WWAs, TAFs, MOAFs, and flight hazards. **(T-1).**

5.9.4.3. Outline the actions to take when forecast conditions change during the METWATCH. **(T-1).** Specify the units to contact and primary and backup contact methods (e.g., telephone, e-mail, phone patch). **(T-1).**

Chapter 6

RESOURCE PROTECTION

6.1. General. Weather units conduct METWATCH to identify and assess emerging and imminent threats to installations for which they have forecast responsibility. SWS and WWAs are special notices provided by these units resulting from both the forecast and METWATCH processes to assist military decision makers with resource protection decisions. SWSs provide advance notice of widespread hazardous weather conditions that have the potential to affect military installation(s). Watches and warnings provide notice of weather events posing a hazard to life or property. Advisories provide specific notice to an operational agency of environmental phenomena with the potential to impact operations.

6.2. WWA Procedures. Designated units produce, disseminate, and amend WWAs to inform supported installations/sites of potential and observed weather conditions that require protective actions.

6.2.1. Within their area of interest, OWSs are responsible for all WWAs at locations without assigned AF weather personnel responsible for airfield services. **(T-1).**

6.2.2. WF/Dets supporting AF or Army controlled airfields (class B, C, or D airspace) are responsible for all host installation WWAs, and providing or arranging for transient aircrew weather briefings. **(T-1).**

6.2.2.1. The geographically aligned OWSs will retain responsibility for WWAs issued for geographically-separated locations (e.g., test ranges, auxiliary fields) excluding those specifically outlined in paragraphs **6.2.5** and **6.2.6**. **(T-1).** The geographically aligned OWS will retain responsibility for TAFs and WWAs that are forecast in nature for ANG managed U.S.C. Title 5 and contract sites. **(T-1).**

6.2.2.1.1. The geographically aligned OWSs will issue watches for installations manned exclusively by AF and Army civilian or contract weather support (does not apply to Title 5 United States Code employees at ANG-managed sites nor contract employees at sites which only perform observations, eyes-forward and observed WWA functions). **(T-1).**

6.2.2.1.2. WF/Dets wishing to retain WWAs for geographically separated locations will coordinate procedures with the appropriate OWS and document the WWA responsibility for the specified areas on the WF/Det installation data page and in the installation weather support plan**. (T-1).**

6.2.2.2. WWA products will specifically state the area affected. **(T-1).** Normally, this is a circle with a 5NM radius around the center of a runway complex or specified location. The area enclosed by a 5NM radius circle is known as the verification area and considered “at the location” for verification of WWA products. WWA products issued for areas such as a missile field, exercise or maneuver area, or a range that are geographically irregular may not be associated with a specific point like an airfield complex. Weather events occurring within the geographic confines of the area are considered “at the location” for verification purposes.

6.2.3. Installation-level organizations with civilian or contract weather personnel will modify (as required) their civilian/contract position descriptions/contracts to comply with **paragraph 6.2.2**, as applicable. **(T-1).**

6.2.4. The WF/Det may enable automated functions to issue observed advisories.

6.2.5. Overseas/OCONUS WF/Dets at locations where the host nation is SAA may coordinate with the servicing OWS to transfer responsibility to issue warnings and advisories.

6.2.6. Weather organizations supporting space launch, missile fields or test missions are designated as the responsible unit for all airfield and supported range WWAs. **(T-3).**

6.2.7. OWSs will retain WWA responsibility for multi-purpose/high-use ranges and military operating areas. **(T-1).**

6.2.8. When issuing WWAs in accordance with **Table 6.1**, the issuing unit will:

Table 6.1. Rules for Issuing WWAs.

1. A watch is not a substitute for a warning. Units issue warnings, as required, regardless of whether or not a watch had previously been issued.
2. All WWAs are issued for specific and distinct locations.
Clearly indicate the area affected by a WWA in the text of the WWA.
Watches may be issued for an area larger than the corresponding warning (e.g., Watch for high winds for Random AFB and surrounding local flying area. Warning for high winds for Random AFB [applicable to the aerodrome]).
Warnings normally affect an area no larger than encompassed by a 5NM radius (except for lightning warnings that have a minimum radius of 5NM in which the end time for observed lightning will reflect the estimated duration) Document deviations in supported agency data pages or parent MAJCOM plans or instructions.
WWAs for Military Operating Areas (e.g., training areas, ranges, and missile complexes) may cover larger areas.
3. The lightning watch and the observed lightning warning are stand-alone criteria and do not supersede WWAs previously issued for other criteria.
4. A separate valid time may be specified for each criterion when warranted.
All times used in a WWA are expressed in Coordinated Universal Time (UTC) and Local Time. **Note:** Local time is changed for Daylight Saving and does not always correspond to Local Standard Time.
The beginning valid time for observed WWAs is when the criteria is first observed. An ending valid time is not used for observed WWAs. In place of and ending valid time, the following statement is used: "Valid until further notice."
5. Do not issue a forecast WWA for a single, unforecasted event that is not expected to persist or recur. Account for this as a RNI.
6. Only one weather *forecast* warning or advisory is in effect at any given time for the same criteria. This does not prohibit the use of a watch, a forecast warning, and an observed advisory being valid at the same time for different thresholds of the same criteria (e.g., A watch for GTE 50kts, a warning for 35-49kts, and an observed advisory for greater than or equal to (GTE) 25kts all valid at the same time.)
7. More than one forecast advisory may be in effect at the same time for the same location, but only one can be in effect for a particular criteria at the same time.
8. When sufficient time does not exist to communicate a change in weather, weather units that do not normally issue WWAs may, without prior coordination, issue to facilitate resource protection actions. When time permits, weather units forward pertinent information to the responsible unit and transfer responsibility for the WWA.

6.2.8.1. Include the maximum expected hail size, rain/snow accumulation, or wind speed as applicable in warnings and advisories. **(T-1).** Include additional criteria if specified by supported agencies.

6.2.8.2. Issue WWAs in a standard format and numbering scheme through the JET for the following installations:

6.2.8.2.1. Regular Air Force, guard, and reserve AF and Army installations. **(T-1).**

6.2.8.2.2. Expeditionary operating locations. **(T-1).**

6.2.8.2.3. Homeland Defense sites and operations, as tasked according to Defense Support of Civil Authorities. **(T-1).**

6.2.8.2.4. Special sites of national military interest (e.g., The White House). **(T-1).**

6.2.8.2.5. Major Continental United States (CONUS) lock and dam facilities. **(T-1).**

6.2.8.2.6. Joint, Coalition, and North Atlantic Treaty Organization (NATO) munitions storage areas. **(T-1).**

6.2.8.2.7. Space-lift operations and assets including government, military, and commercial facilities. **(T-1).**

6.2.8.2.8. DoD and intelligence community satellite ground stations not located on a military installation. **(T-1).**

6.2.8.2.9. Joint bases where the Air Force or Army is the supporting component. **(T-1).**

6.2.8.3. The OWS will evaluate, tailor and disseminate any required NWS flood and fire watches and warnings for US locations (includes Hawaii, Alaska and Guam) that receive WWAs through JET. **(T-1).**

6.2.8.3.1. Special attention should be paid to NWS-issued Flash Flood Warnings. Units issuing WWAs must coordinate with EM and Geobase personnel to evaluate the flash flood threat to the installation. **(T-3)**. NWS warnings may cover an area that does not impact the installation but impacts travel between geographically separated mission areas (e.g., missile fields) and installation personnel within the commuting area. For any areas considered vulnerable to flash flooding, units must develop procedures to disseminate NWS-issued Flash Flood Warnings to base personnel to prevent loss of life, mitigate damage to property, and minimize impact to operations. **(T-3).**

6.2.8.3.2. WFs will coordinate needs for river flood, flash flood, fire weather (red flag), coastal flood, and tsunami watches and warnings. **(T-1).** In the absence of a local weather unit, the geographically aligned OWS will ensure coordination. **(T-1).** Issuing units will **e**valuate, tailor and disseminate any required NWS flood and fire watches and warnings for US locations (includes Hawaii, Alaska, and Guam) that receive WWAs through JET. **(T-1).**

6.2.8.3.3. WF/Dets will coordinate with the installation EM personnel and set up WWA dissemination procedures. **(T-1).** In the absence of a local weather unit, the geographically aligned OWS will ensure coordination. **Note:** For joint installations where the AF has the lead for WWAs, the EM personnel may be from another service.

6.2.8.4. Use WWA text pre-loaded into Integrated Weather Warning Capability (IWWC) to ensure uniformity. Specific text may vary by location. **(T-3).** Text will be brief and clearly describe weather conditions in terms understood by all users of the product. **(T-3).**

6.2.8.5. Issuing personnel will notify the geographically aligned OWS if the OWS products are inconsistent with local conditions to maintain horizontal consistency throughout all WPs. **(T-1).**

6.2.9. Warnings take precedence over forecast advisories for the same phenomena. **(T-1).** Forecast advisories and warnings for the same phenomena will not be valid for the same time. Conversely, observed advisories and forecast warnings for same phenomena may be valid at the same time (e.g., a forecast warning for 35-49kts may be valid while an observed advisory for GTE 25kts is valid).

6.2.10. Watches are standalone products based upon potential and are unaffected by warnings or advisories for the same phenomena.

6.2.10.1. Mandatory watch criteria include: tornados, severe thunderstorms, damaging winds, lightning within 5 nautical miles (NM), and freezing precipitation as the potential warrants. **(T-1).**

6.2.10.2. Additional watch criteria may exist based upon supported agency requirements.

6.2.11. Warnings and advisories are upgraded by adding a phenomena or crossing to a higher threshold and downgraded by removing a phenomenon or crossing to a lower threshold and will use the default wording for upgrading/downgrading in JET. **(T-1).**

6.2.12. Forecast warnings and advisories will maintain horizontal consistency with TAF and other forecast products. **(T-1).** Depending on the circumstance, watches are not required to be included in the body of the TAF-coded forecast.

6.2.13. Units will coordinate annually with each supported unit and maintain documented WWA thresholds, desired lead time (DLT), and mission impacts (this may be accomplished in concert with annual review and update of weather support plan, or equivalent). **(T-1).** **Table 6.2** provides default thresholds and desired lead-times for use when the supported unit/agency does not specify a DLT or state a specific threshold.

6.2.13.1. Units should maximize the use of watches within their effected area of operations until conditions warrant the issuance of a warning to meet desired lead-times for the supported organizations. **(T-1).**

6.2.13.2. Units will issue watches for phenomena other than lightning a minimum of one hour prior to issuing a warning for the same phenomena. **(T-1).** Lightning watches will be issued at least 30 minutes prior to issuing a lightning warning or in accordance with the desired lead time of the supported unit/installation, whichever is longer. **(T-1).**

6.2.13.3. Units will issue warnings when conditions warrant at the using/supported unit DLTs. **(T-3).**

6.2.13.4. Use the default minimum desired lead-times in **Table 6.2** only if the supported organization does not specify a minimum DLT.

Table 6.2. Weather Warning Defaults.

Weather Threat	**Threshold**	**Impact**	**Default Lead-time (See Note: 1)**
Tornado	Tornado, Water Spout, or Funnel cloud (detected by radar or visually observed) AND threatening warned location / aerodrome complex	Immediate threat of catastrophic damage to personnel and property	15 minute advance notice of onset and duration of tornadic thunderstorm activity See Note 2
Severe Thunderstorm	Damaging Wind GTE the specified thresholds and associated with thunderstorms AF: 50 kts Army: 45 kts -OR- Damaging Hail GTE the specified thresholds at the warned location/aerodrome AF: ¾” Army: ½”	Immediate threat to exposed personnel High risk of damage to facilities and exposed aircraft and equipment	1 hour advance notice of severe thunderstorm onset, duration, and intensity See Note 2
Moderate Thunderstorm	<u>Strong Winds</u> GTE 35 kts and less than (LT) severe criteria associated with thunderstorms -OR- <u>Large Hail</u> GTE ¼” and LT severe criteria at the warned location/aerodrome	Increased risk to exposed personnel Increased risk of damage to unsecured property Increased risk to flight line activities and damage to exposed aircraft or vehicles	1 hour advance notice of thunderstorm onset, duration, and intensity See Note 3

Strong Winds	Surface Winds not associated with Thunderstorms GTE 35 kts and LT severe threshold	Increased risk to exposed personnel Increased risk of damage to unsecured property Increased risk to flight line activities and damage to exposed aircraft or vehicles	1 hour advance notice of onset, duration and intensity
Damaging Winds	Surface winds not associated with thunderstorms GTE the specified thresholds. AF: 50 kts Army: 45 kts	Immediate threat to exposed personnel Increased risk of damage to facilities and equipment	1 hour advance notice of onset, duration, and intensity of wind event See Note 3
Freezing Precipitation	Liquid precipitation of any type and intensity that freezes on contact and produces a glaze ice on exposed surfaces	Range of impacts dependent on precipitation type and intensity Examples: Light freezing drizzle increases risk of unsafe driving conditions and disrupts flight line or maneuver activities Effects can be mitigated Moderate or greater intensity freezing rain (ice storm) poses significant risk of damage to facilities and rapidly creates hazardous conditions for personnel and vehicle movement that cannot easily be mitigated	1 hour advance notice of onset See Note 3

Heavy Snow	2” of new snowfall accumulating in LT 12 hours	Disrupts personnel movement or flight line activities	1 hour advance notice of the period meeting or exceeding the heavy snow threshold Ex: It is determined that 2” in a 6 hour period poses a threat to the installation. The responsible unit provides 1-hour advance notice of the onset for a snow event(s) meeting the threshold. (e.g., Issue the warning at 11Z when snow is expected to start falling at 12Z and accumulate GTE 2” by 18Z.) The warning text indicates maximum expected snowfall accumulation during the period specified in the warning.
Blizzard	All of the following must occur: a) Surface visibility less than or equal to (LTE) ¼SM (400M) b) Falling or blowing snow c) Wind (sustained or gusts) GTE 30 kts d) Duration GTE 3 hours	Imposes significant risk to personnel movement Significant risk to maneuver or flight line activities	1 hour advance notice of onset, duration, and character of conditions meeting or exceeding threshold (persistent or intermittent).

Heavy Rain	2” of liquid precipitation accumulating in LT 12 hours	Increased threat of flash flooding or systemic flooding posing credible threat to unprotected resources and personnel Disrupts flight line and maneuver activities Imposes increased risk on personnel movement	1 hour advance notice of the period meeting or exceeding the heavy rain threshold The warning indicates onset, duration, and anticipated maximum rainfall accumulation
Sandstorm	Winds carrying sand particles from the surface up to 50 feet above the surface, prevailing visibility GTE 5/16 but LT 5/8SM (500 to 1000M). For prevailing visibility of LT 5/16SM (500M), the storm is considered a heavy sandstorm	Disrupts personnel movement and aviation operations	1 hour advance notice of the period meeting or exceeding threshold
Dust storm	Winds carrying dust particles from the surface to approximately ten thousand feet above the surface, prevailing visibility GTE 5/16 but LT 5/8SM (500 to 1000M). For prevailing visibility of LT 5/16SM (500M), the storm is considered a heavy dust storm	Disrupts personnel movement and aviation operations	1 hour advance notice of the period meeting or exceeding threshold
Lightning	Lightning within 5NM.	Immediate threat to exposed personnel	As observed

Note 1. Lead-time requirement is determined by the affected installation. Use default lead-times when a local requirement is not specifically stated or researched. Note 2. Mandatory installation SWAP criteria. Note 3. Installation policy directs SWAP activities.

Table 6.3. Rules for Amending, Extending, and Canceling WWAs.

1. When a WWA no longer adequately describes the phenomenon's occurrence, issue a completely new warning or advisory with a new number.
2. WWAs may be extended provided the extension is issued prior to the expiration of the original notice.
3. Clearly state how the amended, extended, or cancelled WWA affects any other issued notices for the same criteria (e.g., "This upgrades warning XX-XXX" or "This extends advisory XX- XXX" or when canceling "Watch XX-XXX for lightning within 5NM remains in effect" etc.)
4. Cancel WWAs when conditions are no longer occurring and are not expected to reoccur within the DLT of the WWA. **Note:** Observed WWAs are cancelled at the discretion of the responsible agency; normally 15 minutes after the last occurrence of the criteria when it is no longer forecast to occur.
5. Lightning Watches are canceled only when the potential for lightning within the next 30 minutes is no longer forecast. Do not cancel if there is potential for another thunderstorm within 30 minutes.

6.3. Verification. Verify warnings and advisories using all available sources of representative sensed or observed data or subjective analysis (when appropriate and credible) for a specific geographic location. Verification is based on the desired lead-time and area specified in the criteria. (e.g., the verification area of a warning for a "lightning within 5NM" is a radius of 5NM around the location). **(T-1).**

6.3.1. WWA products will specifically state the area affected by the WWA product. **(T-1).** Normally, this is a circle with a 5NM radius around the center of a runway complex or specified location. The area enclosed by a 5NM radius circle is known as the verification area and considered "at the location" for verification of WWA products. WWA products issued for an area such as a missile field, exercise or maneuver area, or a range that are geographically irregular may not be associated with a specific point like an airfield complex. Weather events occurring within the geographic confines of the area are considered "at the location" for verification purposes.

6.3.2. Verify warnings and advisories using sensed or observed data within the verification area from the point location. **(T-1).** For example, a warning for lightning within 5NM of an airfield is issued and simultaneously verified based on lightning strikes or radar returns within the verification area, or when reported as occurring on station in a surface observation. A forecast advisory for lightning within 25NM is verified based on lightning strikes or radar returns within the verification area, or when reported as occurring (within 25NM) in a surface observation. When performing verification, units:

6.3.2.1. Omit reporting locations within the verification radius that are not representative of the location receiving WWA products and document these sites in forecast reference material or SOPs. For example, elevated wind reports do not accurately represent surface conditions.

6.3.2.2. Employ all data available from representative sources of sensed or observed data within the verification area to objectively verify warnings and advisories. Sensed data from radars, mesonets, environmental monitoring systems, tactical ATC systems, forward armament and refueling points, or other sensing systems are considered objective data for evaluating and verifying WWA products. Unofficial reports from credible sources (e.g., law enforcement, fire and rescue personnel, off duty AF weather personnel, storm spotter, reports etc.) within the verification area of the warned location are used to verify warnings and advisories when unit leadership determines the reports are credible based on corroborating objective weather data or subjective analysis of relevant weather data (e.g., A weather Airman lives within a verification area and notifies the unit performing verification that they observed 3/4" hail; unit leadership determines whether this report is credible and can be used for verification).

6.3.2.3. When objective verification is not possible, inadequate, or misrepresentative, use subjective analysis of available data to determine if an event occurred. In situations where units use subjective verification, they also take responsibility for a missed occurrence of the weather threat if these phenomena are reported with no WWAs in effect at that time. MAJCOM Weather staff's serve as approval authority for subjective verification. **(T-2).**

6.3.3. Units issuing WWAs verify each phenomenon separately except as indicated below.

6.3.4. Severe thunderstorm and moderate thunderstorm warnings are verified upon first occurrence of either wind or hail threshold at the warned location. Occurrence of either of the specified criteria in severe thunderstorm and moderate thunderstorm warnings verifies these warnings; the criteria are "bundled" for verification purposes.

6.3.5. Verify a lightning watch as if it were a forecast WWA product with a 30-minute desired lead-time. Lead-time is based on the issued time of the watch subtracted from the time of first occurrence of the lightning within specification distance of the warned location.

6.3.6. Verify heavy precipitation warnings using measurements from the airfield observing system, radar precipitation measurements, other rain gauges, or storm reports in the verification radius for the warned location.

6.3.6.1. Heavy rain warnings specifying an accumulation in a specified time period. These warnings are verified using a summation of the one-hour precipitation measurements from the airfield observing system. Collect the one-hour amounts reported by the airfield observing system commencing with the cardinal hour that the warning was issued and indicate on a weather warning verification tracker when the specified precipitation total was reached. Continue to collect the one-hourly accumulations during the valid period of the warning and enter the total liquid precipitation received during the valid period of the warning into the verification database.

6.3.6.2. Use accumulated reports of six-hourly, 12- hourly, or summary of the day during the valid period of the warning for verifying heavy rain warnings at locations where the unit does not have access to the hourly rain gauge data from an airfield observing system. Actual time of occurrence may be estimated based on interpolations from the rate of accumulation in METAR or Synoptic reports.

6.3.6.3. Units with access to radar data may use radar generated precipitation total products to supplement direct measurements from a rain gauge, and verify precipitation accumulation warnings (provided the data has been evaluated for accuracy; account for high reflectivity phenomena such as hail or bright band contamination of the data). Radar generated precipitation products must be evaluated for accuracy against reliable rain gauges (military or NWS sites) for at least one season to account and correct for high reflectivity phenomena such as hail or bright band contamination of the data. **(T-2).**

6.3.6.4. Units may use reports of flooding or visible damage within the area covered by a warning as subjective verification of a heavy rain warning.

6.3.6.5. Heavy snow warnings specify a threshold snow accumulation over a specified period of time and are verified using manually observed snowfall totals from Air Force, sister service, coalition partners, or host nation sources where the capability exists.

6.3.6.6. In the absence of manual snowfall totals, the unit conducting verification of a heavy snow warning converts one-hour liquid precipitation measurements into hourly snow equivalent according to procedures in AFMAN 15-111, *Surface Weather Observations*. Collect the one-hour amounts reported by the airfield observing system commencing with the cardinal hour that the warning was issued, and indicate on a weather warning verification tracker when the specified snowfall total was reached. Continue to collect the one-hourly accumulations during the valid period of the warning and enter the total snowfall and liquid precipitation received during the valid period of the warning into the verification database.

6.3.6.7. Weather radar data is unreliable for determining snowfall and cannot be used to objectively verify heavy snow warnings. Units may use radar reflectivity returns to subjectively evaluate heavy snowfall warnings to justify warnings that do not verify by other means.

6.3.6.8. Use accumulated reports of 6-hourly, 12- hourly, or summary of the day during the valid period of a heavy snow warning at locations where the unit does not have access to hourly data from an airfield observing system. Actual time of occurrence may be estimated based on interpolations from the rate of accumulation in METAR or synoptic reports. Use the observation date/time group on METAR reports with snow increasing rapidly remarks (SNINCR s/tt) to verify heavy snow warnings when either value in the remark meets or exceeds the warning threshold.

6.3.7. During a disruption in service, if responsibility for WWAs is transferred to another unit, that unit is responsible for conducting verification and entering data into IWWC until the service disruption is over and WWA responsibility is transferred back to the original unit. **(T-1).**

6.3.8. Document sound meteorological reasoning used in determining the need for all forecast WWAs in the appropriate spaces provided in the Air Force weather dissemination system.

6.3.9. Warnings and advisories fall into one of five verification categories (see **Figure 6.1**).

6.3.9.1. Met DLT: Issued and verified the threshold criteria within the specified verification area and met (or exceeded) the desired lead-time.

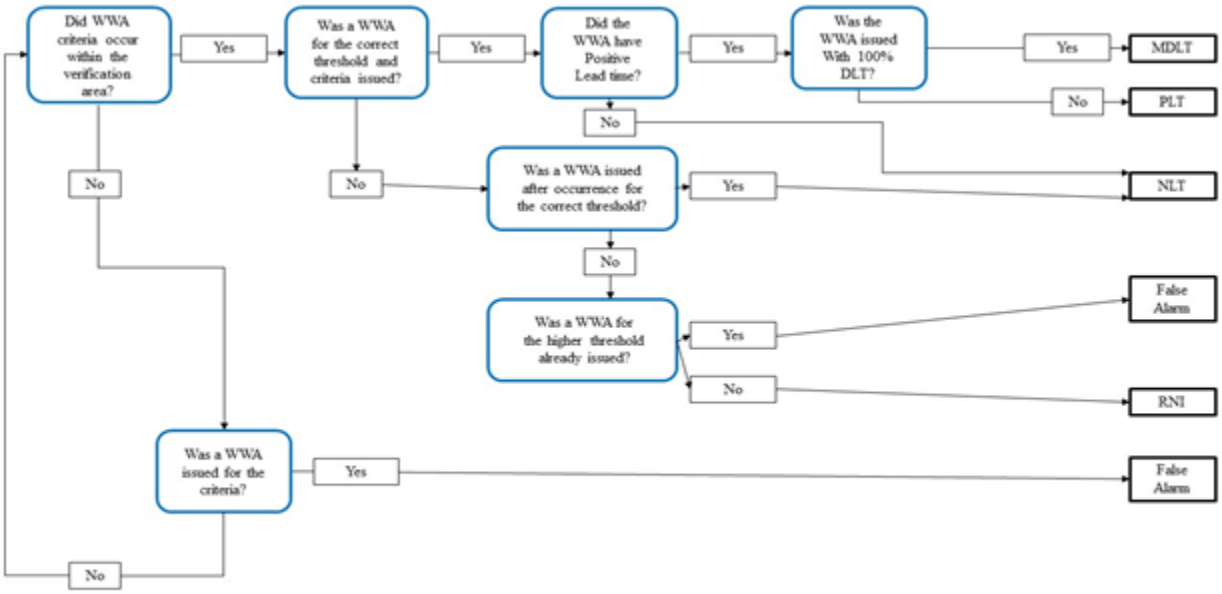
6.3.9.2. Positive Lead Time: Issued and verified with positive lead time, but, did not meet the full DLT.

