

United States Air Force



THOR'S NOTAM

Weather Airman's Magazine

Volume 6
2020



Force Development
and Management



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Acting Director of Weather



Col Gary Kubat - Acting Director of Weather

Weather Warriors,

Please join me in thanking Mr. Stoffler for his contributions to Air Force Weather spanning a 40-year career. His efforts will have lasting positive effects on our career field, and I'm glad to have had the opportunity to serve with him. This edition of Thor's NOTAM was intended to be distributed near his departure; with that in mind we're including what he wrote before retiring as it reflects his heartfelt appreciation for all you do.

I also wish to thank you for your outstanding performance and mission dedication these past few months, especially during the Iranian attacks on our forces, as well as during the continuing pandemic. It may seem like a distant memory now, but it was just this January that our forces in Iraq came under heavy ballistic missile fire from Iran. Our Weather Airmen faced it head on and continued the mission. We are thankful for their courage and that they survived that event.

Right now, COVID-19 impacts people around the world and across our country. While our fellow citizens self-isolated and businesses either closed or reduced their work, you continued AF Weather Operations without skipping a beat. As always, you continue to impress. While we're currently reacting to the immediate needs imposed by this pandemic, we do need to look forward to understand and prepare for challenges that may arise. There are many unanswered questions about medical solutions, and how we may need to adjust our

operations paradigms in the long run. I won't pretend to have the answers yet.

One thing I am sure about is that the future will be different. We will need to rethink some of the basic concepts of how we do business from the first day new Airmen arrive, to the moment we remove our boots on our last duty day. This will take dedicated leadership from front line supervisors to Chiefs and Commanders to confidently pilot our Airmen through the storm. Our units reflect the emotions of their leaders, and as much as ever our leaders need to think clearly and calmly under pressure. We will need to ruthlessly prioritize, shed what may be valuable but simply of lower priority, adapt to emerging warfighting needs, and focus on the essential aspects of our mission. Through all of this our leaders must continue to empathize with our Airmen and their families while positively mentoring up, across, and down the chain. You've got this, and I can't wait to see how well it goes.

"Thank you for your service" is a phrase sometimes said without much substance or understanding of your sacrifices. Rather than closing with that, I simply hope you understand how much I and our team here at the Pentagon appreciate the commitment you've made and the service you provide to the greatest nation this world has ever seen... the best of which is yet to come!

Give 'em Hail!

Col Gary "Q" Kubat



A Change in the Force



Mr. Ralph Stoffler - Previous Director of Weather

A Change in the Force:

Let's step into the time machine together...I remember a day 20 years ago sitting at home on a Saturday morning, the phone rings and the 7th Army Director of Operations calls me. The river around Bad Kreuznach is rising rapidly and he wants to know when will the river crest, and what is that maximum level—i.e., do we need sandbags or should we evacuate? This is a hydrological question, but the DO is asking the SWO. While speaking to him I am clicking through German TV channels to get to the channel that shows river states. All of the information I need is there and I can provide an accurate assessment allowing him to make an informed risk decision. Today, we provide information on severe weather, floods, tsunamis, volcanos, and earthquakes--in short, all aspects of the environment. In fact, many of the most direct METOC questions from Combatant Commanders involve river states in the context of international water rights. Despite this, we only train on meteorology and provide weather equipment and tools that focus on the weather mission. The reality is that operators increasingly look at us as a total environmental capability and not just weather. It is time for us to change the force to reflect this change.

Over the next few years, we will expand the skill set of our career field from where it is today (concentrating on atmospheric and space sciences) to include all aspects of the natural environment. In order for warfighters to understand our true capabilities, we are changing the name of the officer career field from "Weather" to "Weather and Environmental Science". Our education and training will change to reflect these new capabilities and we will begin by integrating Hydrology into our repertoire. The long pole in the tent is to identify, create, and provide the tools and data to support this mission area. Our strategy is to work closely with the

U.S. Army Corps of Engineers and others to develop a global hydrology model that will meet the needs of our warfighters. Over time, we will add other environmental science areas to our set of expertise.

This is not a "dark side of the force" effort; there is a great amount of good to come from making ourselves more relevant to the AF, Army, and Joint fight. The number of commercial weather providers continues to grow, but we are specialized and will flex to these new mission sets.

As our force changes, leadership at the top will change as well. I first walked through the halls of the Air Force Global Weather Center in the summer of 1978. After 40 years of combined military and civilian service, it is time for me to move on. You are the greatest military weather service and the best airmen. Even though many challenges lie ahead, you will master them all and a bright future lies ahead for all of you. I have appreciated the opportunity to serve and want to thank you all for the support you have given. I hope that I have been able to leave you with a better career field and prepared you for the future. Thanks for all you have done and all you will still do.



Technical Director



Mr. Ronald Comoglio - Civilian Force Development

Civilian Force Development

Mr. Ron Comoglio, Weather Civilian Career Field Manager

As this month's Thor's NOTAM issue focuses on force development, it is high time I addressed our career field civilians' personal and professional development! I encourage each member to take advantage of what the AF, DoD, and the Office of Personnel Management (OPM) offer in terms of career planning, receiving feedback, and in attending schools and courses designed to enhance our professional capabilities. Civilian developmental education (CDE) mirrors many of the same AF officer career field's offerings—such as inclusion in developmental education at all three levels and opportunities for mentoring—but there are also many leadership courses available. This article serves up concepts for getting that feedback and coursework.

My intent here is that all interested civilians in specialties which constitute the Weather Career Field (WCF) domain (job series 1340, Meteorologist, or 1341, Meteorological Technician) will know how to access the developmental tools open to them. To be considered requires a simple action on your part: log into the MyVECTOR site before the published deadline. NOTE: If you are a member of another job series within our weather organizations (other than series 0343), there is a career field manager over your area too, but you can still participate in vectoring.

The other vector you can get is the one provided by the WCF Development Team, led by the Director of Weather with a group of Colonels and GS-15s who review records and supervisor assessments to generate recommendations for advancing into higher grades and management levels. Again, this applies to civilians in job series 1340/1341/0343.

With