6.3.9.3. Negative Lead Time: Issued and verified with negative lead-time; negative lead time is not used when the event is deemed to be a one-time occurrence.

6.3.9.4. Required, Not Issued (RNI): Not issued but event occurred within the verification area. RNIs are intended for use during one-time occurrences or when an entire event is missed, for example, a one-time gust of 38kts or multiple reports of large hail discovered after the fact (e.g., storm reports).

6.3.9.5. False Alarm: Issued but event did not occur within the verification area.

Figure 6.1. Weather Warning and Advisory Verification Process.



6.3.10. Lead-time Computation

6.3.10.1. Actual lead-time is the time elapsed between the issue time of the warning/advisory and the first time of occurrence.

6.3.10.2. Actual lead-time computation for warnings and advisories that are downgrades from an existing warning or advisory is based on the issue time of the first warning/advisory lead-time calculation. Upgrades are calculated based on the time the WWA was upgraded, NOT the initial issue time, provided there is no break in coverage. Ensure there is no break in coverage and a "DOWNGRADE" remark is appended to the new warning or advisory. If a break in coverage does occur, actual lead-time is computed from the new issue time. Ensure there is no break in coverage and an "UPGRADE" remark is appended to the new warning or advisory. If a break in coverage does occur, actual lead-time is computed from the new issue time.

6.3.11. Units will issue WWAs consistent with **Table 6.1**, **Table 6.2**, and **Table 6.3** and assess technical performance according to **Chapter 13**. **(T-1).**

Figure 6.2. Rules for Issuing WWAs.

9. A watch is not a substitute for a warning. Units issue warnings, as required, regardless of whether or not a watch had previously been issued.

10. All WWAs are issued for specific and distinct locations.

Clearly indicate the area affected by a WWA in the text of the WWA.

Watches may be issued for an area larger than the corresponding warning (e.g., Watch for high winds for Random AFB and surrounding local flying area. Warning for high winds for Random AFB [applicable to the aerodrome]).

Warnings normally affect an area no larger than encompassed by a 5NM radius (except for lightning warnings that have a minimum radius of 5NM in which the end time for observed lightning will reflect the estimated duration) Document deviations in supported agency data pages or parent MAJCOM plans or instructions. **(T-1).**
WWAs for Military Operating Areas (e.g., training areas, ranges, and missile complexes) may cover larger areas.

11. The lightning watch and the observed lightning warning are stand-alone criteria and do not supersede WWAs previously issued for other criteria.

12. A separate valid time may be specified for each criterion when warranted.

All times used in a WWA are expressed in Coordinated Universal Time (UTC) and Local Time. **Note:** Local time is changed for Daylight Saving and does not always correspond to Local Standard Time.
The beginning valid time for observed WWAs is when the criteria is first observed. An ending valid time is not used for observed WWAs. In place of and ending valid time, the following statement is used: "Valid until further notice."

13. Do not issue a forecast WWA for a single, unforecast event that is not expected to persist or recur. Account for this as a RNI.

14. Only one weather *forecast* warning or advisory is in effect at any given time for the same criteria. This does not prohibit the use of a watch, a forecast warning, and an observed advisory being valid at the same time for different thresholds of the same criteria (e.g., A watch for GTE 50kts, a warning for 35-49kts, and an observed advisory for GTE 25kts all valid at the same time.)

15. More than one forecast advisory may be in effect at the same time for the same location, but only one can be in effect for a particular criteria at the same time.

16. When sufficient time does not exist to communicate a change in weather, weather units that do not normally issue WWAs may, without prior coordination, issue to facilitate resource protection actions. When time permits, weather units forward pertinent information to the responsible unit and transfer responsibility for the WWA.

6.4. WWA Backup Procedures.

6.4.1. When the primary notification system is inoperable, weather agencies issuing WWAs record notification and verification on an AF Form 3807, *Watch/Warning Notification and Verification*, or on an AF Form 3806, *Weather Watch Advisory Log*, as applicable, until a global database capability is restored. Instructions for completing the AF Form 3807 and 3806 are found in **attachment 4** and **attachment 5** respectively.

6.4.2. In the event a WWA does not reach the intended agency, the issuing authority is responsible for notifying ATC and the Command and Control (C2) authority responsible for the Installation Notification and Warning System (per AFI 10-2501) as identified in the supported agency data page or weather support document. Document additional notification requirements in the supported agency data page or weather support document. **(T-1).**

Chapter 7

TERMINAL AERODROME FORECAST (TAF)

7.1. General. A TAF provides official meteorological information for flight planning and command and control (C2) activities for a specific aerodrome. Units that produce TAFs establish logical and repeatable processes for TAF production. **(T-1).** These processes focus on uniformity, production, and quality assurance of final products according to locally-developed guidance. AFMAN 15-124 defines compliance and dissemination guidance. **(T-1).**

7.2. Processes and Procedures. Units providing TAFs analyze and predict environmental conditions paying close attention to mission critical thresholds in the terrestrial or space environments. Forecasts are developed in accordance with mission descriptions and assigned geographic or functional areas of responsibility. Leadership of units producing TAFs:

7.2.1. Reviews unit processes and procedures (e.g., SOPs, OIs) annually to ensure accuracy. **(T-1).**

7.2.2. Establishes a continuous improvement process for analysis and prediction core processes. **(T-1).**

7.2.3. Formally documents both quality assurance and weather product review processes. **(T-1).**

7.2.4. Cross-feeds best practices and lessons learned to other units through the MAJCOM functional managers for standardization across the weather functional community. **(T-1).**

7.3. TAF Production. An aviation forecast formatted as a TAF according to AFMAN 15-124, Meteorological Codes, provides official meteorological information for flight planning and command and control (C2) activities for a specific aerodrome complex. AF Weather organizations produce TAFs for AF or Army controlled airfields and joint base airfields during controlled airfield hours of operation where the AF or Army exercises Senior Airfield Authority (SAA) (within their designated area of responsibility and where Air Force weather personnel augment observations). **(T-1).** Controlled airfields are defined as those sustaining class B, C, and D airspace requiring augmented observations. For new TAFs in support of named operations, TAF generation begins as specified in the SAR, or within 48 hours (whichever is later). **(T-2).** For new TAF support for non-combat operations, TAF generation begins as specified in the SAR, or within 15 business days of SAR submission, whichever is later. **(T-2).**

7.3.1. OWSs issue a TAF when:

7.3.1.1. There are no AF weather personnel deployed to or stationed at a location to provide airfield weather services, and the airfield meets the criteria in **Paragraph 7.3** above. **(T-1).**

7.3.1.2. Requested via a SAR at airfields meeting the criteria in **Paragraph 3.6**. **(T-1).**

7.3.1.3. The AF service component or unit responsible for providing the airfield weather support function for an OCONUS airfield location submits a SAR to request a TAF for an airfield location that either has no TAF or has an existing non-DoD issued TAF with documented shortfalls (e.g., availability, timeliness, amendment criteria, and representativeness). **(T-1). Note:** A non-DoD entity may be responsible for providing the airfield weather support function at locations with an existing non-DoD TAF. **(T-1).**

7.3.2. Co-located WFs/Dets are responsible for providing TAFs for host installations and installation airfield location(s) that meet the criteria described above in **Paragraph 7.3**. **(T-1).**

7.3.3. Units producing TAFs will:

7.3.3.1. Develop a TAF production cycle for locations and coordinate TAF issue times with supported units. **(T-1).**

7.3.3.2. Issue forecasts valid for a 30-hour period. **(T-0).**

7.3.3.3. Issue TAFs during airfield operating hours, at a minimum, every 8 hours; and within 15 minutes of the issue times that were previously coordinated with supported units. **(T-1).**

7.3.3.4. Disseminate all TAF-coded forecast products (including amendments) via standard production and dissemination systems. **(T-1).**

7.3.3.5. Disseminate TAF-coded forecasts for limited operation airfields not more than 3 hours before the airfield opens. **(T-3).** Deviations from this practice will be properly documented in accordance with **paragraph 3.3**. **(T-3).**

7.3.3.6. Ensure continuity of operations in TAF production. **(T-1).**

7.3.3.7. OWS will not assume TAF authority for non-emergency situations at WF/Dets. **(T-1).** WF/Det leadership will coordinate with base operations leaders to employ airspace category changes or NOTAMs for temporary changes to TAF services at an airfield (e.g., switching to limited duty TAF due to personnel shortages). **(T-1).**

7.4. TAF-coded Forecast Specification and Amendment .

7.4.1. Specify the onset, duration, and intensity for the standard criteria in **Table 7.1** throughout the valid period of the forecast. Forecasts are amended when conditions do not match specified conditions within **Table 7.1**. **(T-0).**

7.4.2. Specify and amend ceiling and visibility categories for US Army or US Air Force flight planning criteria throughout the valid period of the forecast. The lower of the two conditions determine the ceiling and visibility amendment category. **(T-2).**

7.4.3. Use ceiling and visibility specification criteria in **Table 7.2** for TAF-coded forecasts issued for Army airfields. **(T-2).**

7.4.4. Use ceiling and visibility specification criteria in **Table 7.3** for TAF-coded forecasts issued for Air Force operating locations. **(T-2).**

7.4.5. Units issuing forecasts for Joint/Coalition airfields validate criteria based on operational requirements. Use Air Force ceiling and visibility specification criteria located in **Table 7.3** when Air Force agencies operate the airfield or Army criteria from **Table 7.2** when Army organizations operate the airfield. **(T-3).**

7.4.6. Forecasters employ trend data from standard display systems (e.g., Airfield Sensor Displays) to determine prevailing conditions. **(T-1).**

7.4.6.1. Prevailing conditions are those that persist for at least 30 consecutive minutes.

7.4.6.2. Conditions occurring once during a specified time-period for less than 30 consecutive minutes or occurring for an aggregate total of less than 30 minutes of every cardinal hour are temporary.

7.4.6.3. During periods of rapidly changing ceilings or visibilities crossing multiple categories, consider conditions occurring for the greatest aggregate total during a cardinal hour the predominant condition for that cardinal hour.

Table 7.1. Standard Specification and Amendment Criteria.

Rule	Phenomena	Criteria	Source	Notes, Examples or Applications
1.	**Surface Winds**	**Wind Speed**: The difference between the predominant wind speed and the forecast wind speed is ≥ 10 knots **Wind Gusts**: The difference between observed gusts and the forecast is ≥ 10 knots **Wind Direction**: A change > 30 degrees when the predominant wind speed or gusts are expected to be 15 knots or greater		IF: Forecast winds 23018G25KT THEN: Amend if predominant winds equal or exceed 28 knots, or if observed gusts equal or exceed 35 knots Amend if predominant winds are 8 knots or less or gusts do not meet 15 knots Amend for prevailing wind directions outside of the arc extending from 200 through 260 degrees

2.	**Icing**, not associated with thunderstorms, from the surface to 10,000ft Above Ground Level (AGL)	The beginning or ending of icing first meets, exceeds, or decreases to less than moderate (or greater) thresholds and was not specified in the forecast	AFI 11-202 V3 and AR 95-1	
3.	**Turbulence** (for weather category II aircraft), not associated with thunderstorms from the surface to 10,000 ft AGL	The beginning or ending of turbulence first meets, exceeds, or decreases below moderate or greater thresholds and was not specified in the forecast	AFI 11-202 V3 and AR 95-1	
4.	**Weather Warning Criteria**	Occur, or are expected to occur during the forecast period, but were not specified in the forecast Specified in the forecast but are no longer expected to occur during the forecast period		**Note:** Watches are exempt from this requirement. Forecasters may specify watch criteria in the TAF when, in their judgment, the specific nature of the threat dictates

5.	**Altimeter Setting**	Altimeter setting meets or exceeds 31.00 INS and was not specified in the forecast Altimeter setting, if above, drops below 31.00 INS and was not specified during the forecast period Altimeter setting drops below 28.00 INS and was not specified in the forecast	AFI 11-202 V3	
		Altimeter setting, if below 28.00 INS, increases above 28.00 INS and was not specified in the forecast		
6.	**Forecast Weather Advisory Criteria**	Occur, or are expected to occur during the forecast period, but were not specified in the forecast Specified in the forecast but are no longer expected to occur during the forecast period		**Note:** Advisories issued for an area not including the terminal aerodrome forecast area are exempt from this policy

7.	**Thunderstorms**	Incorrect forecast start or end time	AFI 11-202 V3 and AR95-1	
8.	**Specification of Temporary Conditions**	Forecast conditions specified as temporary become predominant conditions Forecast conditions specified as temporary do not occur during the cardinal hour as forecast Forecast conditions specified as temporary are no longer expected to occur	AFI 11-202 V3 and AR95-1	
9.	**Changes to Predominant Conditions** Becoming or From Group (BECMG or FM group)	Forecast change conditions occur before the beginning of the specified period of change and are expected to persist Forecast change conditions do not occur within 30 minutes after the specified time Forecast change conditions are no longer expected to occur		

10.	**Representative Conditions**	Forecast conditions are not considered representative of existing or forecast conditions and amending the forecast improves safety, flight planning, operations efficiency, or assistance to in- flight aircraft		

Table 7.2. Army Airfield Ceiling and Visibility Specification and Amendment Criteria.

Rule	Category	Ceiling	Visibility	Source
1.	**D**	Greater Than or Equal to (GTE) 1500ft	Visibility GTE 4800 meters (M) (3 statute miles [SM])	AR 95-1. Aircrew must file for an alternate if conditions are less than 1500ft/3SM **(T-0).**
2.	**C**	Less Than (LT) 1500ft but GTE lowest published landing minimum plus 400ft	Visibility LT 4800M (3SM) but GTE lowest published landing minimum plus 1600M/1SM	AR 95-1. Airfield weather conditions must equal or exceed these criteria to qualify as an alternate when flight filing. **(T-0).**
3.	**B**	LT lowest published landing minimum plus 400ft but GTE lowest published landing minimum	LT lowest published landing minimum plus 1SM (1600M) but GTE lowest published airfield landing minimum	AR 95-1. Airfield does not qualify as an alternate for flight planning but is still suitable for arrival providing a suitable alternate is available.
4.	**A**	LT lowest published airfield landing minimum	LT lowest published airfield landing minimum	AR 95-1. Airfield is not a suitable destination

Note: 1. Forecasts specify when conditions decrease to less than, or if below, increase to equal or exceed the categories in the table.

Note: 2. Forecast category is determined by the lower of the ceiling or visibility value.

Note: 3. Use predominant conditions to determine forecast category (e.g., not tempo or varying). **Note: 4**. For locations Outside the Continental United States (OCONUS), 5000M and 1500M may be substituted for 4800M and 1600M respectively, based on the host-nation practice.

Table 7.3. AF Airfield Ceiling and Visibility Specification and Amendment Criteria.

Rule	Category	Ceiling	Visibility	Source:
1.	**E**	GTE 2000ft	GTE 4800M (3SM)	AFI 11-202, V3. Aircrew must file for an alternate if forecast conditions are less than 2000ft/3SM
2.	**D**	LT 2000ft but GTE 1000ft	LT 4800M (3SM) but GTE 3200M (2SM) or lowest published visibility minima, whichever is greater	AFI 11-202 V3. Airfield qualifies as an alternate
3.	**C**	LT 1000ft and GTE lowest published landing minimum plus 500ft	LT 4800M (3SM) but GTE 3200M (2SM) or lowest published visibility minima, whichever is greater	AFI 11-202 V3. Airfield qualifies as an alternate
4.	**B**	LT the lowest published landing minimum plus 500ft and GTE the lowest published landing minimum	LT 3200M (2SM) but GTE the lowest published airfield landing minimum	AFI 11-202 V3. Airfield does not qualify as an alternate for flight planning but is still suitable for arrival provided a suitable alternate is available
5.	**A**	LT the lowest published airfield landing minimum	LT the lowest published airfield landing minimum	AFI 11-202 V3. Airfield is not a suitable destination

Note: 1. Forecasts specify when conditions decrease to less than, or if below, increase to equal or exceed the categories in the table.

Note: 2. Forecast category is determined by the lower ceiling or visibility value.

Note: 3. Use prevailing surface visibility to determine forecast category.

Note: 4. For OCONUS locations, 5000M and 3000M may be substituted for 4800M and 3200M respectively, based on the host-nation practice.

Note: 5. For AF operations, Category A minima may be replaced with pilot weather categories in MAJCOM supplements to AFI 11-202, V3.

Note: 6. Air Force rotary wing criteria may be substituted when rotary wing aircraft are the primary aircraft assigned at the TAF location as stated in AFI 11-202, V3.

7.5. Analysis Process. Units develop a systematic analysis process to determine the current state of the atmosphere. Analysis entails establishing a coherent, integrated depiction of the past and current state of the natural environment over a specified region. OWSs provide effective analysis of collected weather data (terrestrial and space) to help ensure the accuracy of products. These data are processed and assimilated into environmental databases to provide battlespace awareness and inputs for decision-making and predictions. Analysis drives forecast decision trees throughout the process. The procedures for analyzing data may vary depending on the data and parameters, and methods may include visually inspecting data and producing analysis products.

7.6. Prediction Process. This process guides weather forecasters in developing a prediction of the future state of the atmosphere. Units include climatology, continuity and persistence in the forecast processes and procedures.

7.7. Numerical Weather Prediction (NWP) Models. NWP output is evaluated via an objective process to identify model deviations from the sensed environment and evaluate the run-to-run consistency of meteorological models employed in the forecast process. **(T-2).** Model verification products are used, along with subjective techniques such as continuity and extrapolation, as a guide for adjusting forecasts.

7.8. Ensembles. Units employ Ensemble Prediction Suites (EPS) as a tool to assess credibility of weather data identified by single model forecasts. Analysis of credible data enhances the unit's MDMP.

7.9. Forecast Worksheets/Checklists. Forecasters utilize forecast worksheets and checklists in order to work logically and consistently through the forecast process. Servicing OWS will provide web-based forecast worksheets and decision aids to assist WF/Dets forecast process. **(T-1).** WF/Dets may develop their own worksheets checklists and decisions aids. Units may:

7.9.1. Design worksheets or checklists to help forecast specific terrestrial or space weather parameters.

7.9.2. Integrate location specific forecast reference material, forecast tools and techniques for different seasons and atmospheric patterns as applicable.

7.9.3. Review forecast reference material seasonally for forecast application updates.

7.9.4. Provide a summation of forecast reasoning employed for developing the forecast.

7.10. Dissemination. Units will evaluate options and implement solutions to disseminate weather data and products via systems and data networks approved by combatant or joint commands. **(T-1).** These efforts apply to units participating in joint, coalition, or combined operations within the AOR when cross-system or cross-network data transfer is available.

7.11. TAF Verification (TAFVER). Organizations that produce operational TAFs will ensure their TAFs are verified in accordance with **Chapter 13** and MAJCOM guidance. **(T-3).** Intent is for all organizations to use automated capabilities to perform TAFVER. Organizations without an automated capability to perform TAFVER may adjust or omit TAFVER procedures until an automated process is available to them.

Chapter 8

GRAPHICAL ANALYSIS PRODUCTS

8.1. General. OWSs are organized, trained, and equipped to conduct weather operations and to provide specified WPs and information for AF and Army operations within their regional areas as defined in AFVA 15-137.

8.2. Operational Production. OWSs develop procedures to analyze and predict the environmental conditions. **(T-1).** All meteorological symbols, isopleths, and color representations used in the production of graphical analysis/forecast products must be compliant with World Meteorological Organization (WMO) and the International Civil Aviation Organization (ICAO) standards or the current Military Standard (MIL-STD) 2525, *Joint Military Symbology* (see **Attachment 3**). **(T-1).** In the event that standards conflict, units will follow MIL-STD 2525. **(T-1).** OWSs establish local procedures to ensure the horizontal consistency between all Forecaster-In-The-Loop (FITL) products. **(T-1).**

8.3. Surface Analysis Products. OWSs will produce and make available to operational users, a twice-daily synoptic scale analysis of the 0000Z and 1200Z surface data. **(T-1).** OWSs may produce 0600Z and 1800Z analysis products. These products will be available via standard dissemination systems not later than 90 minutes from valid time. **(T-1).** OWSs may use satellite and model data where surface data is too limited to produce a useful surface analysis.

8.3.1. Analysis products will be displayed using web layering capabilities. At a minimum, the layers will contain the parameters in **Table 8.1**, **Table 8.2**, and **Table 8.3**. **(T-1).**

Table 8.1. Polar/Mid-Latitude Analysis Parameters.

Polar/Mid-Latitude Parameters
- Plotted surface data
- Isobars, base value 1000 millibars (mb) at 4-mb intervals
- Positions of fronts and troughs
- Locations of closed pressure systems with central values and an appropriate H/L symbol
- Air mass type and source region (optional)
- Tropical cyclones
- 12-hour continuity of front, troughs, closed pressure systems and other significant weather features

8.3.2. Joint Typhoon Warning Center (JTWC) low-level streamline tropical analysis products, focused on the parameters in **Table 8.2** are the authoritative product set for their area of responsibility. This product will be available NLT 90 minutes following the release of synoptic data products. **(T-1).** Units who also have coverage responsibilities within the JTWC AOR host these products on their webpage.

Table 8.2. Tropical/Sub-Tropical Analysis Parameters.

Tropical/Sub-Tropical Parameters
- Streamlines
- Confluent & diffluent asymptotes
- Cyclonic and anticyclonic circulation centers
- Cusps and neutral points
- Tropical cyclones
- Other significant weather features (e.g., Equatorial Trough, monsoon troughs, axes of tropical waves, shearlines)
- 12-hour continuity of cyclonic and anticyclonic circulation centers, tropical cyclones and other significant weather features

8.3.3. OWSs will produce 0000Z and 1200Z analysis bulletins, and imbed meta data in web-based display or provide analysis descriptions for WF/Det forecast worksheets as needed to provide situational awareness for end users. **(T-1)**

8.4. Upper Air Analysis.

8.4.1. Analyze the minimum required weather parameters, as listed in **Table 8.3,** from the earth's surface up to and including the first layer above the troposphere.

8.4.2. Use the 00Z and 12Z plotted rawinsonde data to depict synoptic and mesoscale weather features at 200 (optionally 250 or 300), 500, 700, 850, and 925 mb levels (see exceptions in **Table 8.3**).

8.4.3. Track 12 and 24-hour continuity of closed circulation centers.

8.4.4. Maintain vertical and horizontal consistency of weather features with other weather data (e.g., other pressure levels, satellite imagery, and weather radar).

8.4.5. Use computer generated renderings of assimilated and sensed data in production of analysis products.

Table 8.3. OWS Standard Upper Air Analysis Parameters.

Level	*Minimum Parameters*
200mb **250mb or** **300 mb**	Height contours using a base value of 9,000 meters (300 mb), 10,560 meters (250 mb), or 12,000 meters (200 mb) at 120-meter intervals Closed Highs and Lows with center height values in Polar/Mid-latitude regions, Cyclones and Anticyclones in Tropical/Sub-tropical regions Color fill (purple) wind speed maxima using a base value of 70 knots (in 20 knot intervals) Areas of upper tropospheric divergence (isopleth in blue for values greater than >1.95 radians/sec 10^{-4} s^{-1}) **EXCEPTION:** May omit if above lowest layer in stratosphere
500 mb	Height contours using a base value of 5,400 meters at 60-meter intervals Closed Highs and Lows with center height values Isotherms at 5°C intervals Moisture areas. Color fill areas with dew point depressions (DPD) of 5°C or relative humidity (RH) 70% or greater
700 mb	Height contours using a base value of 3,000 meters at 30-meter intervals Closed Highs and Lows with center height values Isotherms at 5°C intervals Moisture areas. Color fill areas with DPD 5°C or RH 70% or greater
850 mb **&** **925 mb**	Height contours using a base value of 1,500 meters (750 meters for 925 mb) at 30- meter intervals (or as required by season and documented in an Analysis and Forecast Program (AFP)) Fronts aloft Closed Highs and Lows with center height values Isotherms at 5°C intervals (highlight 0°C isotherm) Moisture areas. Color fill areas with DPD 5°C or RH 70% or greater Low level jet Streamlines and circulation centers may be used instead of height contours and height centers in tropical regions. **EXCEPTIONS:** May omit analysis for regions within the AOR with surface elevations reaching into these mandatory levels

8.4.6. OWSs may:

8.4.6.1. Use METSAT over data-sparse areas.

8.4.6.2. Produce an analysis of additional pressure levels or parameters on standard levels (e.g., height fall centers) based on seasonal weather patterns.

8.4.6.3. Analyze two levels over tropical areas: low-level (925 or 850 mb) and upper-level (300, 250, or 200 mb).

8.5. Standard Analysis of Upper Air Soundings (SKEW-T/Log-P Diagrams). OWSs will post graphical and tabular displays of sensed and model forecast skew-T/log-P diagrams on their respective webpages. **(T-1).** Where practicable, overlays of derived parameters and thermal/stability curves may be employed to simplify interrogation and display. OWS displays will include the following:

8.5.1. Temperature and dew point vertical profiles. **(T-1).**

8.5.2. Wind directions and speeds at mandatory and significant reporting levels. **(T-1).**

8.5.3. Tropopause height. **(T-1).**

8.5.4. Additional derived parameters (at a minimum):

8.5.4.1. Height of the freezing level(s). **(T-1).**

8.5.4.2. Height and speed of the maximum wind. **(T-1).**

8.5.4.3. Lifted Condensation Level (LCL). **(T-1).**

8.5.4.4. Lifted Index (LI). **(T-1).**

8.5.4.5. Total Totals (TT). **(T-1).**

8.5.4.6. Convective Available Potential Energy (CAPE). **(T-1).**

8.5.4.7. Convective Inhibition (CINH). **(T-1).**

8.5.4.8. Convective Condensation Level (CCL). **(T-1).**

8.5.4.9. Showalter Stability Index (SSI). **(T-1).**

8.6. Severe Weather Analysis.

8.6.1. OWSs will identify, assess, and analyze severe weather threats focusing on areas where conditions impact supported units. **(T-1).**

8.6.2. OWSs will use **Table 8.4** as a guide; specific analysis parameters and thresholds may depend on the region and season. **(T-3).**

8.6.3. Severe weather analysis may be combined with the standard surface and upper air analysis.

Table 8.4. Standard Severe Weather Analysis Parameters

Chart	*Standard Parameters*
200mb **250mb** **or** **300**	- Streamlines and axes of diffluent winds - Isotachs in red with a minimum value of 70 knots in 20-knot intervals; label all speed maxima Height falls (300 mb only) using same procedures as 500 mb Stratospheric warm sinks/cold domes Circulation centers (cyclones **C**, anticyclones **A**)
500 mb	- Axes of maximum wind flow 50 kts; label all speed maxima - Closed Highs and Lows with center height values - 12-hr. height falls every 30m. If the center exceeds 180m, draw height fall isopleths every 60m. Label center with an **X** and the maximum value - Isotherms every 2^{o}C - Warm and cold pockets
700 mb	- Flow streamlines - Axes of maximum wind flow 30 kts, label all speed maxima - Isotherms 2^{o}C intervals; highlight 0^{o}C isotherm (if applicable) - Circulation centers (cyclones **C**, anticyclones **A**) - Dry air intrusions ($\geq$ 10^{o}C dew point difference) intruding into a significant moisture field (DPD < 6^{o}C or RH $\geq$70%)
850 mb **925 mb**	- Streamlines and axes of confluent winds - Axes of maximum wind flow 25 kts; label all speed maxima - Isotherms every 2^{o}C; highlight 0^{o}C isotherm (if applicable) - Thermal ridges and warm/cold pockets. - Axes of Equivalent Potential Temperature (Theta-E) Ridges - Isodrosotherms every 2^{o}C for values 10^{o}C at 925mb and 6^{o}C at 850mb - Circulation centers (cyclones **C,** anticyclones **A)** - Dry air intrusions ($\geq$ 10C dew point difference) intruding into a significant moisture field (DPD < 6C or RH $\geq$70%)

Surface	- Fronts, troughs, and confluent zones. Track fronts until no longer discernible - Dry lines, meso-highs, outflow boundaries, and squall lines - Moisture ridges and axes of maximum moisture advection - Thermal ridges - Isallobars; highlight anallobars (pressure rises) and katallobars (pressure falls) - Tropical depressions and tropical cyclones, as required - Isotherms every 2^{o}C; highlight 0^{o}C isotherm (if applicable)

8.7. NWP Models.

8.7.1. The Global Air Land Weather Exploitation Model (GALWEM) is the Air Force's primary meteorological model for characterization of environmental impacts to operations. GALWEM is available at multiple resolutions and forms the basis for Ensemble Prediction Suites. Forecasters use GALWEM as primary NWP tool and may supplement with other NWPs as mission needs dictate.

8.7.2. The 557 WW may automate as many significant parameters as the capability allows, except for fronts and troughs at the surface. **(T-1).** Develop processes and procedures for depicting significant features on the representative model using **Table 8.5** and **Attachment 3. (T-1).**

8.7.3. OWSs will provide GALWEM visualizations using overlay functions allowing end users to select the parameters needed for briefings or forecast processes. **(T-1).**

8.7.4. OWSs will evaluate the GALWEM model for their AOR, factoring in data availability and the 16 WS monthly or seasonal model performance metrics. **(T-1).**

8.7.4.1. Evaluate data on the synoptic scale or mesoscale, depending on model scale and AOR-specific requirements. **(T-1).**

8.7.4.2. OWSs will provide objective performance data to guide forecasters at all levels of the weather enterprise in validation, initialization, and verification of GALWEM. **(T-1).**

8.7.4.3. Identify and document deviations from the representative model data in appropriate forecast bulletin(s). **(T-1).**

8.7.5. Produce forecast model products at 12-hour intervals starting at the base hour (e.g., 00Z or 12Z) through the 72-hour point for parameters listed in **Table 8.5**. **(T-1).**

8.7.6. Develop modified depiction procedures for tropical regions within the AOR. **(T-1).** OWSs document tropical-unique depiction procedures in analysis and forecast procedures. **(T-1).** OWSs may include a description of the modified depiction parameters in the data page with supported WFs if deemed operationally significant. OWSs may leverage hurricane/typhoon center products if their products are adequate to meet area and type requirements.

Table 8.5. Weather Parameters Depicted in Model Output

Chart	*Parameters*
300, 250 or 200 mb Package	Height contours (same as **Table 8.3.**) Isotachs – Minimum value of 70kts with a 20-kt interval Closed Highs and Lows with center height values Areas of divergence. (Isopleth in blue dashed lines for areas $\geq$1.95 radians/sec 10^{-4} s^{-1})
500 mb Package	Height contours and temperatures (same as **Table 8.3.**) Seasonal representative contour; maintain continuity to determine significant weather changes Closed Highs and Lows with center height values Vorticity isopleths Areas of Vorticity advection (positive advection shaded red, negative advection shaded blue) Significant areas of RH (isopleth in green or green color shade areas of 70% / 90%)
700 mb Package	Height contours and temperatures (same as **Table 8.3.**) Closed Highs and Lows with center height values Isopleth in green or color shade in green areas of RH (70% / 90%) Contour upward vertical velocity values – Base 0 interval $\pm$3 microbars/sec Qualitative precipitation forecast (QPF) output 0.25 inches (other values may be included as required based on season)
850 mb Package	Height contours and temperatures (same as **Table 8.3.**) High and low centers. Closed Highs and Lows with center height values Identify areas of RH (70% / 90%) Wind Barbs Highlight the 0^{o}C isotherm in blue

925 mb Package	Height contours and temperatures (same as **Table 8.3.**) Closed Highs and Lows with center height values Areas of convergence Isopleth in green or green color shade RH (area of 70% / 90%) High and low centers Highlight the 0°C isotherm in blue
Surface Package	Isobars at 4 mb intervals Fronts, troughs, pressure centers, and tropical cyclones Areas of precipitation

8.8. OWS Standard (FITL) Graphics Products.

8.8.1. Extended Forecast. OWSs provide a 120-hour forecast product for all TAF sites and other point locations documented with support agencies. **(T-1).**

8.8.1.1. The first 30 hours of this extended range forecast is extracted from the TAF. **(T-1).**

8.8.1.2. Days 2 – 5 (or longer) is extracted from meteorological models, and modified as required by a forecaster for significant weather events not properly specified. **(T-1).**

8.8.1.3. OWS post extended forecasts to their webpages at least once daily in a standardized, exportable format containing the following information:

8.8.1.3.1. Generalized sky condition/weather.

8.8.1.3.2. Maximum and minimum temperature.

8.8.1.3.3. Predominant wind condition.

8.8.1.3.4. Precipitation type.

8.8.2. OWSs will:

8.8.2.1. Generate product suite in **Table 8.6** valid at 3-hour intervals out to 30 hours using the following rule set. **(T-1).** All graphical products, except theater thunderstorm forecast, are valid at a point in time and consistent with the spatial resolution of the model selected by the OWS for its AOR and clearly labeled with the spatial resolution of the depicted weather parameters.

8.8.2.1.1. One hour prior to each valid period, update the next two product sets (e.g., next valid "Current" and "Current+3-hour"). Update additional product sets as deemed necessary. **(T-1).**

8.8.2.1.2. Create a new product set for the 30-hour point, every three hours. **(T-1).**

8.8.2.2. Produce model-rendered products from 33-120 hours or greater (as applicable) at the temporal resolution of the model. **(T-1).**

8.8.2.3. Produce Clouds and Horizontal Weather Depiction (HWDs) products from gridded data fields. **(T-1).**

Table 8.6. FITL Graphics Product Suite.

Products	***Weather Parameters***	***Threshold Values***	***Map Depictions***
Theater Icing Forecast **(Mean Sea Level (MSL))**	- Mesoscale icing outside thunderstorms. - Rime, clear (CLR) and mixed (MXD) - Surface - 18,000ft and 18,000 - 50,000ft (to the nearest 1,000ft)	- Light (LGT) - Moderate (MDT) - Severe (SVR)	- As defined in **Attachment 3**
Theater Turbulence Forecast (MSL)	- Mesoscale turbulence outside thunderstorms. - Mechanical, mountain wave (MTN Wave), and clear air turbulence (CAT) - Surface - 18,000ft and 18,000 - 50,000ft (to the nearest 1,000ft)	- Light (LGT) (Surface to 18,000 only. **Note:** If no requirement exists, OWSs may omit LGT) - Moderate (MDT) - Severe (SVR) - Extreme (EXTRM)	- As defined in **Attachment 3**
Theater Thunderstorm Forecast (MSL)	- Theater-scale convective activity - 3 hour time period	mum instantaneous areal coverage - Isolated (ISOLD): 1-2% - FEW: 3-15% - Scattered (SCT) 16-45% - Numerous (NMRS): >45%	- Maximum tops (MSL) - Amount of coverage Thunderstorm symbol (optional stand-alone thunderstorm prognosis)
Horizontal Weather Depiction above ground level (AGL)	- Ceiling and Visibility	AGL Areas: - 2,000ft/3SM (USAF) fixed-wing IFR)	- As defined in **Attachment 3**

Theater Surface Pressure, Fronts, and Weather Forecast	- Mesoscale surface pressure centers and values, fronts, troughs - Significant weather - Tropical cyclone positions (as required, from official tropical cyclone forecast centers).	- As displayed. Fronts maintained as long as air mass discontinuity exists	- As defined in **Attachment 3**
Theater Cloud Forecast	- Mesoscale depiction of ceilings above 5,000ft AGL extending to the tropopause	- Broken (BKN) or Overcast (OVC) cloud cover	- As defined in **Attachment 3**.

8.8.3. OWSs will employ standard forecast techniques for FITL graphic products and refine areas without causing the chart to be filled or covered in a way that confuses, impedes, or reduces the effectiveness of the chart. **(T-1).**

8.8.4. MSL Heights. All forecast heights on OWS thunderstorm, icing, turbulence products, and the cloud tops on theater cloud products are depicted using MSL values. **(T-1).** OWSs take into account the geography changes in the AOR to prevent forecast MSL bases below general terrain heights. **(T-1).** This does not include the small-scale changes in terrain heights (e.g., differences between mountain peaks in close proximity), which units integrate into the mission execution forecast process to further refine forecasts.

8.8.5. AGL Heights. The OWS HWD and theater cloud forecast products depict cloud bases as AGL height depictions. **(T-1).**

8.8.6. METWATCH and amendments to the FITL aviation hazards information. OWSs METWATCH and amend the aviation hazards information for the criteria listed in **Table 8.8** **(T-1).** Use perishable data (e.g., PIREPS, SIGMETS, AIRMETS, observations, radar data, and METSAT imagery) and NWP output available at forecast hours after the production cycle to METWATCH and amend products as required.

Table 8.7. Amendment Criteria for OWS Standard FITL Graphics Products

1. Moderate or greater icing incorrectly depicted in horizontal extent, vertical extent, type, intensity, or time of occurrence.
2. Moderate or greater turbulence incorrectly depicted in horizontal extent, vertical extent, intensity, or time of occurrence.
3. Lines or organized clusters of thunderstorms, not easily circumnavigated (usually described as numerous thunderstorms) incorrectly depicted on the forecast.
4. Thresholds listed in **Table 8.8.** incorrectly forecast.
5. Vertical extent incorrectly forecast by ≥2,000 ft below 10,000AGL, ≥5,000 ft above 10,000MSL.
6. Horizontal extent incorrectly forecast by ≥90 nautical miles.
7. Graphical depiction is not representative of existing or forecast conditions.

8.9. Automated Products. The 557 WW will manage automated products as listed in **Table 8.8 (T-1).** The 557 WW may produce additional automated products based on coordinated, validated and supported user requirements.

Table 8.8. 557 WW Automated Products.

Weather Parameters	*Minimum Threshold Values*
Freezing Level	Height of the freezing level in 2,000ft increments. **Note:** Freezing-level chart parameters may be combined with theater icing forecasts in the Standard OWS FITL Graphics suite.
Surface Wind	Wind plots in 5-knot intervals.
Surface Temperature	Base 0ºC, interval 3ºC. Units may substitute equivalent ºF temperatures.
Surface Wind Chill Temperature	Base -5ºC incremented every 5ºC below that value. **Note:** OWSs may request adjusted thresholds to meet mission requirements for Polar climatic zones in their AOR. Units may substitute equivalent Fahrenheit values provided the product legend clearly indicates units of measure.
Heat Stress Index	Base 25ºC incremented every 5ºC above that value. **Note:** OWSs may request additional heat stress products to meet mission requirements in the AOR (e.g., Fighter Index of Thermal Stress). Units may substitute equivalent Fahrenheit values provided the product legend clearly indicates units of measure.

8.10. Military Operation Area Forecast (MOAF) and Joint Operational Area Forecast (JOAF). Each regional OWS will use GALWEM grid extractions for the following weather elements: cloud cover, winds, temperature, visibility, turbulence, icing, and thunderstorms for use in mission planning and execution forecasts. **(T-1)**.

8.10.1. Development of a MOAF/JOAF is based on a SAR and capabilities for products and services derived from weather production units. **(T-1).** Development of a MOAF/JOAF for new contingences or exercises is done when requested by the AF component, or designated lead unit to the aligned OWS. **(T-1).**

8.10.2. MOAFs and JOAFs clearly identify heights as AGL or MSL. **(T-1).**

8.10.3. Alphanumeric MOAFs/JOAFs for higher-altitude flying areas (usually for altitudes above 10,000ft) and IFR Military Training Routes depicts forecast heights as MSL values. **(T-1).**

8.10.4. Amend MOAFs/JOAFs for the minimum criteria listed in **Table 8.9**. **(T-1).**

Table 8.9. Minimum Amendment Criteria for data MOAFs/JOAFs.

1. Vertical extent incorrectly forecast within 1,000 feet above and below for all higher-altitude MOAFs/JOAFs.
2. Horizontal extent incorrectly forecast within 25 miles either side for all higher-altitude MOAFs/JOAFs.
3. Representativeness for all MOAFs/JOAFs.

8.11. Meteorological Discussions .

8.11.1. Produce and disseminate standardized meteorological analysis and forecasts discussions based on the 00Z and 12Z synoptic analysis issued as soon as applicable model solutions are available. **(T-1).**

8.11.2. Use topics listed in **Table 8.10** in discussion products. The amount of detail required for each item depends on the degree of situational awareness required by the end users of the product.

Table 8.10. Minimum Items Included in OWS Discussion Bulletins.

1. Current air masses 2. Current upper air pattern 3. Significant synoptic and regional weather features 4. Significant weather features in current meteorological satellite imagery 5. Departures/deviations and identification of the NWP model Model verification	6. Hazardous weather in the AOR to include severe weather, turbulence, icing, precipitation, winds, low ceilings/visibilities, and other items deemed significant to the OWS forecaster 7. Space weather (if relevant to daily operations) 8. Pertinent OWS operations information (e.g., scheduled outages and product availability), if applicable

Chapter 9

SPACE WEATHER OPERATIONS

9.1. General . Space weather describes the conditions in space that affect the near-Earth space environment, to include satellites, aircraft, and ground based systems used by the military and civil sectors. Space weather is a consequence of the behavior of the Sun, its interaction with the nature of Earth's magnetic field and atmosphere, and the planet's location in the solar system.

9.2. 2d Weather Squadron (2 WS) 2 WS operates the DoD's only 24 hours, 7 days a week (24/7) Space Weather Operations Center (Space WOC) that operates on all enclaves. 2 WS:

9.2.1. Operates and maintains the Air Force's Solar Electro-Optical Observing Network. Develops and maintains local training plans.

9.2.1.1. Provides solar observations. **(T-0).**

9.2.1.2. Utilizes 5 global detachments to conduct 24 hours, 7 days a week situational awareness of the sun.

9.2.1.3. Maintains a space weather catalog on the AFW-WEBS Space Weather page, found here **https://weather.af.mil/confluence/display/AFWWEBSTBT/Space+Weather+Main+Page**, that describes all products issued. **(T-1)**

9.2.2. Ensures space weather modeling capabilities through the use of the Space Weather Analysis and Forecast System (SWAFS), and other applications/tools. **(T-1).**

9.2.2.1. Monitors other space and ground based sensors for space situational awareness. **(T-1).**

9.2.2.2. Collects and analyzes solar radio and optical data from its 5 global solar observatories to provide 24/7 space situational domain awareness of solar activity and its impact on the near-earth space environment. **(T-0).**

9.2.3. Provides and disseminates event level alerts and forecast and observed warnings impacting space operations and ground communications to DoD organizations, Intelligence Community, and other government agencies. **(T-0).**

9.2.4. Lead analysis unit for the DoD and NATO for space weather operations that provides routine bulletins, forecasts, notices and data for past, current and future state of space weather.

9.2.4.1. Analyzes the current state of space weather through the use of models, observations, and forecaster inputs, focusing on how space weather impacts the warfighter. **(T-0).** Produces global and regional events and impacts chart that depicts observed and forecasted solar, charged particle and geomagnetic events, and their impact on communications, satellite operations, space object tracking, high altitude flight and over the horizon radars. **(T-1).**

9.2.4.2. Produces situational awareness products, (e.g., scintillation, radio communications, and GPS impacts) tailored to warfighter needs.

9.2.5. Works closely in conjunction with other national space partners, including AFRL and national laboratories, to develop new sensing capabilities and modelling techniques. **(T-1).**

9.2.6. Acts as the lead unit for space weather anomaly attribution process and coordinates space anomaly assessments with the 21 OSS WF (21 OSS/OSW) and 614 CTS/DOW. **(T-1).**

9.2.7. Conducts space anomaly environmental assessments for the DoD, IC and other government agencies to determine, retrospectively, the likelihood that the natural environment caused an anomaly. **(T-0).** Upon notification of a space anomaly, saves all pertinent space weather data necessary to completely reconstruct the environmental picture at the time of the anomaly. **(T-1).**

9.2.8. Conducts space weather training to certify Space WOC personnel. **(T-1).** Conducts additional classes, as resources allow, to educate users on the impacts of space weather, including international space weather courses to further educate partner nations. **(T-0).**

9.2.9. Serves as the focal point for processing and responding to SARs for specialized space weather support. **(T-1).**

9.2.10. When notified of an incident, conducts Aircraft/Ground Mishap procedures for all mishaps involving space-segment assets (including during spacelift or on-orbit) as required. **(T-1).**

9.2.11. Conducts post-mission analysis, including space anomaly assessments, if required. **(T-1).**

Chapter 10

TROPICAL WEATHER OPERATIONS

10.1. General. Tropical cyclones pose a significant threat to lives, property, and operations. Military decision makers at affected installations are driven by directive to take time-phased actions to evacuate or shelter personnel and aviation assets that are largely influenced by forecast elements. OWSs provide detailed information based on the official track forecast in order to facilitate efficient and effective evacuation, survival, and post event reconstitution activities. Horizontal consistency between national centers, OWSs, AOC's, and installation-level weather personnel is critical to successful planning and execution of military operations driven by tropical cyclone events.

10.2. Procedures . OWSs and WFs fully exploit online official forecast resources provided by tropical cyclone forecast centers (e.g., the National Hurricane Center (NHC, Miami, FL), the Central Pacific Hurricane Center (CPHC, Honolulu, HI), and the Joint Typhoon Warning Center (JTWC, Pearl Harbor, HI). **(T-1).**

10.2.1. Units will not deviate from the broad overarching official forecast, but have leeway to depict weather impacts for their installation based on the localized effects expected. **(T-1).** Integration into local EM and understanding of tripwire events for the installation are crucial for decision makers. The following are examples of circumstances that could require a deviation from official forecasts:

10.2.1.1. Warnings and advisories issued for outer-band convective activity (away from the storm center) may exceed forecast maximum wind for that time period.

10.2.1.2. OWSs and WF/Dets may adjust forecast wind speeds if terrain, foliage, and land use data for an affected location indicates higher or lower wind speeds than originally forecasted.

10.2.2. OWS analyze moderate to severe flight hazards in and near tropical cyclones based on storm intensity in the aviation hazards information set so that these hazards are depicted on visualization products.

10.2.3. OWSs perform METWATCH responsibilities and serve as the primary liaison between the tropical cyclone forecast centers and units.

10.2.4. Queries for tropical storm information from non-operational sources are directed to publically available products from responsible forecast agencies (NWS, NHC, etc.).

10.3. Tropical Cyclone Threat Assessment Product (TC-TAP). The purpose of the TC-TAP is to provide a standardized product for units to use in assisting installation commanders and EM personnel in making decisions on the evacuation and sheltering of aircraft and personnel, and other mitigation actions.

10.3.1. TC-TAP is generated directly from the storm track and intensity data provided in the official forecast from the designated agency. OWSs collaborate with supported units to identify and communicate potential variances from the TC-TAP output. Deviations from the TC-TAP output are included in theater forecasts, threat assessments, TAFs and other forecast products as necessary.

10.3.2. The TC-TAP contains, at a minimum, the following:

10.3.2.1. Time and date product was produced and the NHC/CPHC/JTWC bulletin number/ identifier used to create the product. **(T-1).**

10.3.2.2. Onset and duration of sustained 35-knot and 50-knot winds. **(T-1).**

10.3.2.3. Peak wind and time of occurrence, including gusts. **(T-1).**

10.3.3. Onset and duration of operationally significant (locally determined) crosswinds, including gusts for the primary instrumented runway. **(T-1).** Use 25-knot crosswinds as the default unless specified differently for the installation. **(T-1).** Wet runways may change the crosswind factor as well.

10.3.3.1. Closest point of approach of the storm relative to the installation. **(T-1).**

10.3.3.2. Forecast cone product. **(T-1).**

10.4. Preparation/Dissemination of TC-TAP.

10.4.1. The standardized software for producing TC threat assessments is the tropical cyclone software contained in the baseline OWS Production System.

10.4.2. The TC-TAP is valid through a minimum of 96 hours and updated as new information is received from the NHC, CPHC, or JTWC.

10.4.3. Develop procedures to expeditiously disseminate the TC-TAP information to all applicable organizations. Ensure TC-TAP information is consistent from initial dissemination through actual posting of the information on the webpage. **(T-1).**

10.5. Integration. Units must fully utilize the tropical cyclone information provided by the aligned OWS (e.g., TC-TAP) derived from specialized tropical forecast organizations. **(T-1).** Authorized deviations are indicated in paragraphs **10.2** and **10.5.2**-**10.5.3**.

10.5.1. Units provide tropical cyclone forecasts and updates to commanders and supported organizations as required for mission execution decisions such as evacuation and force protection. **(T-1).**

10.5.2. Use the MEFP to tailor the official tropical cyclone forecasts into a mission specific forecast weather product for their supported units. **(T-1).** Tailoring may include local effects of vegetation/ground cover, terrain, and position relative to the storm.

10.5.3. Inland locations may often require the frictional TC-TAP application.

10.5.4. Provide the necessary forecast services/products required for installation commanders to determine or declare a Tropical Cyclone Condition of Readiness and Hurricane Conditions. **(T-0).**

10.5.5. Follow installation public affairs policies and procedures regarding the release of tropical cyclone forecasts to the general public.

Chapter 11

KQ TEMPORARY LOCATION IDENTIFIERS (KQ IDS)

11.1. General. The 557 WW, acting on behalf of all the United States military services, assigns special use ICAO temporary location identifiers beginning with KQ, for use by deployed units supporting real-world contingencies; deployed/in-garrison units providing support during exercises; classified operating locations; and units that have requested, but not yet received a permanent location identifier. **(T-1).**

11.2. Requesting KQ IDs. Weather organizations request KQ IDs through the lead METOC element to 557 WW's KQ ID Manager.

11.2.1. To reach the KQ ID Manager during normal duty hours (non-holiday weekdays 0700L-1600L, U.S. Central Time):

11.2.1.1. ORG MAILBOX ADDRESSES (use to ensure quickest response):

11.2.1.2. NIPRMail: **557WWKQ@US.AF.MIL**

11.2.1.3. SIPRMail: **usaf.offutt.557-ww.mbx.afwakq@mail.smil.mil** (not monitored constantly – follow up with NIPR email or phone call)

11.2.1.4. Commercial Phone: (402) 232-3162 DSN Phone: 272-3162.

11.2.2. During non-duty hours (after 1600L/before 0700L, U.S. Central Time, weekends and holidays) or in case of emergency:

11.2.2.1. 557th WW Global Mission Support Cell (GMSC) 24x7 Contact Information:

11.2.2.2. NIPR email: **557WW.GMSC@us.af.mil**

11.2.2.3. SIPR email: **usaf.offutt.557-ww.mbx.557-ww-gmsc@mail.smil.mil**

11.2.2.4. Commercial Phone: 402-294-2586 option 1 DSN Phone: (312) 271-2586 option 1.

11.2.3. All requests for KQ IDs should be made as far in advance as possible to ensure timely issuance.

11.2.4. Requestors, through the lead METOC element or SMO/JMO, contact the 557 WW KQ ID manager who will then provide requester with a KQ ID request template document. The requestor completes the document with as much information as possible, and returns it to KQ ID manager, who then issues/activates the KQ ID.

11.2.5. For peacetime KQ identifier requests, the Air Force lead METOC element is normally the MAJCOM Functional Manager, the Navy lead METOC element for KQ requests is normally Fleet Numerical METOC Center (FNMOC), and the Marine Corps lead element is the Marine Expeditionary Force SWO.

11.2.6. For wartime and contingency operations, the lead METOC element is the SMO responsible for establishing the weather force for the particular contingency. The SMO may designate a JMO to execute this responsibility.

11.2.7. Requestors, through the lead METOC element or SMO/JMO, provide the following information:

11.2.7.1. Start and stop dates (if known).

11.2.7.2. Name, organizations, e-mail address, and DSN/commercial phone number of POC.

11.2.7.3. Classification of location and supported operation or exercise.

11.2.7.4. Name of exercise, test, contingency, etc.

11.2.7.5. Releasability (for non-DoD use or handled as sensitive non-releasable).

11.2.7.6. Location name, latitude, longitude, and elevation; must specify whether in degrees/minutes/feet or degrees/decimal/meters. **NOTE:** 557 WW converts all lat/lon/elev readings into degrees/decimal/meters.

11.2.7.7. Runway headings for airfield primary runways (if available).

11.2.7.8. Observation equipment to be used.

11.2.7.9. Military Grid Reference System (MGRS) coordinates (if known).

11.2.7.10. WMO number/block station number (if assigned).

11.2.8. Once this information is provided, the KQ ID manager issues a new KQ ID. If mission and time constraints limit the amount of information the requestor can provide or the ability to submit the request through the lead METOC element, the KQ ID manager issues a KQ ID and follow up with the POC when time permits.

11.2.9. Once the KQ ID is no longer required, the requestor contacts the KQ ID manager and the lead METOC element to discontinue the use of identifier.

11.3. Classified KQ Compromise. Weather Airmen will immediately report compromised classified KQ IDs to the 557 WW KQ ID manager. **(T-1).**

11.4. KQ ID Use. Units issuing surface observations or TAFs will:

11.4.1. Use established ICAO location identifiers for enduring airfields coordinated with the host nation, if required. **(T-1).** KQ-identifiers will be used temporarily until coordination is complete or the requirement to use a KQ-identifier has passed. **(T-2).**

11.4.2. Use KQ-identifiers for temporary, exercise, or classified locations, or as supplemental information at locations with an indigenous observation. **(T-1)**.

11.4.2.1. Unclassified KQ-information qualifies as operations sensitive and combat mission sensitive information, and access is controlled according to DoDI 8520.03, *Identity Authentication for Information Systems*.

11.4.2.2. Restrict non-DoD (e.g., allied/coalition) access to only the specific KQ-information for the operation in which they participate; as specified by the CCDR or initial requestor of the KQ-identifier. Make all efforts to restrict non-DoD member access to only the specific KQ-information for the operation in which they participate when used in support of allied/coalition operations. **(T-1).**

11.4.2.3. Unclassified documents, presentations, or reports based on TAFs or surface observations issued under KQ-identifiers are protected to comply with AFI 10-701, *Operations Security*, when linked to a location identifier.

11.4.3. Restrict KQ-identifiers to military use. **(T-1).** For operations where agencies require observation data, such as humanitarian assistance or disaster relief operations, coordinate data release requirements with KQ ID managers.

11.4.4. Due to their temporary nature, do not use KQ IDs in any permanent documentation/regulatory guidance such as SOPs, OPORDs, and FLIPs etc. This is to avoid use of KQ IDs after they have been reclaimed/deactivated. If a placeholder needs to be in any of those types of documents, please insert language like, "KQ temporary location identifier (KQ ID) requirements/requests need to be coordinated through the lead/senior METOC officer for the operation/exercise/test to the 557WW KQ ID Manager (**AFWAKQ@us.af.mil**)

11.5. KQ ID Deactivation. Once a KQ site is no longer in operational use, the KQ-information and reports (e.g., archived observations, climate summaries, etc.) for unclassified sites may be released unless otherwise directed by the original requesting unit/CCDR. The information and reports should refer to the actual location and not the temporary/supplemental KQ-identifier. Classified sites follow guidance set by the appropriate classification authority.

Chapter 12

SUPPORT ASSISTANCE REQUESTS, REALLOCATION OF RESOURCES, WAIVERS, AND NEW WEATHER REQUIREMENTS

12.1. Support Assistance Request (SAR). A SAR is a request for specialized environmental support or standard weather products or services that can be satisfied within the existing capability of the Air Force weather enterprise and architecture to support a mission need. AF weather organizations and other supported units submit a SAR when requesting specialized terrestrial, space, or climatological services from supporting weather organizations (e.g., 2 WS, 14 WS), or specialized theater-level support from regional OWSs for their respective AOR.

12.1.1. Provide as much detail as possible to clearly state the need. If there is a problem in providing the support, the supporting weather organization or OWS contacts the requestor to clarify the requirement and to discuss alternatives.

12.1.2. To determine the aligned OWS in an AOR, refer to AFVA 15-137.

12.1.3. Supported AF, Army, Space Force, and government organizations may submit SARs to meet mission needs. If the SAR is time sensitive, organizations should give servicing weather units time to work the request effectively. For recurring support, organizations should codify support requests in appropriate source documents (e.g., OPLAN, EXORD, support agreement) or staff their requests through supported higher headquarters (e.g., MAJCOM, Office of the Secretary of Defense (OSD), CCMD) to the supporting higher headquarters for appropriate advocacy and resourcing. Requests for weather capabilities in support of CCMD missions should be formally submitted via the joint orders process in accordance with CJCSI 3810.01F, *Meteorological and Oceanographic Operations*.

12.1.4. Weather personnel may direct units or agencies needing specialized support to the appropriate supporting weather organization to guide them through the SAR process.

12.1.5. The 557 WW satisfies SARs for supported units' needs for a wide variety of weather data, products, and services. If a 557 WW unit is unable to provide the requested support, they will inform their chain of command (1 WXG or 2 WXG) as soon as practical. **(T-3).** Upon notification, 1 WXG or 2 WXG (as appropriate) will attempt to reallocate or reprioritize resources to satisfy the SAR. **(T-3).** If they are unable to satisfy the SAR, they will inform 557 WW and advise the supporting OWS or specialized weather unit to non-concur with the SAR and send a formal response to the requesting unit or agency to inform them of the shortfall. **(T-3).** The requesting organization will elevate the denied request, as required, via their MAJCOM weather functional for resolution and awareness. **(T-3).**

12.1.6. Foreign (Allied or Partner) Military Operations Support and Data Requests. Requests for support (e.g., products or data) to foreign (allied or partner) military operations must be validated by the supported CCMD/J5 as covered by an existing mil-mil or gov-gov data sharing or technical agreement. **(T-0)**. If not, then supported CCMD will staff the request for approval by OSD and SAF/IA to enable lawful expenditure of DoD resources for foreign entities (foreign military assistance or security cooperation). **(T-0)**. For example, a request from USAFE-AFAFRICA (beyond an existing data or technical agreement) for weather support to an ally must be staffed from USAFE-AFAFRICA to EUCOM to OSD to Joint Staff to J3 prior to being sent to ACC then 557 WW for completion.

12.1.7. Contractor Data Exchange Requests and Contractor-Owned, Contractor-Operated Mission Support. Requests for support that result in delivery of products, data, or services to contractor-owned/contractor operated entities, or are sent for contractor-operated mission support, must be staffed through the supported higher headquarters (e.g., CCMD, OSD, MAJCOM) and validated by the applicable contracting office/officer. **(T-1).** Before providing weather support to contractors, weather organizations will verify the government's responsibility to provide weather support to said contractor. **(T-3).** Weather organizations can verify by engaging the appropriate HHQ (e.g., MAJCOM or CCMD), consulting the applicable contracting office, officer, or representative, and reviewing the actual contract or associated Tasking Orders. If the contract or associated documents (e.g., TASKORDs) do not directly or indirectly specify the government will provide support, weather organization will not provide weather support until the contract is modified to address weather support requirements in accordance with AFI 64-105 and the Weather Operational Contract Support Smart Card located on the AFICC Operational Contract Support Portal (**https://intelshare.intelink.gov/sites/afica-ocs-portal/SitePages/Home.aspx**). **(T-3).**

12.2. Unclassified SARs: Submit requests for unclassified support directly to the appropriate supporting weather organizations or OWS using the SAR function on the applicable webpage. Organizations may also submit requests for unclassified support via telephone, fax, or e-mail when the applicable webpage is not available.

12.3. Classified SARs: Submit requests for classified support using the SAR function on SIPRNET or other classified dissemination systems. Organizations may also submit requests for classified support via secure telephone, fax, or e-mail when the applicable webpage is not available.

12.3.1. DELETED

12.3.2. DELETED

12.3.3. DELETED

12.3.4. DELETED

12.3.5. DELETED

12.3.6. DELETED

12.3.7. DELETED

12.4. Reallocation of Resources and Waivers. In the event an OWS is unable to provide standard products and services to supported units, they will inform the 1 WXG of the shortfall. **(T-3).**

12.4.1. The 1 WXG has the authority to use their own RM assessment to balance workload across OWS geographic boundaries as needed to mitigate surge requirements, enhance daily operations, and for back-up of tier 1 products. **(T-2). Note:** Tier 1 products and services support wartime, contingency or force protection missions and must be capable of being backed up via immediate transfer to backup organization. Tier 1 products and services include: Combined/Joint Operations Area Forecast (C/JOAF); forecast WWA's, space weather warnings; flight weather briefings; MOAF; Control Weather Products (CWP); flight weather hazards in the combatant command AOR; TAFs; CBRN hazard products (CDMs/EDMs); and classified products and services.

12.4.2. An OWS, or other weather squadron, will submit a waiver when it can no longer meet requests for standard products and services. **(T-1).**

12.4.3. The MAJCOM requesting standard products and services may leverage host nation and coalition WPs that meet ICAO and WMO requirements in lieu of AF weather standard products and services in the event waivers are approved**.**

12.4.4. Weather flights, detachments and operating locations will submit waivers if they do not have the resources required to issue WWAs. **(T-1).** Request waivers in accordance the *Purpose* paragraph of this document and AFI 33-360.

12.5. Weather Requirements. Weather requirements (e.g., ACC's Weather Requirements Request) are those capabilities not already available within the existing weather enterprise. Solutions for these requirements typically require a long lead time and may impact the weather enterprise through changes to doctrine, organization, training, materiel, leadership, personnel, facilities, policy or a combination thereof. They may drive adjustments to the current fiscal year funds execution or impose portfolio tradeoffs within the near-term, or consideration for future planning years within the POM.

12.5.1. Weather organizations with new requirements must submit their request through the chain of command to their MAJCOM functional team for validation before submission to the lead command requirements division. **(T-1).** These requests must be established by, derived from, and traceable to assigned roles, missions, functions and operations, and such needs are fully understood in the context of associated Concept of Operations. **(T-1).**

12.5.2. Most weather requirements are managed by ACC/A5W. Space-based environmental monitoring requirements are managed by AFSPC/A5FW. Refer to AFPD 10-9, *Lead Command Designation and Responsibilities for Weapon Systems*, for authoritative lead command designation.

Chapter 13

WEATHER TECHNICAL READINESS PROGRAM

13.1. Overview. The weather technical readiness program measures performance of weather functional capabilities and processes in support of AF service core functions. Metrics measure operational performance of end-user requirements, determine trends, and provide analysis data for supported organizations and senior leaders. The weather metrics program focuses on performance measurement to provide timely, relevant, accurate, and consistent environmental information to decision makers and commanders at all levels, and to identify potential improvement areas. Commanders should use these metrics as a tool to assess their weather readiness and evaluating their ability to meet mission essential tasks in the Defense Readiness Reporting System. Weather metrics include:

13.1.1. Weather Watch, Warning and Advisory (WWA) Verification (WARNVER): A threshold-based verification program that reports WWA accuracy and timeliness by measuring whether the criteria stated in the WWA were met or not met according to the predetermined desired lead time (DLT). Organizations producing operational forecast WWAs will:

13.1.1.1. Establish and maintain a WARNVER program to assess WWA performance, analyze trends and identify/address forecast technique and/or training shortfalls as required. **(T-3).**

13.1.1.2. Collect and report WARNVER measures of performance (MOPs) for supported locations according to **paragraph 13.2**. **(T-3).**

13.1.1.3. Assess operational performance using WARNVER MOPs, identify and document performance trends at the organization level. **(T-3).** In addition, organizations will assess performance of individual weather personnel, identify improvement areas, and direct performance improvement measures or additional training as required. **(T-3).**

13.1.1.4. Provide WARNVER metrics for all supported locations to parent and supported MAJCOMs and to their supported unit commanders as applicable. **(T-3).**

13.1.1.5. When resources permit, create a monthly report that identifies WWA performance shortfalls and corrective actions taken. Include areas of exceptional performance so leadership can cross feed them to other organizations. Units should send these reports to the parent MAJCOM and supported unit commanders as applicable.

13.1.2. Terminal Aerodrome Forecast (TAF) Verification (TAFVER): A threshold-based verification program that reports TAF accuracy by verifying forecast conditions against observed conditions including specific mission-critical weather phenomena and thresholds. Organizations producing TAFs as specified in **paragraph 7.11** will:

13.1.2.1. Establish and maintain a TAFVER program to assess TAF performance, analyze trends, and identify/address forecast technique and/or training shortfalls as required. **(T-3).**

13.1.2.2. Report TAFVER MOPs on all Forecaster-in-the-loop (FITL) TAFs in accordance with **paragraph 13.3** for both the model-generated (no FITL) and the final FITL TAFs. **(T-3).** OWS(s) will collect and report TAFVER MOPs for all model-generated TAFs within their Area of Responsibility (AOR). **(T-3).**

13.1.2.3. Assess performance using TAFVER metrics and document performance trends at the organization level. **(T-3).** In addition, organizations will assess performance of individual weather personnel, identify improvement areas, and direct additional training as required. **(T-3).**

13.1.2.4. Provide TAFVER metrics for all supported locations to the parent and supported MAJCOMs and to supported unit commanders as applicable. **(T-3).**

13.1.2.5. Cross-feed any improved verification methods or tools developed to the parent MAJCOM. **(T-3).**

13.1.3. Numerical Weather Model (NWM) Verification (MODVER): A threshold-based verification program that reports weather model accuracy by verifying model forecasts against observed weather conditions. Organizations producing Numerical Weather Model Depictions will:

13.1.3.1. Establish and maintain a MODVER program to measure product utility, analyze trends, establish benchmarks, and implement changes as required. **(T-3).**

13.1.3.2. Collect, analyze, and report MODVER metrics according to **paragraph 13.4** and any additional guidance provided by MAJCOMs and/or chain of command. **(T-3).**

13.1.3.3. Provide MODVER results to the parent MAJCOM and supported unit commanders as applicable. **(T-3).**

13.1.3.4. Develop, implement, and document internal processes to use MODVER metrics to identify model performance strengths/weaknesses, operations shortfalls, and to include standardized products and conditional verification (e.g., based on synoptic situations). **(T-3).** Document findings and report them to the parent MAJCOM. **(T-3).**

13.1.3.5. Make MODVER MOPs and MODVER assessments (i.e., consumable "forecaster-ready" interpretations of MOPs) readily available (e.g., online) to supported units and headquarters functional staffs. **(T-3).** Coordinate the means of achieving this through the parent chain of command. **(T-3).**

13.1.3.6. Maintain an active and documented unit-level program for evaluating and integrating new and appropriate verification metrics to support the AF fielding of combat acquisitions and new numerical weather modeling capabilities. **(T-3).** At a minimum, apply and evaluate the feasibility and usefulness of Optional NWM verification MOPs listed in **Table A7.8** and **Table A7.9**. **(T-3).**

13.1.3.7. Request AF/A3W technical assistance if needed to analyze and exploit results from MODVER MOPs. **(T-3).**

13.2. WARNVER Guidance and Procedures. Warnings and Watches are special notices of weather events or conditions of such intensity as to pose a hazard to life or property for which the supported organization/customer has documented protective posture or protective actions. Forecast Advisories are special notices of weather conditions that have potential to impact operations and safety. WARNVER uses objective measurements to quantify performance of WWA issuance and provides technical readiness insight.

13.2.1. WARNVER definitions are provided in **Attachment 7**, **Table A7.1** and WARNVER standards are included in **Table 13.1** WARNVER will include the minimum MOPs as defined in **Table A7.2**. **(T-3).**

13.2.2. Units producing warnings, advisories and lightning watches will verify them according to **paragraph 6.3**. **(T-3).**

13.2.3. Units will calculate and report MOPs for all WWA criteria individually, to include raw monthly data used for all calculations. **(T-3).**

13.2.4. Combined MOPs are calculated by including all forecast warnings, forecast advisories, and lightning watches into a single metric. The raw number of WWAs is totaled to create the overall average MOP. Do not use the average score for each MOP category when calculating the single overall average MOP. **(T-3).**

13.2.4.1. The combined warning MOP is calculated by including only forecast warnings.

13.2.4.2. The combined forecast advisories MOP is calculated by including all forecast advisories.

13.2.4.3. The combined watch MOP is calculated by including only lightning watches.

13.2.5. MAJCOMs and subordinate organizations may develop additional MOPs and include them with the required monthly data.

Table 13.1. WARNVER Standards.

MOP	Standard
Met DLT	Greater than, or equal to 75%
Positive Lead Time	Greater than, or equal to 90%
False Alarm Rate (FAR)	Less than, or equal to 40%
Mean Timing Error (MTE)	To be determined after sufficient data is collected and analyzed to establish a credible standard.
Negative Lead Time	Less than, or equal to 10%
NOTE: RNI WWA percentages are tracked internally and reported monthly according to Paragraph 13.1.1.5 if they occur.	

13.3. TAFVER Guidance and Procedures. Timely, relevant, accurate, and consistent TAFs provide meteorological information and form the foundation for mission execution, flight planning, and command and control activities for a specific aerodrome complex. TAFVER uses objective measurements to quantify the accuracy of TAF production. The results of TAFVER provide information on forecast strengths, areas for improvement, recommended training areas, value added by the FITL, and overall technical readiness. TAFVER is based on observed conditions throughout the valid period of the TAF.

13.3.1. Evaluate the draft TAF generated by the model (if applicable) and the final FITL TAF. **(T-3).**

13.3.2. Evaluate TAFs using all available observations. **(T-3).**

13.3.3. Measure performance for all TAF change groups that are forecast, becoming (BECMG), temporary (TEMPO), and from (FM). Determine if each change group was correctly forecast or incorrectly forecast for each hour. **(T-3).**

13.3.3.1. For a BECMG group to verify, forecast values can change up to 30 minutes before the start time and up to 29 minutes after the end time of the date/time group and must occur for at least 31 minutes each hour. **(T-3).**

13.3.3.2. For a FM group to verify, forecast values change at the time specified and must occur for at least 31 minutes each hour. **(T-3).**

13.3.3.3. For a TEMPO group to verify, forecast values change at the time specified and must occur at least once per hour, last less than 30 consecutive minutes and less than 30 aggregate minutes each hour, and last less than half the entire TEMPO period when all instances are totaled. **(T-3).**

13.3.4. Critical Success Index (CSI) is introduced in this Chapter and also used in Tables **A7.4 and A7.8** CSI is based off the 2x2 contingency matrix as shown in **Table 13.2**.

Table 13.2. 2x2 CSI Contingency Matrix.

2x2 Contingency Matrix	**Forecast Criteria Event**	**Forecast Non-criteria Event**
Observed Criteria Event	A: Hit	B: Miss
Observed Non-criteria Event	C: False Alarm	D: "Correct Rejection"
Criteria events are significant / mission impacting weather phenomena. Non-criteria events are weather conditions that do not impact customers. CSI is focused on the correct forecasts of criteria events and is defined as: CSI = A / (A+B+C) (CSI Formula)		

13.3.5. TAFVER criteria definitions are listed in **Table A7.3** Compute TAFVER MOPs and technical readiness metrics, according to **Table A7.4** and **Table A7.5** for all groups that are forecast in the initial FITL TAF. **(T-3).** The initial FITL TAF is valid at the issue time; amendment scoring is not required.

13.3.6. MAJCOMs and subordinate organizations may develop additional TAFVER MOPs and technical readiness metrics as required and include them in monthly reports.

13.3.7. AF/A3W will determine TAFVER standards in the future as automated verification tools are fielded and reports of MOPs in this chapter are analyzed to determine appropriate standard values. AF/A3W will re-issue, revise, or publish an interim change to this publication when standards are established.

13.4. MODVER Guidance and Procedures. Timely, relevant, accurate and consistent numerical weather model predictions provide a significant part of the foundation for meteorologists to build mission execution, flight planning and command and control activities for large- and small-scale geographic areas. MODVER uses a significant amount of objective measurements to quantify the accuracy, skill, value, and performance of weather models. MODVER results provide information on weather model strengths and weaknesses, help scientists and decision makers identify areas for improvement, and support strategic partnerships through the application and reporting of regional and international MOPs. MODVER metrics inform decisions, but do not provide enough information to make the decision. An empowered human analyzes metrics in relation to the overall question and then makes an informed, data-based decision.

13.4.1. MODVER is based on a comparison of forecast weather model conditions and those observed weather conditions throughout the model valid period. Units that create weather model predictions will use statistical analysis to create MOPs and standards for the models. **(T-3).** The MOPs will be created to compare models to standards of performance, in **Table A7.7**, **Table A7.8** and **Table A7.9**, as applicable.

13.4.2. AF-led modeling efforts with international and or interagency partners may require specific MOPs not listed in the aforementioned tables. AF/A3W will direct agencies to report any additional MOPs at the level of detail and frequency required through the applicable MAJCOM.

13.4.3. Units that create weather model predictions will evaluate forecast model direct output and derived forecast variables using the appropriate observations sources, to include station-based, gridded analysis data, and/or remotely sensed (e.g., satellite, radar). **(T-3)**.

13.4.4. Units that create weather model predictions will establish and employ automated and/or manual quality control procedures on observational data prior to use in MODVER and scientifically determine if the observation source is adequate for the purpose of MODVER. **(T-3)**.

13.4.5. Units that create weather model predictions will evaluate multiple types of MOPs. **(T-3)**. **Table A7.7** lists the minimum MOPs to be used for all numerical weather model (NWM) output. However, these should almost always be supplemented by additional MOPs appropriate for the NWM characteristics and phenomenon being predicted. Suggested supplemental MOPs may include but are not limited to those listed in **Table A7.8** (for deterministic NWM output) and **Table A7.9** (for stochastic NWM output).

13.4.5.1. Employ scale and physically appropriate MOPs. Traditional approaches to MODVER (i.e., precise matching of a single observation point to a single forecast point, contingency table, root mean square error metrics, etc.,) do not adequately assess the quality or value of high resolution models (i.e., model grid-spacing less than 5 km, a.k.a. “kilometer scale”) and may mask poor representation problems with coarse resolution models.

13.4.5.2. Evaluate probabilistic model forecasts (e.g., ensemble output) with appropriate MOPs.

13.4.5.3. Employ spatially or object aware MOPs for forecast model direct output and derived variables, as appropriate. Neighborhood and spatially or object-aware MOPs more closely examine a model’s storm structure performance and organization, key elements in an assessment of model’s ability to resolve features at all appropriate scales (i.e., convective to synoptic).

13.4.5.4. Units that create weather model predictions will, at a minimum and to maintain a consistent baseline, compute the MOPs listed in **Table A7.7** for the indicated parameters at forecast hours of 6, 12, 24, 48, 72, and 120 for a global model. **(T-3)**. At a minimum, verify higher-resolution limited-area models at these same forecast hours excluding the hours beyond the length of the forecast run (i.e., verify a limited-area model that extends to 48 hours at forecast hours of 6, 12, 24, and 48). **(T-3).** Include additional variables, levels, and forecast hours as appropriate for the standardized MOPs listed in **Table 7.2** and

any supplemental MOPs. **(T-3).** Variables may be direct from the model output (e.g., temperature, moisture, wind) or derived (e.g., visibility, max wind gust).

13.4.5.5. When selecting supplemental MOPs, make selections appropriate for the physical scale of the primary phenomena being predicted, as well as the intended purpose of the NWM output. Many traditional approaches to MODVER (i.e., precise matching of a single observation point to a single forecast point, contingency table, root mean square error metrics, etc.) inherently reward coarse resolution output's lack of small-scale features, which often punish high-resolution models if not located and timed precisely. In some machine-to-machine applications of NWM output (e.g., flight level winds), a lack of small-scale features may not be an issue, and traditional metrics may be suitable. Conversely, if the NWM output is used for predicting severe weather or other small-scale features, supplemental MOPs are necessary to adequately assess NWM performance. This is especially true when the NWM output is used as a tool for assessing the threat of extreme or small-scale events.

13.4.5.6. If a primary purpose of the NWM output is to predict "events" (thunderstorms, high winds, dust storms, tornados, etc.), employ spatially- or object-aware MOPs such as the Fractions Skill Score or MODE listed in **Table A7.8** These MOPs more closely examine a model's performance with regards to storm structure and organization, key elements in its ability to resolve features at all appropriate scales (i.e., convective to synoptic).

13.4.5.7. Although **Table A7.9** lists commonly used MOPs for stochastic NWM output, it is also possible to apply deterministic MOPs from **Table A7.7** to stochastic output, which might be desirable when assessing the added value of an ensemble. This is especially useful for NWM severe weather predictions using spatially- or object-aware MOPs. Deterministic verification of an ensemble can be performed by using the ensemble mean or a certain ensemble probability threshold as a deterministic forecast.

13.4.6. Subjective MOPs.

13.4.6.1. The objective MOPs described in **paragraph 13.4.5** are repeatable, require little to no interpretation, and are generally preferable for routine NWM performance assessments. However, in some instances, subjective verification is useful to compliment objective MOPs to capture aspects of model performance not easily defined by an equation.

13.4.6.2. Subjective verification relies on qualitative interpretation of NWM products and is based on thorough knowledge of meteorology and modelling and on experience gained in operational forecasting. It may be useful for evaluating derived and other unique meteorological parameters for which there is limited verification data. For instance, subjective verification may turn to non-traditional observations, satellite data, derived sounding products, or other data sources to qualitatively evaluate NWM predictions.

13.4.6.3. Subjective verification is best used when comparing two or more different NWM outputs. For example, a valid subjective MOP can be attained by having a group of experienced weather personnel use two different NWM outputs for multiple days, and having each individual subjectively grade the NWM output on a scale from 1 to 10 for how useful it was to the forecast process.

13.4.6.4. Subjective verification is far more useful when paired with objective MOPs to the extent possible. It also serves to independently corroborate and evaluate traditional and newer non-traditional objective methods to ensure verification procedures are performing as desired.

13.4.6.5. When performing subjective verification, units will maintain adequate documentation of the evaluation, methodology, and justification. **(T-3).** Since subjective verification does not always entail rigidly-defined evaluation criteria, documentation is the only way to ensure key elements of the results are not misinterpreted over time.

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Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

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Abbreviations and Acronyms

AAR—After Actions Report

ACC—Air Combat Command

AF—Air Force

AEF—Air and Space Expeditionary Forces

AFDPO—Air Force Departmental Publishing Office

AFI—Air Force Instruction

AFOG—Air Force Operations Group

AFMAN—Air Force Manual

AFMD—Air Force Mission Directive

AFP—Analysis and Forecast Program

AFPAM—AF Pamphlet

AFPD—Air Force Policy Directive

AFRC—Air Force Reserve Command

AFRL—Air Force Research Laboratory

AFVA—Air Force Visual Aid

AFW—Air Force Weather

AFWTL—Air Force Weather Technical Library

AGL—Above Ground Level

ALOHA—Area Locations of Hazardous Atmosphere

AMC—Air Mobility Command

ANG—Air National Guard

AOB—Airfield Operations Board

AOC—Air Operations Center

AOL—Alternate Operating Location

AOR—Area of Responsibility

AOS—Air Operations Squadron

AIRMET—Airmen's Meteorological Information

AP—Available Points

ASCC—Army Service Component Command

ATC—Air Traffic Control

ATT—Air Transportability Training

BCT—Brigade Combat Team

BECMG—Becoming

BKN—Broken

BS—Brier Score

C/JFACC—Combined/Joint Forces Air Component Commander

C2—Command and Control

C4ISR—Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance

CAC—Combined Arms Center

CAMEO—Computer Aided Management of Emergency Operations

CARCAH—Chief, Aerial Reconnaissance Coordination, All Hurricanes

CAT—Category

CBRN—Chemical, Biological, Radiological, Nuclear

CBRNE—Chemical Biological Radiological Nuclear, and High Yield Explosive

CBS—Commission for Basic Systems

CCMD—Combatant Command

CCDR—Combatant Commander

CDM—Chemical Downwind Message

CFETP—Career Field Education Training Plan

CIF—Central Issue Facility

CIG—Ceiling

CLR—Clear

COMAFFOR—Commander Air Force Forces

CONUS—Continental United States

COOP—Continuity of Operations Procedures

COP—Common Operating Picture

C-NAF—Component-Numbered Air Force

CPHC—Central Pacific Hurricane Center

CRF—Contingency Response Force

CRG—Contingency Response Group

CRPS—Continuous Ranked Probability Score

CSI—Critical Success Index

CWP—Control Weather Products

CWSS—Combat Weather Systems Squadron

DELETE AFFOR—Air Force Forces

DELETE FM—Flight Manager

Det—Detachment

DLT—Desired Lead Time

DOD—Department of Defense

DPD—Dew point Depression

DTG—Date Time Group

DZ—Drop Zone

EDM—Effective Downwind Message

EOC—Emergency Operations Center

ESF—Emergency Support Function

EWXS—Expeditionary Weather Squadron

EXORD—Exercise Order

EXTRM—Extreme

FA—False Alarm

FAM—Functional Area Manager

FAR—False Alarm Rate

FEW—Few

FITL—Forecaster In The Loop

FLIP—Flight Information Publication

FM—From

FOA—Field Operating Agency

FRM—Forecast Reference Material

FWB—Flight Weather Brief

GALWEM—Global Air Land Weather Exploitation Model

GCC—Geographic Combatant Command

GDSS—Global Decision Support System

GHOC—Global Hawk Operations Center

GTE—Greater Than or Equal To

HF—High Frequency

hPa—Hectopascal

HSF—Human Space Flight

HQDA—HQ Department of the Army

HWD—Hazardous Weather Depiction

IC—Intelligence Community

ICAO—International Civil Aviation Organization

IFM—Integrated Flight Management

IFR—Instrument Flight Rules

IPB—Intelligence Preparation of Battlespace

IPOE—Intelligence Preparation of the Operational Environment

ISOLD—Isolated

ISR—Intelligence, Surveillance, and Reconnaissance

IWEDA—Integrated Weather Effects Decision Aid

IWWC—Integrated Weather Warning Coordination System

JA—Joint Airborne

JP—Joint Publication

JEM—Joint Effects Model

JET—Joint Environmental Toolkit

JFC—Joint Force Commander

JMO—Joint Meteorological and Oceanographic Officer

JOAF—Joint Operational Area Forecast

JOC—Joint Operations Center

JOPP—Joint Operating Planning Process

JTWC—Joint Typhoon Warning Center

JWICS—Joint Worldwide Intelligence Communication System

KQ ID—"KQ" Temporary Location Identifier

LMPU—Lead Meteorological and Oceanographic Production Unit

LGT—Light

LOI—Letter of Instruction

LRE—Launch and Recovery Element

LWO—Launch Weather Officer

LWU—Lead Weather Unit

LT—Lead Time

LZ—Landing Zone

M&S—Modeling and Simulation

MAF—Mobility Air Forces

MAJCOM—Major Command

MCTP—Mission Command Training Program

MDMP—Military Decision Making Process

MDS UTCs—Mission Design Series Unit Type Codes

MDT—Moderate

MEFP—Mission Execution Forecast Process

MET—Mission Essential Task

METOC—Meteorological and Oceanographic

METSAT—Meteorological Satellite

METWATCH—Meteorological Watch

MICT—Management Internal Control Toolset

MIL-STD—Military Standard

MOA—Memorandum of Agreement

MOAF—Military Operating Area Forecast

MODE—Method for Object-Based Diagnostic Evaluation

MODVER—Model Prediction Verification

MOP—Measures of Performance

MSE—Mean Square Error

MSL—Mean Sea Level

MTE—Mean Timing Error

MXD—Mixed

NASIC—National and Space Intelligence Center

NCOIC—Non-Commissioned Officer in Charge

NIPRnet—Non-Classified Internet Protocol Router Network

NHC—National Hurricane Center

NHOP—National Hurricane Operations Plan

NLT—Negative Lead Time

NMCC—National Military Command Center

NMRS—Numerous

NOGAPS—Navy Operational Global Atmospheric Prediction System

NOTAM—Notice to Airmen

NWM—Numerical Weather Model

NWP—Numerical Weather Prediction

NWS—National Weather Service

NWSOP—National Winter Season Operations Plan

OCONUS—Outside of the Contiguous United States

OFCM—Office of the Federal Coordinator for Meteorology

OI—Operating Instruction

OIC—Officer in Charge

OPLAN—Operations Plan

OPORD—Operations Order

OPR—Office of Primary Responsibility

OPREP-3—Operational Report 3

OSD—Office of the Secretary of Defense

OSS—Operational Support Squadron

OWS—Operational Weather Squadron

OVC—Overcast

PACAF—Pacific Air forces

PAROC—Persistent Attack and Reconnaissance Operations Center

PCF—Points for Correct Forecast

PIREP—Pilot Report

PMSV—Pilot to Metro Service

POC—Point of Contact

POD—Probability of Detection

PSM—Program Support Managers

QPF—Qualitative Precipitation Forecast

RFI—Request For Information

RH—Relative Humidity

RM—Risk management

RMSF—Root Mean Square Factor

RNI—Required, Not Issued

ROT—Rule of Thumb

RPA—Remotely Piloted Aircraft

RPS—Rank Probability Score

RSC—Runway Surface Conditions

RSO—Remote Split Operations

SAA—Senior Airfield Authority

SAR—Support Assistance Request

SCT—Scattered

SIGMET—Significant Meteorological Information

SIPRNet—Secret Internet Protocol Router Network

SMO—Senior METOC Officer

SOF—Special Operations Forces

SOP—Standard Operating Procedures

SOWS—Special Operations Weather Squadron

SPECI—Special Weather Observation Criteria

SRM—Sustainment Readiness Model

STW—Sub-Threshold Weather Watch, Warning, and Advisory

SWAP—Severe Weather Action Plan

SWO—Staff Weather Officer

SWS—Special Weather Statement

SYOS—System Operations Squadron

SVR—Severe

TACC—Tanker Airlift Control Center

TACON—Tactical Control

TAF—Terminal Aerodrome Forecast

TAFVER—Terminal Aerodrome Forecast Verification

TAWS—Target Acquisition Weapons Software

TC-TAP—Tropical Cyclone Threat Assessment Product

TDA—Tactical Decision Aid

TEMPO—Temporary

TTP—Tactics, Techniques, and Procedures

TOC—Tactical Operations Center

UHF—Ultra High Frequency

USAF—United States Air Force

USAFE-AFAFRICA—United States Air Forces Europe & Air Force Africa

USSOCOM—United States Special Operations Command

URC—Unit Radar Committee

UUA—Urgent PIREP

VAAC—Volcanic Ash Advisory Center

VHF—Very High Frequency

VIPSAM—Very Important Person Special Airlift Mission

VIS—Visibility

WARNVER—Weather Watch, Warning, and Advisory Verification

WF—Weather Flights

WP—Weather Product

WRS—Weather Reconnaissance Squadron

WS—Weather Squadron

WSS—Weather Systems Squadron

WSSC—Weather Systems Support Cadre

WST—Weather Specialty Team

W-VAAC—Washington Volcanic Ash Advisory Center

WW—Weather Wing

WWA—Warning, Watch, Advisory

WXG—Weather Group

Terms

Analysis and Forecast Program (AFP)—A systematic and consistent approach to weather forecasting. The AFP identifies techniques and tools used to forecast individual weather elements, describes requirements for locally prepared work charts/composites, and explains refinements and application of centralized products.

Climatology—In contrast to weather, which encompasses the state of the atmosphere over a brief period, climatology represents the statistics of day-to-day weather conditions averaged over a longer period of time. A location's climatology may be represented by quantities such as average (or mean) and extreme conditions that are often based on 10 or more years of measured or observed conditions. Within the DoD, climatology data and depictions can inform planning, design, basing, and strategy decisions.

Continuity—The property of a field such that neighboring values of a parameter differ only by an arbitrarily small amount if they are close enough in space or time. In synoptic meteorology, continuity of a field is interpreted as requiring a certain smoothness of analysis and a similar adjustment in the time sequence of synoptic charts.

Decision Cycles—Joint Operational Planning Process (JOPP), Military Decision Making Process (MDMP), Joint Intelligence Preparation of the Operational Environment, IPOE, Risk Management (RM) process, and Common Operating Picture (COP).

Desired Lead Time (DLT)—Customer defined time (in minutes) the supported organization requires a WWA to be issued, in order to complete protective actions prior to the onset of hazardous weather phenomenon.

False Alarm—When a lightning watch, weather warning, or forecast weather advisory is issued and the specified criteria do not occur during the specified valid time.

Forecaster-In-the-Loop (FITL)—Term covering a range of human activities to ensure forecast information is meteorologically sound. FITL activities span a broad spectrum from a basic review and editing of information to a detailed production process resulting in forecaster-created WPs such as graphical forecast products or mission specific environmental impacts decision aids.

FITL Graphics (Standard)—A suite of WPs depicting standardized criteria, created by forecasters in an Operational Weather Squadron for a specific geographic region. These products represent the sum of the forecasting activities for basic weather parameters necessary for creation of mission execution forecasts.

Forecast Weather Advisory (FWA)—A weather advisory issued when the supported user requires advance notification of an impending weather condition with sufficient time to allow for protective actions.

Forecast Worksheet—Tool used to document, track, and evaluate past and future weather events. It may contain forecast rules-of-thumb, question and answer discriminators, decision logic trees, etc., to help develop a forecast.

Group 1 UAS—Unmanned aircraft typically less than 20 pounds in weight that normally operate below 1200 feet above ground level (AGL) at speeds less than 250 knots (e.g., RQ-11B Raven, gMAV).

Group 2 UAS—Unmanned aircraft in the 21-55 pound weight class that normally operate below 3500 feet AGL at speeds less than 250 knots (e.g., Scan Eagle).

Group 3 UAS—Unmanned aircraft that weigh more than 55 pounds, but less than 1320 pounds, and normally operate below 18,000 feet mean sea level (MSL) at speeds less than 250 knots (e.g., RQ-7B Shadow).

Group 4 UAS—Unmanned aircraft that weigh more than 1320 pounds and normally operate below 18,000 feet MSL at any speed (e.g., MQ-1B Predator, MQ-1C Gray Eagle, MQ-5B Hunter).

Group 5 UAS—Unmanned aircraft that weigh more than 1320 pounds and normally operate higher than 18,000 feet MSL at any speed (e.g., MQ-9A Reaper, RQ-4 Global Hawk).

Horizontal Consistency—Weather data provided in one product that is consistent to data provided in another product for the same area and time. For example, TAFs must be consistent with all other products, including the current observation, weather warnings, weather advisories, lightning watches, etc. Elements within each TAF must also be consistent, for example, if heavy snow showers are forecast, the visibility will be restricted appropriately. Strong gusty winds or hail would generally be expected if severe thunderstorms were forecast. Product consistency prevents supported users from receiving conflicting information.

ICAO Identifier—A specifically authorized 4-letter identifier assigned to a location. The ICAO is not to be confused with the Routing Identifier used by the Automatic Digital Weather Switch to transmit addressed messages including Automated Response to Queries. Routing IDs may not always match a station ICAO and can have 5 characters.

INS—Inches of Mercury (Hg)

Installation Data Page—A document defining the specific environmental support requirements, technical data, reference material, and contact information for each organization.

International Civil Aviation Organization (ICAO)—A United Nations organization specializing in international aviation and navigation.

Issue Time—The time when an agency is notified of a watch, warning, or advisory. When more than one agency is notified, the issue time is the time the last agency is notified. Follow-up notifications are not considered when determining issue time.

Joint Operational Area Forecast (JOAF)—The JOAF, as approved by the JMO, is the official planning forecast for all components of the joint force. It is issued at the Joint Force Commander (JFC) level to ensure that all components are aware of what the JFC is using to plan the coordinated battle. Significant deviations from the JOAF will be coordinated with the JMO. Components and individual units will use the JOAF as the point of departure to tailor METOC information and to develop tailored mission execution forecasts. The JOAF may include a forecast database when needed for tactical decisions used in planning.

KQ Temporary Location Identifier (KQID)—Location identifiers (similar but NOT ICAOs) beginning with KQ used by deployed units supporting real- world contingencies; deployed/in-garrison units providing support during exercises; classified operating locations; and units that have requested, but not yet received a permanent location identifier.

Launch and Recovery Element—Deployed personnel based at a forward location who are responsible for the launch, recovery and ground support of a RPA.

Lead Weather Unit—The weather unit having overall responsibility for coordinating air and space weather support, issuing the weather support LOI, and providing or arranging forecasts for the Controlling WP.

Main Operating Location—For the purposes of this instruction, a main operating location is a military installation operated by the US Department of Defense for which the primary flying mission is conducted by a DoD unit and the service is the primary agent responsible for Air Traffic Control. Generally, main operating locations serviced by an OWS are designated as Air Force Bases, Air Reserve Bases, Air National Guard Bases, or Army Air Fields.

Mesoscale—Systems which vary in size horizontally from 1 to 500 nautical miles (2 to 926 kilometers) and have a duration from tens of minutes to several hours (e.g., low level jets, squall lines, thunderstorms, clear air turbulence, or land-sea breezes).

METWATCH—A deliberate process for monitoring the terrestrial weather or space environment in an area or region. The purpose of a METWATCH is to identify when and where observed conditions significantly diverge from forecast conditions and determine courses of action to update or amend a forecast product or group of products and notify designated agencies.

Military Operating Area Forecast—A forecast guidance product that provides the weather or space environmental conditions for a specific area in which military operations are occurring.

Mission Execution Forecast Process (MEFP)—A systematic, repeatable process for tailoring WPs and forecasting mission-limiting meteorological parameters and providing decision quality environmental information for an operational end user. This process provides a basic framework for fusing perishable meteorological data, operational and strategic forecast products, and an understanding of the supported user's tactics which will be applied to any mission their supported user may undertake. The MEFP describes an end-to-end process incorporating management steps, forecast development, mission meteorological watch, and post- mission analysis of the information provided.

Mission Integration—The ability to understand mission platforms, equipment, and systems capabilities/sensitivities as well as mission processes (e.g., JOPP, MDMP, IPOE, RM, COP, tactics, etc.) and inject the right information at the right time every time, enabling mitigation of environmental threats as early as possible in the mission planning process, ultimately optimizing mission execution.

Mission Profile—describes a mission's operating platform(s), route, flight level(s), weapons systems, equipment, target(s), tactics/techniques/procedures (TTPs), and timing.

MISSIONWATCH—A deliberate process of monitoring terrestrial weather or the space environment for specific mission-limiting environmental factors that may adversely impact missions in execution. The MISSIONWATCH process is performed by WFs and WSTs and is intended to identify previously unidentified environmental threats and alert decision-makers at the operational unit or airborne mission commanders, enabling dynamic changes to mission profiles that may mitigate the environmental threat and optimize the chance of mission success.

Numerical Weather Prediction (NWP)—The processes involved in representing the atmospheric system with fundamental mathematical equations, which can be solved in discrete time steps to achieve a numerical forecast of the parameters (e.g., pressure, temperature, humidity) used to define the state of the atmosphere.

Objective Verification—A set of predetermined meteorological criteria used to determine the accuracy of a forecast product.

Observed Weather Advisory (OWA)—A weather advisory issued when a particular weather event first occurs and the supported user does not require advanced notification of the observed weather phenomenon.

Observed Weather Warning—A weather warning issued when a particular weather event first occurs and the supported user does not require advanced notification of the observed weather phenomenon.

Operational Weather Squadron (OWS)—A unit comprised of management, technician, and training personnel responsible for providing regional weather support. Their mission is to produce fine-scale tailored weather forecast products and services to supported users within their area of responsibility (AOR).

Pilot Report (PIREP)—A report of in-flight weather provided by an aircrew member.

Risk Management—The systematic process of identifying hazards, assessing risks, analyzing risk control measures, making control decisions, implementing risk controls, and supervising and reviewing the process.

Severe Thunderstorm—A thunderstorm presenting a threat to lives or property that requires agencies to enhance resource protection measures. Generally, thunderstorms producing hail greater than or equal to ¾ inch diameter or surface wind greater than or equal to 50 knots.

Severe Weather—Any weather condition that poses a hazard to property or life.

Severe Weather Action Plan (SWAP)—Actions taken by a weather unit to enhance the unit's response capability during a severe weather event. Actions include, but are not limited to, recalling personnel or reallocating resources from other tasks to provide focused support during a severe weather event.

Special Weather Statement (SWS)—An OWS notice to supported customers of meteorological effects which could impact future operations. This notice is for situational awareness purposes only and does not require action by supported customers.

Subjective Verification—A review to determine meteorological soundness by comparing the product in question with other weather data and products.

Support Assistance Request (SAR)—Within weather operations, a request for a specialized weather, space environmental, or climatological support product(s) from a weather production unit. A request for information (from a non-weather activity) may qualify as a SAR if the analysis and production is within the scope of production for the unit. **Note:** A SAR is not a mechanism or requirements document to request additional manpower, or products or capabilities that would drive a software or hardware baseline change to an existing system.

Synoptic Scale—Systems which vary in size horizontally from 100 to 1,000 nautical miles and have a duration of tens of hours to several days (e.g., migratory high and low pressure systems, frontal systems, or tropical cyclones).

Terminal Aerodrome Forecast (TAF)—A coded weather bulletin providing the official forecast information for an aerodrome complex to facilitate flight planning and command and control activities.

Valid Time (VT)—Time in which weather watches, warnings, or advisories are in effect. Valid times start when meteorological phenomena are expected to begin. Valid times end when phenomena is expected cease.

Weather Advisory—A special WP to alert an end user of the occurrence of, or imminent occurrence of weather conditions impacting operations.

Weather Flight (WF)—Weather flights, detachments, and operating locations whose primary purpose is to facilitate exploitation of the environment through integration at every step of the operations planning and execution process. The WF may be located with the supported unit on an Air Force base, Army post, remotely located in another weather unit, or at a deployed location.

Weather Product (WP)—WPs generated by weather personnel for weather personnel or for non-weather personnel to use for planning purposes. WPs include, but are not limited to, military operations area forecasts (MOAFs), air refueling forecasts, air combat maneuver/training area forecasts, instrument flight rules (IFR) military training route forecasts, drop/landing zone (DZ/LZ) forecasts, training range forecasts, and control forecasts for an operation with multiple missions.

Weather Warning—A special WP to facilitate resource protection decisions. Weather Warnings alert designated agencies to the imminent or actual occurrence of weather conditions of such intensity as to pose a hazard to life or property for which the agency must take immediate protective actions.

Weather Watch—A special WP to facilitate resource protection decisions. Weather Watches provide advance notice to designated agencies of the existence of a potential for weather conditions of such intensity as to pose a hazard to life or property for which the agency should consider taking protective measures.

Attachment 2

DD FORM 175-1, FLIGHT WEATHER BREIFING INSTRUCTIONS

A2.1. General Instructions . Unless directed by MAJCOMs, higher headquarters, or local operating procedures, all entries in the individual blocks are at the discretion of the briefer, based on aircrew requirements and the weather situation. Entries on the DD Form 175-1 or equivalent briefing form must be horizontally and vertically consistent and show sound meteorological reasoning. For example, if a weather warning or advisory for surface wind is indicated in block 11, the surface wind forecast in block 9 should reflect the warning or advisory wind criteria, along with the warning or advisory number entered in block 13. Enter all times in UTC, all winds in five digits (six for wind speeds over 99 knots), and record all heights in hundreds of feet with the surface level as "SFC."

A2.2. PART I - TAKEOFF DATA. Enter the general forecast for takeoff 1 hour either side of the estimated time of departure (ETD). See **Figure A2.1** for an example of **Part I**.

A2.2.1. Block 1. **DATE.** Enter the UTC departure date in the format needed for operational use and communication with C2 systems (e.g., DD MMM YYYY, YYYY MM DD).

A2.2.2. Block 2. **ACFT TYPE/NO.** Enter aircraft type (F22, B52, C5) and radio call sign, mission number, or the last three digits of the tail number.

A2.2.3. Block 3. **DEP PT/ETD.** Enter the departure location identifier (ICAO ID#) and estimated time of departure. Enter departure grid point or latitude/longitude for locations that do not have location identifiers.

A2.2.4. Block 4. **RWY TEMP.** Enter the runway temperature (prefixed with a + or - as applicable) and designate degrees Celsius or Fahrenheit used.

A2.2.5. Block 5. **DEW POINT.** Enter the runway temperature (prefixed with a + or - as applicable) and designate degrees Celsius or Fahrenheit used.

A2.2.6. Block 6. **TEMP DEV.** Enter in degrees Celsius unless requested in Fahrenheit. For USAF flights, enter "Temp Dev" as the difference between the forecast temperatures for climb and the US Standard Atmosphere temperature. For Navy/Marine flights, enter the difference between forecast runway temperature (prefixed with a + or - as applicable) and US Standard Atmosphere temperature corresponding to field elevation.

A2.2.7. Block 7. **PRES ALT.** Enter the pressure altitude in feet with algebraic sign. Primarily used by USAF aviators. Army aviators usually use density altitude.

A2.2.8. Block 8. **DENSITY ALT.** Enter in feet with algebraic sign. Primarily used by Army aviators in mountainous terrain only.

A2.2.9. Block 9. **SFC WIND.** Enter the surface wind direction in magnetic for missions departing the airfield, and in true direction for missions departing another airfield. Designate "M" for magnetic or "T" for true. Enter surface wind direction to the nearest 10 degrees in three digits and surface wind speed (including gust) in two or three digits. Ensure wind entries use a minimum of 5 digits (3 digits for direction and 2 digits for speed). Surface winds will have 2 digits to represent gusts, while winds aloft will use 3 digits for speed when winds exceed 99 knots. Enter "VRB" for a forecast variable wind direction and "CALM" when the winds are forecast calm.

A2.2.10. Block 10. **CLIMB WINDS.** Enter the true direction. Enter a representative wind (or winds) from takeoff to cruise altitude. Enter wind direction to the nearest 10 degrees in three digits and wind speed in two or three digits to the nearest 5 knots. Enter climb winds in layers if there are significant differences (wind speed changes of greater than or equal to 20 knots or wind direction changes greater than or equal to 30 degrees and the wind speed is expected to be over 25 knots) from one stratum to another.

A2.2.11. Block 11. **LOCAL WEATHER WATCH/WARNING/ADVISORY.** Enter any known forecast/observed weather watch, warning, or advisory valid for ETD +/-1 hour. When watch, warning, and advisory information for a location are not available (e.g., remote briefing), enter "Check with local flight agencies." Inform the aircrew that the status of local weather watches, warnings, or advisories is undeterminable, and recommend they check with the local ATC or airfield operations for any weather watches, warnings, or advisories that may be in effect.

A2.2.12. Block 12. **Runway Surface Condition (RSC)/Runway Condition Reading (RCR).** Enter the latest reported Runway Surface Condition/Runway Condition Reading (RSC/RCR) for the departure airfield, if available (e.g., WR//, RCRNR, IRPSR10, P DRY). When RSC/RCR is not available, enter "N/A."

A2.2.13. Block 13. **REMARKS/TAKEOFF ALTN FCST.** Enter remarks on weather that will affect takeoff and climb (e.g., inversions, icing, turbulence, low level wind shear). Ensure the contents of the briefing and the local TAF are consistent. If requested, enter a forecast for the specific takeoff alternate and time.

Figure A2.1. Example PART I - TAKEOFF DATA.

FLIGHT WEATHER BRIEFING							
PART I – TAKEOFF DATA							
1. DATE 20 Mar 02	2. ACFT TYPE/NO. C130/CATS01	3. DEP PT/ETD KOFF/1410 Z	4. RWY TMP -2 °F/C	5. DEWPOINT -3 °F/C	6. TEMP DEV	7. PRES ALT +1130 FT	8. DENSITY ALT FT
9. SFC WIND M 29012G18 T	10. CLIMB WINDS 24025 (SFC-060) 21035 (060-100)		11. LOCAL WEATHER WATCH/WARNING/ADVISORY 03-10 SNOW 4 – 6 INCHES VALID 20/1200Z TO 20/2000Z				12. RSC/RCR LSR15
13. REMARKS/TAKEOFF ALTN FCST MDT RIME ICG 005-140 DURGC KOFF			TAKE OFF ALTN KSUX VALID 1410-1540Z 29012 4 –SN OVC018 ALSTG 29.95 TEMPO 1 SN OVC009				

A2.3. PART II – ENROUTE & MISSION DATA. Enter data for the duration of the specific mission and the entire route of flight. Brief hazards for the specific mission (if applicable) and enroute generally within 25 miles either side of the route and within 5,000 feet above and below the planned flight level. Insert or attach forecasts for drop zones, ranges, air-refueling areas, or low-level routes, etc., as applicable to the specific mission. See **Figure A2.2** for an example of **Part II**.

A2.3.1. Block 14. **FLT LEVEL/WINDS/TEMP.** Enter planned flight level in hundreds of feet in three digits (e.g., "280" for 28,000 feet, "080" for 8,000 feet). Enter true wind direction at flight level in tens of degrees and speed to the nearest 5 knots. Enter forecast flight level temperature in degrees Celsius (prefixed with a + or - as applicable). If there are significant wind speed and direction changes, break the forecast into legs (e.g., BLV-MXF 27045/-45). Otherwise, brief a representative wind and temperature for the entire route (e.g., 32040/-38). If a computer flight plan (CFP) is available, review it for accuracy before briefing aircrews. If accurate, enter "See CFP" in this block. Check "See Attached" if providing a CFP or specific wind charts.

A2.3.2. Block 15. **SPACE WEATHER.** Check the appropriate block indicating the Frequency (FREQ), Global Positioning System (GPS), and Radiation (RAD) as applicable to the specific mission. Indicate the boundaries of the degradation in the space provided in block 15, (e.g., UHF 20N180W to Paya Lebar). When using the High Altitude Radiation Dosage Chart, 10.0 to less than 100.0 milirems per hour constitute marginal and 100.0 milirems per hour and greater constitute severe. A second option is to simply check the appropriate blocks and attach the applicable Space Weather charts to the DD Form 175-1. Indicate there are attachments by writing ―SEE ATTACHED in block 15 and check ―Yes in block 34.

A2.3.3. Block 16. **SOLAR/LUNAR.** Enter the location specified by the aircrew, Beginning Morning Nautical Twilight (BMNT), Sunrise, Sunset, Ending Evening Nautical Twilight (EENT), Moonrise (MR), Moonset (MS), and Percent Moon Illumination (ILLUM).

A2.3.4. Block 17. **CLOUDS AT FLT LEVEL.** Check appropriate block. "Yes" implies flight in cloud at least 45 percent of the time; "No" implies the flight will be in cloud less than 1 percent of the time; and "In and Out" implies the flight will be in cloud between 1 percent and 45 percent of the time.

A2.3.5. Block 18. **OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY**. Check the appropriate block. If "Yes," enter the type of forecast obscurations that could potentially restrict the in-flight visibility along the planned route or mission flight level (e.g., fog, haze, smoke, etc.). Specify the intensity and location if applicable.

A2.3.6. Block 19. **MINIMUM CEILING.** Enter the lowest ceiling enroute and for the specific mission (if applicable) in hundreds of feet **AGL,** and the geographical location (e.g., "060 ft BLV-MXF"). If the minimum ceiling is over hilly or mountainous terrain, or in thunderstorms, so indicate; e.g., "010 feet BOSTON MTS," or "020 feet SW KY TSTMS."

A2.3.7. Block 20. **MAXIMUM CLOUD TOPS.** Enter maximum tops of cloud layers (exclusive of thunderstorm tops) with more than 4/8 coverage in hundreds of feet **MSL** and the geographical location.

A2.3.8. Block 21. **MINIMUM FREEZING LEVEL.** Enter the height and geographical location of the lowest freezing level enroute and for the specific mission (if applicable) in hundreds of feet **MSL**. If the lowest freezing level is at the surface, enter "SFC" and geographical location.

A2.3.9. Block 22. **THUNDERSTORMS.** Enter the name and DTG of the thunderstorm product used (e.g., OWS products, radar summary, satellite imagery, NWS or foreign weather service In-Flight Weather Advisories). Enter the type, extent, maximum tops, and geographical location of thunderstorms affecting the route or specific mission. The extent percentages on the DD Form 175-1 directly correspond to the Maximum Instantaneous Coverage (MIC) depicted on OWS thunderstorm products. Never use the terms "cumulonimbus‖ or ―CB." Instead, use "thunderstorm."

A2.3.10. Block 23. **TURBULENCE** (not associated with thunderstorms)**.** Enter the name and DTG of the turbulence forecast product used (e.g., 557 WW/OWS products, NWS or foreign In-Flight Weather Advisories). Enter the type, intensity, levels, and locations of turbulence affecting the route or specific mission.

A2.3.11. Block 24. **ICING** (not associated with thunderstorms)**.** Enter the name and DTG of the icing forecast product used (e.g., 557 WW/OWS products, NWS or foreign In-Flight Weather Advisories). Enter the type, intensity, levels, and locations of icing affecting the route or specific mission. **Note:** Like AFW and OWS forecast products, In-Flight Weather Advisories are advisory in nature and should be used as guidance when preparing the enroute forecast. They must be carefully evaluated and tempered with all available data (e.g., radar, PIREPs, upper air soundings, online resources) to determine the potential effects on the specific mission and aircraft. Even if not used as the basis for the forecast, weather personnel must alert aircrews to all existing In-Flight Weather Advisories that affect their mission. If the weather briefer disagrees with the advisory, annotate the fact in the "Remarks" section of the DD Form 175-1 or equivalent. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate based on experience, the mission, and the operational limits of the aircraft. See FAA *Aeronautical Information Manual* for detailed information on NWS In-Flight Weather Advisories.

A2.3.12. Block 25. **PRECIPITATION**. Enter the type, intensity, character, and geographical location of precipitation areas affecting the route or specific mission. This block is for precipitation encountered at flight level, not at the surface.

Figure A2.2. Example PART II – ENROUTE & MISSION DATA.

PART II – ENROUTE & MISSION DATA						
14. FLT LEVEL/WINDS/TEMP [ ] SEE ATTACHED	15. SPACE WEATHER UHF 20N180W to Paya Lebar				16. SOLAR/ LUNAR	LOCATION
		NO IMPACT	MARGINAL	SEVERE	BMNT 0600 Z	
100 KOFF – KSUX 21035/-10	FREQ		X		SR 0628 Z	MR 2023 Z
KSUX – Nrn MN 17050/-05	GPS	X			SS 1836 Z	MS 0755 Z
	RAD	X			EENT 1904 Z	ILLUM 92 %

17. CLOUDS AT FLT LEVEL						18. OBSCURATIONS AT FLT LEVEL RESTRICTING VISIBILITY				
X	YES		NO		IN AND OUT		YES	X	NO	TYPE

19. MINIMUM CEILING - LOCATION	20. MAXIMUM CLOUD TOPS - LOCATION	21. MINIMUM FREEZING LVL - LOCATION
003 Ern NE FT AGL	280 NE, IA, Srn SD FT MSL	SFC RTE FT MSL

22. THUNDERSTORMS						23. TURBULENCE			24. ICING				25. PRECIPITATION				
CHART 15 OWS 20 / 12Z						CHART 15 OWS 20 / 12Z			CHART 15 OWS 20 / 12Z				CHART				
X	NONE		AREA		LINE	NONE	IN CLEAR	IN CLOUD	NONE	RIME	MIXED	CLEAR	NONE	DRIZZLE	RAIN	SNOW	PELLET
	ISOLATED 1-2%					LIGHT		X	TRACE				LIGHT			X	
	FEW 3-15%					MODERATE			LIGHT				MODERATE			X	
	SCATTERED 16-45%					SEVERE			MODERATE	X			HEAVY				
	NUMEROUS > THAN 45%					EXTREME			SEVERE				SHOWERS				
HAIL, SEVERE TURBULENCE, ICING, HEAVY PRECIPITATION, LIGHTNING & WIND SHEAR EXPECTED IN AND NEAR THUNDERSTORMS						LEVELS 080-120			LEVELS SFC – 140				FREEZING				
LOCATION						LOCATION Ern NE – Srn SD			LOCATION NE, IA, Srn SD				LOCATION NE, IA, Srn SD				

A2.4. PART III - AERODROME FORECASTS. Brief the worst conditions expected to prevail during the valid period for both destination and alternate. Ensure the aircrew is briefed on, and fully understand, the entire weather situation at the destination and alternates. The need for and the selection of an alternate is a pilot decision. However, weather technicians need to be familiar with the basic USAF, Army, and Navy/Marine provisions for alternate selection. Refer to AFI 11-202V3, 95-1, or CNAF M-3710.7, *NATOPS General Flight and Operating Instructions Manual* for specific alternate requirements. Enter forecasts for subsequent stops and alternates on request, but advise the pilot that updates are necessary. Brief destination forecasts in terms the aircrew understands and prefers. See **Figure A2.3** for an example of **Part III**.

A2.4.1. Block 26. **DEST/ALTN.** Enter the appropriate station identifier (ICAO) for the destination (DEST) or alternate (ALTN) aerodrome forecast. Designate DEST or ALTN used. Place conditions described by a TEMPO group on the next line, line through DEST/ALTN, and enter TEMPO in the block. **Note:** PGS/S-developed briefings place TEMPO groups on the same line. Place local hazard forecasts from the TAF in the Remarks section. For Army multi-stop missions, where the forecast for all stops is similar, enter "A/S" (for "all stops"), enter the worst conditions expected along the route, and identify the location having the worst condition. These entries imply conditions at all other stops are the same, or better.

A2.4.2. Block 27. **VALID TIME.** For USAF and Navy/Marine missions, enter valid time as 1 hour either side of ETA. For flights less than 1 hour, the valid period will be ETD to ETA plus 1 hour. Briefings for Army missions require a valid time from ETA through 1 hour after ETA. For "A/S" entries, valid times are determined from original ETD to last stop ETA plus 1 hour.

A2.4.3. Block 28. **SFC WIND.** Enter true wind direction if the destination is an airfield other than current location. If the flight departs from and terminates at current airfield with no intermediate stops, enter the wind direction magnetic. Designate "M" for magnetic" or "T" for true. Enter the wind direction to the nearest 10 degrees, and speed (including gusts) to the nearest whole knot. For "A/S" missions, enter the highest wind speed expected (including gusts) and the location.

A2.4.4. Block 29. **VSBY/WEA.** Enter the lowest prevailing visibility and weather expected during the valid period. Represent in statute miles for CONUS and overseas US locations, and in meters for other overseas locations, unless otherwise specified by the aircrew.

A2.4.5. Block 30. **CLOUD LAYERS.** Enter the lowest prevailing sky condition expected during the valid period. Weather briefers must fully evaluate all NWS probability groups (e.g., PROB30/40%) and indigenous variations of the TAF code. If necessary, use the Remarks section to record the briefer's assessment and translation of these conditions.

A2.4.6. Block 31. **ALTIMETER/RWY TEMP/PRES ALT.** Enter the lowest altimeter setting expected during the valid period in all cases except those in which it is impossible to obtain or determine. Enter the forecast temperature (RWY TMP) and designate degrees Celsius or Fahrenheit used (prefixed with a + or - as applicable). Enter the forecast pressure altitude (PRES ALT) for the arrival time at the destination.

Figure A2.3. Example PART III – AERODROME FORECASTS.

PART III – AERODROME FORECASTS							
26. DEST/ALTN	27. VALID TIME	28. SFC WIND	29. VSBY/WEA	30. CLOUD LAYERS	31. ALTIMETER	RWY TEMP	PRES ALT
DEST/~~ALTN~~ KOFF	ZTO Z 1705 – 1905	M ~~T~~ 04012G18	1/2 SN	OVC005	INS 29.70	°F/C -1	FT 11150
DEST/ALTN	ZTO Z	M T			INS	°F/C	FT
~~DEST/ALTN~~ KSUX	ZTO Z 1735 – 1935	~~M~~ T 06014	6 -SN	OVC012	INS 29.80	°F/C	FT
~~DEST/ALTN~~ TEMPO	ZTO Z	M T	1 -SN BR	OVC005	INS	°F/C	FT
DEST/ALTN	ZTO Z	M T			INS	°F/C	FT
~~DEST/ALTN~~ KRDR	ZTO Z 1800 – 2000	~~M~~ T 06009	7	SCT060 BKN090	INS 30.04	°F/C	FT
DEST/ALTN	ZTO Z	M T			INS	°F/C	FT
DEST/ALTN	ZTO Z	M T			INS	°F/C	FT

A2.5. PART IV - COMMENTS/REMARKS. See **Figure A2.4** for an example of **part IV**.

A2.5.1. Block 32. **BRIEFED RSC/RCR.** Check the appropriate block and enter the latest available RSC/RCR value briefed to the aircrew for the destination and the alternate in the Remarks section. If unavailable, annotate N/A.

A2.5.2. Block 33. **PMSV.** Enter the PMSV frequency or phone patch number of the weather unit providing the briefing. If PIREPs are requested for specific areas, enter the areas in Remarks [e.g., Request PIREP During Climb (DURGC)].

A2.5.3. Block 34. **ATTACHMENTS.** Check the appropriate block indicating if attachments are provided with the briefing.

A2.5.3.1. Block 35. **REMARKS.** Enter any other significant data (e.g., data for which there was insufficient space in other blocks and specialized mission forecasts, such as low-level mission areas, air refueling, or gunnery/bombing ranges, etc.) Weather briefings provided electronically (e.g., faxed, posted on webpage, or e-mailed) must include the following statement: ***"Call (ICAO) at DSN ###-#### or commercial (###) ###-#### for a weather update."*** Also include information on how the aircrew can get weather support at the next location. For example: "For Wx updates/briefs at Eglin AFB, call 28OWS at DSN 965-0588 or toll free at 1-877-297-4429."

Figure A2.4. Example PART IV - COMMENTS/REMARKS.

PART IV – COMMENTS/REMARKS										
32. BRIEFED FSC/RCR	X	YES		NOT AVAILABLE	33. PMSV KOFF 342.5	34. ATTACHMENTS		YES	X	NO
35. REMARKS Request PIREP DURGC MDT RIME ICG 050-100 DURGD KOFF, KRDR DRY					Call Eglin AFB at DSN ###-#### or commercial (###) ###-#### for a weather update.					

A2.6. PART V - BRIEFING RECORD. See **Figure A2.5** for an example of **Part V**.

A2.6.1. Block 36. **WX BRIEFED TIME.** If briefed in person/verbally, enter time briefed. If sent electronically and not verbally briefed, enter time brief was faxed, posted on a webpage, local LAN, or passed to a central dispatch facility (TACC, AOC Air Mobility Division, etc.) and Append an "E" in front of the time (e.g., E1015Z). If the crew calls later for a verbal briefing, put a solidus after the "E" time and enter the verbal brief time (e.g., E1015Z/1035Z).

A2.6.2. Block 37. **FLIMSY BRIEFING NUMBER.** If a flight weather briefing folder, flimsy, or CFP was prepared for this mission, enter the folder, flimsy, or CFP identification number.

A2.6.3. Block 38. **FORECASTER'S INITIALS.** Enter the initials of the weather briefer or the forecaster preparing and disseminating the briefing.

A2.6.4. Block 39. **NAME OF PERSON RECEIVING BRIEFING.** (Remote briefings only). If available, enter receiver's name and, if applicable, military grade.

A2.6.5. Block 40. **VOID TIME.** (Army and Navy/Marine Corps only). Army: Add 1:30 to the "Weather Briefed" time. For Army briefings sent electronically, calculate the void time from the "E" time. If the crew calls later for a verbal briefing, recalculate the void time from the verbal briefing time and enter the new void time after the first time (e.g., 1145Z/1205Z). Navy/Marines: Add 1/2 hour to ETD. **Note:** Navy and Marine Corps aircrews are required to receive a flight weather briefing within 3 hours of ETD. Adjust the void time if the ETD changes.

A2.6.6. Block 41. **EXTENDED TO/INITIALS.** (Army and Navy/Marine Corps Only). When an Army or Navy/Marine pilot asks for an extension, recheck all weather entries, rebrief, and indicate the required changes (e.g., highlight/bold if electronic, green ink if paper) and enter the initials of the forecaster providing the extension. Extensions follow the same rule as for void times.

A2.6.7. Block 42. **WX REBRIEFED TIME/INITIALS.** (Not required for Army, Army equivalent is "Extended To") If weather rebriefed is different than originally briefed, indicate the changes to original weather entries as specified in Block 41 and enter the rebriefing time and initials of the forecast providing the rebrief.

A2.6.8. Block 43. **WX DEBRIEF TIME/INITIALS.** Enter the time the aircrew debriefed and the initials of the forecaster receiving the debriefing.

Figure A2.5. Example PART V – BRIEFING RECORD.

PART V – BRIEFING RECORD			
36. WX BRIEFED TIME **E1329/1345** Z	37. FLIMSY BRIEFING NO.	38. FORECASTER'S INITIALS **LM**	39. NAME OF PERSON RECEIVING BRIEFING
40. VOID TIME **1459/1515** Z	41. EXTENDED TO / INITIALS Z	42. WX REBRIEFED TIME / INITIALS Z	43. WX DEBRIEF TIME / INITIALS **1930/SB** Z

DD Form 175-1, Revision Date (EG)

Attachment 3

STANDARD WEATHER REPRESENTATION AND SYMBOLS

A3.1. General Instructions . **Figure A3.1** depicts line types and colors for commonly used isopleths, **Figure A3.2** depicts bounded areas for specific weather parameters, and **Figure A3.3** depicts standard frontal zone symbols and other commonly weather symbols.

Figure A3.1. Recommended Line Types and Colors for Commonly Used Isopleths.

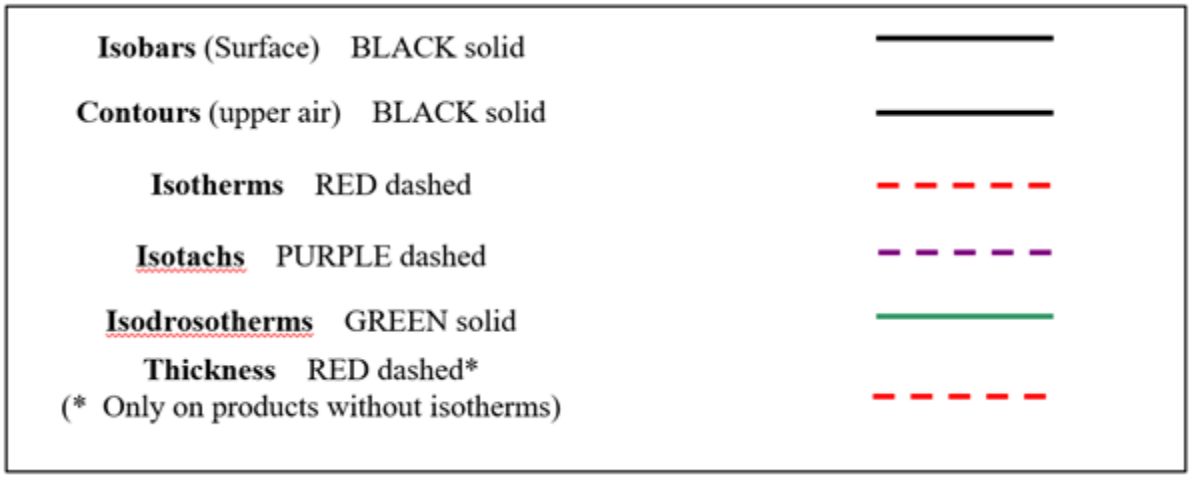
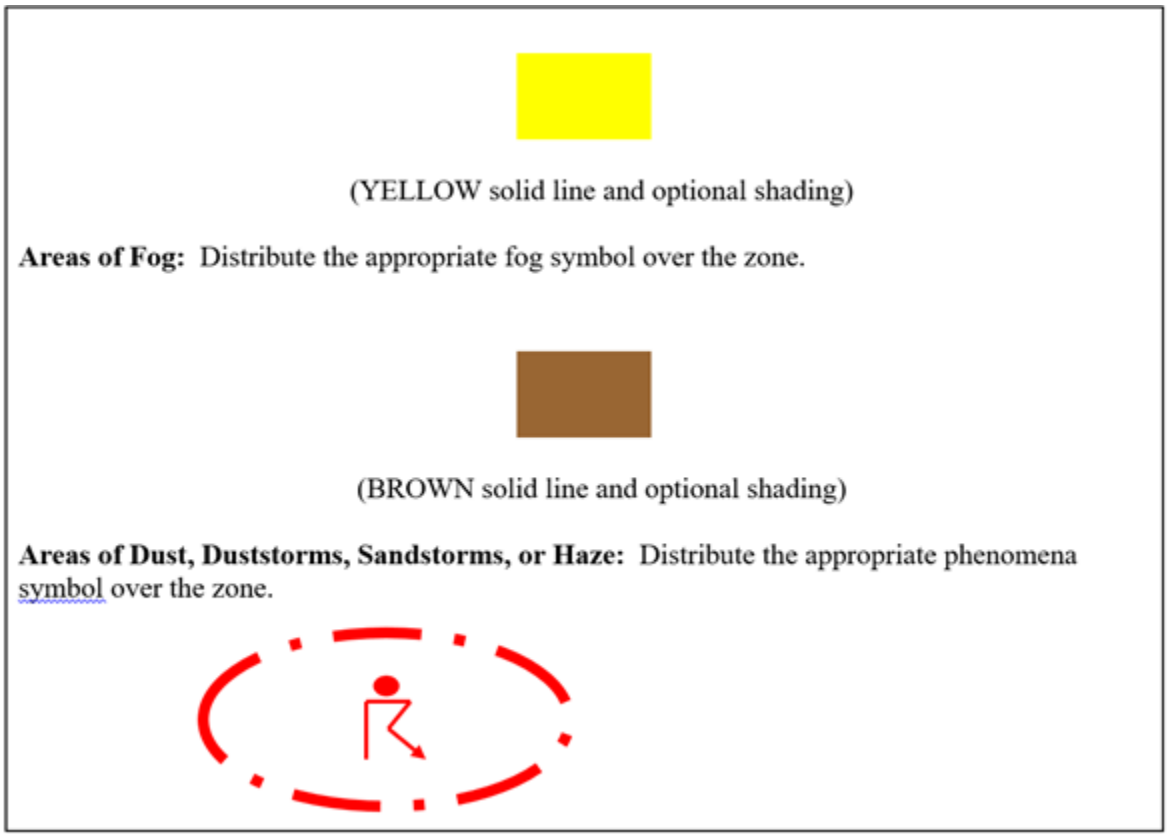


Figure A3.2. Standard Depictions for Bounded Areas of Weather.



(Thunderstorms—RED line with dash or dot)
(Rain/Snow Showers—GREEN line with dash or dot)

Thunderstorm-Convective Precipitation Areas: Distribute the appropriate convective weather symbol over the zone with the height of the thunderstorm top, if applicable.

(GREEN/RED solid line)

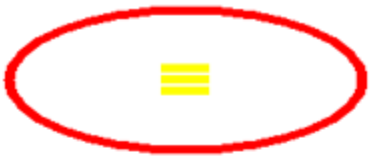
Non-Convective Continuous or Intermittent Precipitation Areas: Distribute the appropriate precipitation symbol over the zone. Color in RED for freezing precipitation. Optional: Cross hatch continuous and single hatch intermittent precipitation.

(BLUE dots or dashes: Clear Air Turbulence & Mechanical Turbulence)
(BLUE solid line: Mountain Wave Turbulence)

Turbulence Areas: Distribute the appropriate turbulence symbol over the zone with the height of the bases and tops (MSL).

(BROWN intersecting line segments)

Icing Areas: Distribute the appropriate icing symbol over the zone with the height of the bases and tops.



(RED solid line)

Areas of Ceilings less than 1500 feet or Visibility less than 3 miles: Distribute the appropriate weather symbol causing IFR visibility conditions over the zone.

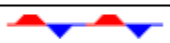
Cloud Forecasts greater than or equal to 1500 feet and above: Outline in BROWN scalloped line and place bases/tops inside cloud areas.

Upper-air/Severe Analysis moisture areas and of ≥ 70% RH on Model Charts: Bound in light GREEN scalloped line.

Areas of ≥ 90% RH on Model Charts: Color fill/shade in GREEN, border in darker GREEN scalloped line (optional).

Dry areas on upper-air/model charts: Bound in BROWN scalloped line.

Figure A3.3. Symbols for Frontal Zones and Other Weather Features.

Item	*Symbol*
(BLUE) Cold front at the surface	
Cold front above the surface	
Cold front frontogenesis	
Cold front frontolysis	
(RED) Warm front at the surface	
Warm front above the surface	
Warm front frontogenesis	
Warm front frontolysis	
(PURPLE) Occluded front at the surface	
Occluded front above the surface	
Occluded front frontolysis	
(ALTERNATE RED & BLUE) Quasi-stationary front at the surface	
Quasi-stationary front above the surface	
Quasi-stationary front frontogenesis	
Quasi-stationary front frontolysis	
Quasi-stationary occluded front at the surface	
Quasi-stationary occluded front above the surface	
Quasi-stationary occluded front frontolysis	
(RED or BLACK) Jet Stream maximum wind line	
(BLACK) Instability line	
Shear line	

(ORANGE) Near-Equatorial Tradewind Convergence Zone, formerly called the Inter-Tropical Convergence Zone. **Note:** The separation of the two horizontal lines gives a quantitative representation of the width of the Near Equatorial Tradewind Convergence. The diagonal lines may be added to indicate areas of activity.	
(ALTERNATE RED & GREEN) Inter-tropical discontinuity	
(BROWN) Sub-tropical discontinuity	
(BLACK) Axis of trough Axis of ridge	 
(BLUE) Highs/Anticyclones	**H/A**
(RED) Lows/Cyclones	**L/C**
Positive Vorticity Advection/Convergence Vorticity troughs Positive Vorticity Centers	Shade RED RED trough symbol RED **X**
Negative Vorticity Advection/Divergence Vorticity ridges Negative Vorticity Centers	Shade BLUE BLUE ridge symbol BLUE **X**
(RED) Tropical Depression	
(RED) Tropical Storm	
(RED) Hurricane/Typhoon	
Tropical Storm Wind Areas and Date/Time Labels	

Attachment 4

INSTRUCTIONS FOR COMPLETING AF FORM 3807, WATCH/WARNING NOTIFICATION AND VERIFICATION

A4.1. General Instructions. Unit leaders may use these instructions as guidance in preparing local procedures for logging weather watches and warnings. Enter all times in UTC.

A4.1.1. **Block 1. Number** . Enter the locally specified number, or numbers when a watch and corresponding warning have different numbers (e.g., Watch # A4-008, WW # 4-002).

A4.1.2. **Block 2. Location** . Enter the location (installation or area) for which the watch/warning is valid.

A4.1.3. **Block 3. Date** . Enter the issue date of the watch/warning.

A4.1.4. **Block 4. Issued By** . Enter the name or initials of the individual who issues the watch/warning.

A4.1.5. **Block 5. Verified By** . Enter the name or initials of the individual who verifies the warning.

A4.1.6. **Block 6. Criteria:**

A4.1.6.1. **Watches/Warnings Are Issued For The Following** . Enter the watch/warning criteria.

A4.1.6.2. **Desired Lead-Time** . Enter the desired lead-time.

A4.1.6.3. **Valid Period** . Enter the valid period of the watch/warning on the appropriate line (opposite the criteria for which the watch/warning is issued). The ending time for observed lightning will reflect the estimated duration.

A4.1.6.4. **Forecast** . Enter the specific value or category forecast if different than that listed in the watch/warning criteria block. For example, if the threshold is for winds greater than 35 knots, but the forecast is for 40 knots, specify 40 knots in this block.

A4.1.6.5. **Verification** . See paragraphs **6.3 and 13.2** for verification procedures.

A4.1.6.5.1. **Occurred** . Enter the time the weather element first occurred within the area covered by the warning. For WWs issued for winds 50 knots or greater, or hail 3/4 inch or greater that do not occur within the area covered by the warning but DO occur within 10 nautical miles, use the time the event occurred within 10 nautical miles. If the weather element did not occur, leave blank and indicate the nonoccurrence in the Did Not Occur block.

A4.1.6.5.2. **Did Not Occur** . Check those weather elements that did not occur.

A4.1.6.5.3. **Lead-Time** . Enter the actual lead-time of each verified weather element. In cases where a warning downgrades an earlier warning that did not verify (with no break in coverage), compute actual lead-time using the issue time of the earlier warning.

A4.1.6.5.4. **Timing Error** . Enter timing error when computing lead time.

A4.1.6.6. **Text** . Enter the text and valid period of the watch or warning as disseminated to customers. Overprinting the text of standardized watch warning criteria (with blanks for specific values) may improve relay times. For example, overprint:

Figure A4.1. Text Overprint Example.

THUNDERSTORMS WITH _____ WINDS AND _____ INCH HAIL OR
WINDS _____ KNOTS NOT ASSOCIATED WITH THUNDERSTORMS

This space may also be used to document extension information.

A4.1.6.7. **Block 7. Dissemination:**

A4.1.6.7.1. **Agency** . List all agencies notified of the watch or warning. Include the primary dissemination system and all agencies not on the primary dissemination requiring notification. Some agencies on the primary dissemination system may require a backup call to verify receipt (indicated by an *****); do not use the time of backup calls in verification statistics.

A4.1.6.7.2. **Contact** . List primary and secondary means of contacting the agencies, for example, N-TFS/x1234.

A4.1.6.7.3. **Agency Criteria** . Mark the watch/warning criteria for each agency.

A4.1.6.7.4. **Watch Issued** . Enter the dissemination/notification time, the initials of the forecaster issuing the watch, and the initials of the person receiving the watch if that agency requires a backup call or is not on the primary dissemination system.

A4.1.6.7.5. **Watch Cancelled** . Enter the dissemination/notification time, the initials of the forecaster cancelling the watch, and the initials of the person receiving the cancellation if that agency requires a backup call or is not on the primary dissemination system. If the watch runs full term, enter an appropriate remark such as "allowed to expire" or "ATE."

A4.1.6.7.6. **Warning Issued** . Enter the dissemination/notification time, the initials of the forecaster issuing the warning, and the initials of the person receiving the warning if that agency requires a backup call or is not on the primary dissemination system.

A4.1.6.7.7. **Warning Cancelled** . Enter the dissemination/notification time, the initials of the forecaster cancelling the warning, and the initials of the person receiving the cancellation if that agency requires a backup call or is not on the primary dissemination system. If the warning runs full term, enter an appropriate remark such as "allowed to expire" or "ATE."

A4.1.6.8. **Block 8. Remarks** . Use for miscellaneous information.

A4.1.6.9. **Block 9. Pertinent Observations** (back of form). List all pertinent observations or data points, both "official" and "unofficial," that aid in verification or justification of watches and warnings. Forecasters may include any observational data they deem relevant, that assisted in the issuance, verification, or cancellation process. Examples include (but are not limited to) radar information, off-duty observer reports, and locally reported weather conditions.

A4.1.6.10. **Block 10. Forecast Review and Comments** (back of form). Forecast review section also referred to as weather product review in this publication, is used for forecast review information. AF weather leaders can use this space to include written comments on weather watches and warnings.

Attachment 5

INSTRUCTIONS FOR COMPLETING AF FORM 3806, WEATHER WATCH ADVISORY LOG

A5.1. General Instructions. Unit leaders may use these instructions as guidance in preparing local procedures for logging forecast and observed weather advisories. Enter all times in UTC.

A5.1.1. **Date** . Enter the month and year.

A5.1.2. **Issued** . Enter the issue DTG.

A5.1.3. **Valid** . Enter the valid time of the WA. Leave blank for observed WAs.

A5.1.4. **Terminal or Area** . Enter the installation or area for which the advisory is being issued. Enter the locally assigned WA number (e.g., WA # 05-A05).

A5.1.5. **Text** . Enter the text of the advisory.

A5.1.6. **Dissemination** . Use this section to enter information for the initial issuance, extensions, and cancellations of WAs. If the WA is allowed to expire, enter a remark such as "allowed to expire" or "ATE" in one of the time blocks. Use the Remarks block or back of the form if needed.

A5.1.6.1. **Agency** . Enter the agencies notified of the WA. Include the primary dissemination system and all agencies not on the primary dissemination system that must be notified. **Note:** Minimize individual notification calls to no more than three.

A5.1.6.2. **Time** . Time agency is notified.

A5.1.6.3. **Initials** . Enter the initials of the individual receiving the WA information, if required. This is normally used for agencies not on the primary dissemination system and for follow-up calls.

A5.1.6.4. **Forecaster** . Enter the name or initials of the forecaster issuing, extending, or canceling the WA.

A5.1.7. **Remarks** . Use as required.

A5.1.8. **Verification** . Verify all forecast WAs either objectively or subjectively as determined by unit leaders. For WAs containing multiple phenomena, verify each phenomenon separately.

A5.1.8.1. **Occurred** . Check "Yes, No, or Not Applicable."

A5.1.8.2. **Lead-Time** . Enter the actual lead-time. Lead-time is not required for observed WAs, downgrades of previously verified WWs or WAs with no break in coverage, or extensions unless the WA has not yet verified. In cases where a WA downgrades an earlier warning or advisory that *DID NOT* verify (with no break in coverage), compute the lead-time using the issue time of the earlier warning or advisory.

A5.1.8.3. **Timing Error** . Enter the calculated timing error, if required.

A5.1.8.4. **Verified By** . Enter the initials of the individual verifying the advisory.

A5.1.8.5. **Comments/Remarks** . Enter enough meteorological reasoning and information, such as observations, radar reports, and PIREPs, to verify or justify the WA. This includes information to verify the WA objectively or subjectively.

Attachment 6

EXAMPLE MOAF AND CONTROL WEATHER PRODUCT (CWP)

A6.1. General. Figure A6.1. contains suggested weather parameters for various alphanumeric MOAFs. The CWP in **Figure A6.2** contains several different MOAFs for specific missions conducted within one large multiple-unit operation. In this example, the individual MOAFs are combined to form the official CWP developed by the LWU. The LWU aligned with the C2 element will coordinate the CWP with all weather units supporting missions participating in the multiple-unit operation. These weather units will produce a WP from the information in the CWP. **Figures A6.3.** and **A6.4.** provide examples of MOAFs functioning as the official CWP for a multiple-unit operation.

Figure A6.1. Suggested Weather Parameters for Alphanumeric MOAFs

Higher-Altitude MOAFs	Weather Parameters
Air Refueling (AR) Tracks, High-Altitude Orbits Air Combat Maneuver/Training Areas IFR Military Training Routes (Instrument Route)	Degree of cloud cover, and heights of cloud bases and tops of layers. In-flight visibility (AR and other MOAFs), as required. Turbulence (category II) & Icing. Thunderstorm coverage and MAX tops. Winds and temperatures (at flight level). Minimum altimeter for duration of mission (as required).
Lower-Altitude MOAF	Weather Parameters
Drop Zone (DZ), Landing Zone (LZ), VFR Military Training Routes (VR), Slow-Speed Low-Altitude Training Routes, Forward Arming and Refueling Point (FARPs), Training Ranges (e.g., Nellis Range, Eglin Range, National Training Center at Ft Irwin, etc.), Extraction Zones (EZ), Target Areas, Low-Altitude Orbits	Degree of cloud cover, and heights of cloud bases and tops of layers. Surface visibility. Surface weather. DZ winds and temperatures at the surface, 200, 500, 700, 1000, 1,500, 2,000, and 3,000 or a specified drop altitude (AGL). Include wind and temperature forecasts for additional altitudes as required. Turbulence (category II) & Icing. Thunderstorm coverage and MAX tops. Minimum altimeter for duration of mission (as required). MAX/MIN temperature F° or C° (as required). Low Level Wind Shear (LLWS) (as required).

Notes:

1. Route, Orbit, and Air Combat Maneuver/Training Area MOAFs. Provide forecasts for weather parameters at the route/orbit altitude for the duration of the mission. Provide forecasts for weather parameters within 25 miles either side of the planned route/orbit, and within 1,000 feet above and below the route/orbit (or as specified by the customer for VR/Instrument Route missions).

2. AR MOAFs. Provide forecasts for weather parameters within 25 miles either side of the AR track and within 1,000 feet above and below the AR track. Provide forecasts for weather parameters valid for 30 minutes before entering the AR track to 1 hour after exiting.

3. LZ MOAFs. Prepare LZ MOAFs for the specific location in TAF format, or as required by the customer. Valid time will be 1 hour before and 1 hour after period of the mission.

4. EZ MOAFs. Prepare EZ MOAFs for the specific location in TAF or DZ format, depending on the extraction altitude and customer requirements. Valid time will be 1 hour before and 1 hour after period of the mission.

5. Format MOAFs for Target Areas, FARPs, Combat Maneuver Areas, Instrument/Low Level Routes, Tactical Ranges, and Gunnery Ranges as required by the customer. Valid time will be 1 hour before and 1 hour after period of the mission.

Figure A6.2. Example CWP for an Operation with Multiple Missions.

FXUS 1 KXXX (if entered in the AWN).
CWP FOR MISSION NUMBER & DEPARTURE STATION
PART 1. SYNOPTIC DISCUSSION: VT: XX/XXXXZ - XXXXZ JULY XXXX. A STATIONARY COLD FRONT EXTENDS FROM THE GREAT LAKES INTO CENTRAL IL, IA, AND SOUTH-CENTRAL NE AND REACHES WESTWARD TO A LOW IN CENTRAL CO. A HIGH PRESSURE RIDGE DOMINATES THE SOUTHEAST US.
PART 2. ROUTE X FORECAST: VT: XX/XXXXZ - XXXXZ JULY XXXX.
ALL FORECAST HEIGHTS MSL.

CLOUDS:	180	260
FEW 150		BKN
TURBC:		240
	NO	
NE		
ICING:		
	NO	
NE		
TSTMS:	ISOLD, MAX TOPS 360	

PART 3. CLEAR TARGET DZ FORECAST: VT: XX/XXXXZ - XXXXZ JULY XXXX.
ALL FORECAST HEIGHTS AGL.

	WINDS:	TEMPS:
SFC:	28010/18	P23C
200 FT:	28011	P22C
500 FT:	28012	P21C
700 FT:	28012	P20C
1,000 FT:	28013	P19C
1,500 FT:	30014	P18C
2,000 FT:	32015	P17C
3,000 FT:	33017	P15C
SFC VIS/WX:	6 HZ	
TSTMS:	NONE	

ICING: NONE
TURBC: NONE
CLOUDS: SKC
MIN ALSTG: 29.92
INS
PART 4. ORBIT X FORECAST: VT: XX/XXXXZ - XXXXZ JULY XXXX.
ALL FORECAST HEIGHTS AGL. (Low altitude
example). CLOUDS:050
BKN 025
SFC VIS/WX: 4 HZ
WIND/TEMP: 2,500 FT AGL:
27019/P16C TSTMS: NONE
ICING: NONE
TURBC: OCNL LGT 030 TO 060
PART 5. AR XXX FORECAST: VT: XX/XXXXZ - XXXXZ JULY XXXX.
ALL FORECAST HEIGHTS MSL.
FLIGHT LEVEL 240 MSL
CLOUDS: 350
26 BKN
0 SCT 180 300

VIS: 1 Nautical Mile (NM) IN CLD, 7+
OUT FL WINDS: 25030KTS
TSTMS: ISOLD, MAX TOPS
380 ICING: LGT MXD 180 TO
220
TURBC: LGT TURBC 180 TO 240 WESTERN 1/3
OF TRACK
PART 6. CONFIRMATION: PLEASE ACKNOWLEDGE RECEIPT BY PHONE
(DSN XXX-XXXX), E-MAIL, FAX, OR SERVICE MESSAGE.

Figure A6.3. Example CWP for a JA/ATT Mission.

JA/ATT CWP FOR MSN NUMBER XXX – KAAA (Mission Number & Departure Station).
1. MISSION DESCRIPTION: ON 17 JULY XXXX, ONE XXX AW C17 WILL DEPART KAAA AND FLY THE FOLLOWING ITINERARY.

2. ITINERARY: ALL DATES JULY XXXX/ALL TIMES UTC.

ARRIVAL	STATION	DEPARTURE	REMARKS
	KAAA	17/1500	ORIGIN
17/1900	FIRST TARGET DZ PA	17/1950	DROP
17/2020	KBBB	17/2235	OFF LOAD
17/2335	KCCC	19/1400	REST
19/1500	KDDD	19/1715	LOAD
19/2200	SECOND TARGET DZ NJ	19/2230	DROP
19/2300	KEEE	20/2230	REST
20/2359	KFFF	21/0215	LOAD
21/0300	THIRD TARGET DZ NY	21/0340	DROP
21/0410	KFFF	21/2140	REST
22/0310	KAAA		TERMINATE

3. COORDINATION:
A. KAAA: WILL PROVIDE INITIAL CREW BRIEFING TO FIRST TARGET DZ AND KBBB.
B. KBBB: PLEASE PROVIDE FIRST TARGET DZ FORECAST TO KAAA WITH INFO COPIES TO KCCC NLT 17/1300Z AND CREW BRIEF TO KCCC.
C. KCCC: PLEASE PROVIDE CREW BRIEFING TO KDDD, SECOND TARGET DZ, AND KEEE.
D. KEEE: PLEASE PROVIDE FORECAST FOR SECOND TARGET DZ TO KCCC WITH INFO COPIES TO KAAA AND KDDD NLT 19/1200Z AND CREW BRIEF TO KFFF.
E. KFFF: PLEASE PROVIDE CREW BRIEFING TO THIRD TARGET DZ, AND RETURN MISSION BRIEF TO KAAA.
F. KGGG: PLEASE PROVIDE THIRD TARGET DZ FORECAST TO KFFF WITH INFO COPIES TO KAAA AND KDDD NLT 20/2215Z.

4. MISSION PRODUCTS:
1. FIRST TARGET DZ FORECAST –
KBBB. 3X.XXN 9X.XXW (Lat/Long).
TOT: 17/1950Z DROP ALTITUDE 1000 AGL.
VT: 17/1850Z - 2050Z JULY XXXX.
2. SECOND TARGET DZ – KEEE.
3X.XXN 7X.XXW.
TOT: 19/2230Z DROP ALTITUDE 800 AGL.
VT: 19/2130Z - 2330Z JULY XXXX.
3. THIRD TARGET DZ – KGGG.
4X.XXN 7X.XXW.
TOT: 21/0300Z DROP ALTITUDE 800 AGL.

VT: 21/0200Z - 0400Z JULY XXXX.
5. POINTS OF CONTACT:
a. 12 OSS/OSW (KAAA): TSGT Jenkins, DSN 123-4567.
b. 45 OSS/OSW (KBBB): SSGT Richards, DSN 234-5678.
c. 67 OSS/OSW (KCCC): MSGT Vu, DSN 345-6789.
d. 89 OSS/OSW (KDDD): TSGT Tyler, DSN 456-7890.
e. 101 OSS/OSW (KEEE): 1 LT Costa , DSN 567-8910.
f. 68 OSS/OSW (KFFF): SSGT Siebert , DSN 678-9101.
g. 15 0SS/OSW (KGGG): 2 LT Budzco , DSN 789-1011.
6. REMARKS: PLEASE NOTIFY KAAA POC OF ANY PROBLEMS IN PROVIDING SUPPORT TO THIS MISSION. 12 OSS/OSW SENDS, 2 LT GREEN.

Figure A6.4. Example CWP for Range Control.

VALID TIME VT: XX/XXXXZ - XXXXZ JULY XXXX. ALL FORECAST HEIGHTS AGL.
AVERAGE RANGE SURFACE ELEVATION: +190 FEET MSL.

CLOUDS:	040	120
	SCT 020	BKN 070 (LYRD)
AFT 17Z:	040	120
BKN 020		OVC 070 (SOLID)
SFC VIS/WX:	7+/NONE	
SFC WINDS:		
	32008KT	
S		
MIN ALSTG:	30.02INS	
TSTMS:	ISOLD, MAX TOPS 350	
TURBC:	LGT SFC TO 130	
ICING:	LGT RIME 070 TO 120	
LLWS:	NONE	

MAX/MIN TEMP: P21C/P18C REMARKS: NONE WINDS/TEMPS ALOFT:

200 FT:	28010KTS/P16C	3,000 FT:	33030KTS/P09C
500 FT:	30010KTS/P15C	5,000 FT:	34035KTS/P03C
700 FT:	31015KTS/P14C	7,000 FT:	35040KTS/00C
1,000 FT:	32015KTS/P13C	9,000 FT:	35045KTS/M03C
1,500 FT:	34020KTS/P12C	11,000 FT:	35050KTS/M06C
2,000 FT:	33025KTS/P11C	13,000 FT:	35055KTS/M09C NEAREST METAR

SITE: KXXX (4 NM W).
FCSTR: TSGT CARES, QA: 1LT
CHECKS. DSN 321-5678, EXT 222.

Attachment 7
WEATHER METRICS DEFINITIONS AND MEASURES OF PERFORMANCE

A7.1. WARNVER Instructions. Calculate WARNVER metrics based on the following definitions in **Table A7.1** and MOPs in **Table A7.2**.

Table A7.1. WARNVER Definitions.

Term	**Definition**
Required	An observed event that meets a WWA criteria.
Issued	An issued WWA forecast for a specified weather event.
Required and Issued	A verified accurate WWA, i.e., an issued WWA for which a specified event was also observed. Also known as a Hit, may include met DLT, PLT and NLT depending on how it is counted.
Required Not Issued (RNI)	A weather event that meets a WWA criteria occurs, but a WWA was not issued. Also known as a "miss."
Desired Lead Time (DLT)	The advance notice time for WWAs prior to onset of an event as determined by the supported unit/organization. A WWA that meets DLT also counts as a Positive Lead Time (PLT) WWA.
Positive Lead Time (PLT)	A verified WWA issued prior to the specified event being observed.
Negative Lead Time (NLT)	A verified WWA issued simultaneous to or after an observed event. Classified as a "miss" for metrics calculations.
False Alarm (FA)	A WWA that was issued but the specified criteria are not observed during the WWA valid time.
Timing Error (TE)	The time difference between WWA event forecast onset time and the time the event occurred.
Sub-Threshold WWA (STW)	For moderate or greater WWA categories only. A special case of FA for which the observed intensity level is one category lower than the specified WWA intensity, and STWs still count as FAs. For example, a warning for ¾" hail issued and ½" hail was observed; the ½" hail occurrence counts as a STW. For precipitation, the STW is 1" lower i.e., for 2" heavy precipitation WWA, 1"-1.99" of precipitation satisfies STW criteria.
Justified FA (JFA)	A special case of FA for which the observed intensity level reaches 90% of the specified WWA intensity. JFAs are FAs, and STW and JFA may overlap; for example a 50kt wind warning meets both STW and JFA thresholds when 46kt-49kt is observed.

Table A7.2. WARNVER MOPs.

MOP Category: Event Count/Time record	**By WWA Category Row Calculation Description**	**Math Expression**
Met Desired Lead Time (DLT): the number of verified WWAs that Met DLT	The number of verified WWAs that met DLT, divided by the total number of events accurately forecast (Required and Issued WWAs (PLT+NLT)*).	Met DLT% = (Total Met DLT/(Total (PLT+NLT)) x 100
Positive Lead Time (PLT): the number of verified WWAs with lead time greater than 0	The number of PLT WWAs divided by the total number of Required and Issued WWAs (PLT+NLT).	PLT% = (Total PLT/(Total (PLT+NLT)) x 100
Negative Lead Time (NLT): the number of verified WWAs with NLT	The number of NLT WWAs divided by total number of Required and Issued (PLT+NLT).	NLT% = (Total NLT/(PLT + NLT)) x 100
Required Not Issued: the number of WWAs required but not issued (i.e., a miss)	The number of WWAs required but not issued, divided by the total number of Required.	RNI% = (Total RNI/Required) x 100
False Alarm: the number of Issued WWAs that did not verify.	The number of FA divided by the total Issued.	FAR (False Alarm Rate is a common historical term – FAR is the percentage of the FA ratio.) = (Total FA / Issued) x 100

MOP Category: Event Count/Time record	By WWA Category Row Calculation Description	Math Expression
Timing Error: record the timing error as an absolute value for each WWA Required and Issued **Note:** Exclude WWAs with less than 50% DLT, as they skew calculations.	Sum the Total TE with 50% or greater DLT, and divide by the number of verified accurate WWAs Required and Issued (PLT + NLT).	MTE = (Total $\|TE_1\|+\|TE_2\|\ldots\|TE_n\|$)/ (Total (PLT+NLT))
Sub Threshold Warning (STW): for moderate or greater intensity only, count those WWAs that met STW criteria	The total STW WWAs divided by the number of moderate or greater WWAs Issued.	STW% = (Total STW/Issued $_{\text{moderate or greater}}$) x 100
Justified FA: count WWAs that met JFA criteria	The total JFAR WWAs divided by the total Issued.	JFA Rate = (Total JFA/Issued) x 100
NOTE: On Overall Category (Row) and Total (Column) calculations: total each column of WWA criteria counts to create an overall WWA verification count, i.e., sum all of the Met DLTs, PLTs, NLTs, RNIs, etc. Then, compute the overall MOP verification rates for the total group of all Warnings. Similarly compute separate overall MOP verification rates for the grouping of Forecast Advisories and Lightning Watches together. Finally, total all WWA column counts and compute each of the total overall MOP verification rates.		

A7.2. TAFVER Instructions. Calculate TAFVER metrics based on the following definitions in **Table A7.3** and MOPs in **Table A7.4** and **Table A7.5**.

Table A7.3. TAFVER Criteria Definitions.

Term	**Criteria Definition**
Ceiling (cig)	All ceiling specification and amendment criteria as documented on the installation data page/installation weather support plan (or equivalent) verified within forecast categories as a correct forecast or an incorrect forecast for all groups.
Visibility (vis)	All visibility specification and amendment criteria as documented on the installation data page/installation weather support plan (or equivalent) verified within forecast categories as a correct forecast or an incorrect forecast for all groups.
Wind Speed	Verify all forecast groups where wind speeds are greater than or equal to (GTE) 6 knots. If the forecast is within +/- 9 knots it is a correct forecast. 10 knots or greater error forecast is an incorrect forecast.
Wind Direction	Verify all forecast groups. For periods when winds are more than 6 knots but less than 15 knots, a forecast direction within 50 degrees is a correct forecast. For periods when winds are greater than or equal to 15 knots, a forecast direction within 30 degrees is a correct. When the forecast error is greater than these thresholds, the forecast is incorrect.
Wind Gusts	If gusts occur and are within 10 knots of the forecast criteria or no gusts are forecast and no gusts occur, the forecast is correct. For all cases where gusts are not forecast and gusts occur, or where gusts are forecast, but do not occur, no points are awarded and the forecast is incorrect.
Present Weather	Verify all forecast groups present weather for each phenomena separately, precipitation in liquid, freezing, or frozen, obscurations, and other. Intensity/proximity qualifiers are not mandatory for verification. A correct forecast is when a phenomena is forecast and observed. An incorrect forecast is when a phenomena is forecast but not observed or not forecast but was observed.
Lowest Altimeter Setting	Verify lowest altimeter setting, as measured for every forecast group (except TEMPO), within forecast categories as a correct forecast or an incorrect forecast as follows: If the lowest altimeter observed during a given hour was no more than .05 INS lower than forecast during that hour it counts as a correct forecast. If the lowest altimeter observed during a given hour was more than .05 INS lower than forecast during that hour it counts as an incorrect forecast.
Combined TAF Accuracy	The overall TAF score using all available points earned divided by the possible available points for every hour in the TAF for all groups that were forecast, BECMG, TEMPO, and FM.

Table A7.4. TAFVER MOPs.

MOP Category: Event Score	**By TAF Category Description**	**Math Expression**
Ceiling (cig): The hourly score is one point for a correct cig forecast and zero points for an incorrect cig forecast.	The overall TAF cig percentage correct is the total number of points for correct forecasts (PCF) divided by the total number of available points (AP) multiplied by 100.	cig % = (Total cig PCF /Total cig AP) x100
Visibility (vis): The hourly score is one point for a correct vis forecast and zero points for an incorrect vis forecast.	The overall TAF vis percentage correct is the total number of vis PCF divided by the total number vis AP multiplied by 100.	vis % = (Total vis PCF /Total vis AP) x100
Wind Speed: The hourly score is one point for a correct wind speed forecast and zero points for an incorrect wind speed forecast.	The overall TAF Wind Speed percentage correct is the total number of Wind Speed PCF divided by the total number of Wind Speed AP multiplied by 100.	Wind Speed % = (Total Wind Speed PCF /Total Wind Speed AP) x100
Wind Direction: The hourly score is one point for a correct wind direction forecast and zero points for an incorrect wind direction forecast.	The overall TAF Wind Direction percentage correct is the total number of Wind Direction PCF divided by the total number of Wind Direction AP multiplied by 100.	Wind Speed % = (Total Wind Direction PCF /Total Wind Direction AP) x100
Wind Gusts: The hourly score is one point for a correct wind gusts forecast and zero points for an incorrect wind gusts forecast.	The overall TAF Wind Gusts percentage correct is the total number of Wind Gusts PCF divided by the total number of Wind Gusts AP multiplied by 100.	Wind Gusts % = (Total Wind Gusts PCF /Total Wind Gusts AP) x100

Present Weather: The hourly score is the hourly CSI, with a perfect forecast equal to 1 point, and less than a perfect forecast a fraction of a point as defined by the CSI formula. CSI = A/(A+B+C)	The overall TAF Present Weather percentage correct is the sum of the number of Present Weather points (and fractions of a point) awarded each hour from the hourly CSI score divided by the total number of Present Weather AP multiplied by 100.	Present Weather % = (Total Present Weather CSI points /Total Present Weather AP) x100
Lowest Altimeter Setting: The hourly score is one point for a correct Lowest Altimeter Setting forecast and zero points for an incorrect forecast.	The overall TAF Lowest Altimeter Setting percentage correct is the total number of Lowest Altimeter Setting PCF divided by the total number of Lowest Altimeter Setting AP multiplied by 100.	Lowest Altimeter Setting % = (Total Lowest Altimeter Setting PCF /Total Lowest Altimeter Setting AP) x100
Combined TAF Accuracy: Aggregate accuracy score for an entire verified TAF using forecast group PCF and AP totals.	The combined TAF accuracy percentage is found from the sum of the total PCF per group divided by the sum of the total AP per group multiplied by 100.	Combined TAF Accuracy % = ((BECMG $_{PCF}$ + TEMPO $_{PCF}$ + FM $_{PCF}$) / (BECMG $_{AP}$ + TEMPO $_{AP}$ + FM $_{AP}$)) x 100

Table A7.5. TAFVER Metrics.

Criteria	**Requirement (BCMG, TEMPO and FM)**	**Hourly Score and Overall Percentage Correct (BCMG, TEMPO and FM)**
Category cig Accuracy	As described in Table A7.4 for individual weather personnel. Identify individual skills and deficiencies and take actions as necessary.	As described in Table A7.4 for individual weather personnel.
Category vis Accuracy	As described in Table A7.4 for individual weather personnel. Identify individual skills and deficiencies and take actions as necessary.	As described in Table A7.4 for individual weather personnel.
Category cig bias	Number of total hours forecast for each cig category divided by the number of hours observed in each cig category.	Report scores by hour in the TAF and an overall score for all hours of the TAF.
Category vis bias	Number of total hours forecast for each vis category divided by the number of hours observed in each vis category.	Report scores by hour in the TAF and an overall score for all hours of the TAF.
Present Weather Accuracy	As described in Table A7.4 for individual weather personnel. Identify individual skills and deficiencies and take actions as necessary.	As described in Table A7.4 for individual weather personnel.
Present Weather Bias	Number of total hours forecast for each present weather event divided by the number of hours observed in each present weather category.	Report scores by hour in the TAF and an overall score for all hours of the TAF.
FITL Value Added	Compute TAFVER MOPs according to Table A7.4 for the model produced TAF (if applicable). Subtract the model produced TAF MOPs from the FITL TAF MOPs to determine the FITL value added.	Report scores by hour in the TAF for each MOP in Table A7.4 and include an overall score for all hours of the TAF.

A7.3. MODVER Instructions. Calculate MODVER metrics based on the following definitions in **Table A7.6** and MOPs in Table **A7.7, A7.8 and A7.9**.

Table A7.6. Definition of MODVER Variables.

Variable	Description
n	Number of forecast/observation pairs
m	Model forecast value
o	Observed value
c	Climatological value (i.e., long-term mean)
y	Stochastic forecast probability of event occurrence
p	Observed event occurrence (0 or 1)
w_j	Weighting assigned to the *j*th forecast parameter
SS_j	Skill Score for the *j*th forecast parameter
ref	Reference forecast (often output from another NWP model)
k	An event occurrence threshold
K	Total number of event occurrence thresholds
O_i	Used in Fractional Skill Score. For a given location, ***i***, it is the fraction of the surrounding area (e.g., a 10-km ring) that is observed to meet the criteria threshold (e.g., thunderstorm)
M_i	Used in Fractional Skill Score. For a given location, ***i***, it is the fraction of the surrounding area (e.g., a 10-km ring) that is predicted to meet the criteria threshold (e.g., thunderstorm).
$F_i^f(x)$	Cumulative distribution function of the stochastic forecast probability for the *i*th forecast case
$F_i^o(x)$	Cumulative distribution function of the observation for the *i*th forecast case (normally a single stepwise function from 0 to 1 at the observed value)
A	Criteria event forecast, Criteria event observed
B	No criteria event forecast, Criteria event observed
C	Criteria event forecast, No criteria event observed
D	No criteria event forecast, No criteria event observed
A_{MODE}, B_{MODE}, and C_{MODE}	Same as "A", "B", and "C" above, but based on a forecast field matching procedure from the Method for Object-Based Diagnostic Evaluation (MODE). A_{MODE} refers to an observed area matched to a corresponding forecast area, B_{MODE} refers to an observed area not matched to a corresponding forecast area, and C_{MODE} refers to a forecast area not matched to a corresponding observed area.

Table A7.7. MODVER Required Minimum MOPs.

Performance Metric	Example Equations	Description
Mean Square Error (MSE)	$\frac{1}{n}\sum (m - o)^2$	Primary metric to measure model accuracy. Observed values should be from station data as opposed to model analysis. Required parameters are temperature at 500 hectopascals (hPa) and 2 meters, wind direction and speed at 500 hPa and 2 meters, and sea-level pressure.
Bias	$\frac{1}{n}\sum (m - o)$	The average error, with sign, of the predicted and observed value. Observed values should be from station data as opposed to model analysis. Required parameters are temperature at 500 hPa and 2 meters, wind direction and speed at 500 hPa and 2 meters, and sea-level pressure.
Anomaly Correlation	$\frac{\sum\{[(m-c)-\overline{(m-c)}][(o-c)-\overline{(o-c)}]\}}{\sqrt{\sum[(m-c)-\overline{(m-c)}]\sum[(o-c)-\overline{(o-c)}]^2}}$	Commonly used metric at modeling centers to assess model accuracy. Verifies NWM output against a model analysis (usually from the same model) rather than against observations. Also has the benefit of not rewarding a lack of variability in the model forecast, which can occur with MSE. Required minimum parameter is 500 hPa geopotential height, but other variables can be used as well.

Table A7.8. Optional MOPs for Deterministic NWM Output.

Performance Metric	Example Equations	Description
Skill Score	$\left(1-\frac{MSE}{MSE_{ref}}\right)$	Useful for comparing performance of two models.
Generalized Operations Index	$\sqrt{\frac{1}{1-\frac{1}{\sum w_j}\left(\sum w_j SS_j\right)}}$	Useful for consolidating the Skill Score for multiple forecast parameters into a single index. The skill score for each parameter, ***j***, is assigned a weight based on its importance to the overall index.
Root Mean Square Error	$\sqrt{\frac{1}{n}\sum (m-o)^2}$	Similar to MSE, another common measure of NWM accuracy.
Probability of Detection (POD)	(A/(A+B)) x 100%	For measuring NWM ability to predict occurrence of a specific event, such as 25-kt surface winds. POD measures the percentage of all event occurrences that were predicted by the model.
FAR	(C/(A+C)) x 100%	For measuring NWM ability to predict occurrence of a specific event, such as 25-kt surface winds. FAR measures the percentage of all predicted event occurrences in which the event did not occur.
CSI	A/(A+B+C)	For measuring NWM ability to predict occurrence of a specific event, such as 25-kt surface winds. CSI takes into account both POD and FAR, and is therefore a more balanced single metric. Tends to excessively penalize predictions of rare events, so is better used when threshold is routinely observed. Values range from 0 to 1 (perfect forecast).
Root Mean Square Factor (RMSF)	$\exp\left(\sqrt{\frac{1}{n}\sum\left[\log\left(\frac{m}{o}\right)\right]^2}\right)$	Similar to MSE, another common measure of NWM accuracy. A perfect forecast is 1, with values greater than 1 indicating greater model error. RMSF penalizes an under forecast more than an over forecast, and is therefore useful for sensible weather (e.g., wind gusts), when an under forecast may be particularly undesirable.
Fractions Skill Score	$1-\frac{\sum (O_i-M_i)^2}{\sum O_i^2+\sum M_i^2}$	This is a spatially-aware MOP useful for evaluating NWM ability to predict location and spatial extent of an event, such as thunderstorms, high winds, dust storms, or tornados. Values range from 1 (perfectly-matched location) to 0 (complete mismatch).

MODE	$A_{MODE}/(A_{MODE}+B_{MODE}+C_{MODE})$	This is an object-aware MOP best suited for verification of highly localized, irregular fields, such as thunderstorms, high winds, dust storms, or tornados. There are many variations of the MODE MOP, but all entail some sort of procedure to determine if observed fields of the phenomenon are or are not "matched" by a corresponding forecast field from the NWM output. A contingency table is built that is based on hits, misses, and false alarms from the matching procedure. Once this table is built, the MODE MOP can be expressed using the equation shown; the same as that used to compute CSI. The procedure may also examine attributes of the fields, such as intensity, area, axis angle, aspect ratio, or curvature, and incorporate these into the final statistics.
Commission for Basic Systems (CBS) Index	The model output is re-gridded to 1.5 degrees, compared with analysis of four parameters, at four levels, in three regions, at five forecast hours for deterministic forecasts only.	CBS Index is a World Meteorological Organization (WMO) standard used by major modeling centers. It is an aggregated statistic relative to a standard (i.e., UK Meteorological Office – UKMO - Unified Model). Zero represents parity with UKMO Unified Model. Negative numbers represent better performance than the UKMO Unified Model.

Table A7.9. Optional MOPs for Stochastic NWM Output.

Performance Metric	Example Equations	Description
Brier Score (BS)	$\frac{1}{n}\sum (y - o)^2$	For measuring ability of stochastic NWM output to predict occurrence of a specific event, such as 25kt surface winds.
Brier Skill Score	$1 - \frac{BS}{BS_{ref}}$	Useful for comparing performance of two stochastic models to predict occurrence of a specific event.
Rank Probability Score (RPS)	$\frac{1}{K-1}\sum_{k}^{K} BS_k$	Similar to BS, except it consolidates stochastic model performance at multiple event thresholds into a single metric.
Rank Probability Skill Score	$\left(1 - \frac{RPS}{RPS_{ref}}\right)$	Compares RPS for two different stochastic models.
Continuous Ranked Probability Score (CRPS)	$\frac{1}{n}\sum_{1}^{n}\int_{x=-\infty}^{x=+\infty}\left(F_i^f(x) - F_i^o(x)\right)^2 dx$	A thorough metric that measures stochastic model accuracy at all forecast thresholds for a given parameter.
Continuous Ranked Probability Skill Score	$\left(1 - \frac{\overline{RPS}}{\overline{RPS}_{ref}}\right)$	Compares CRPS for two different stochastic models.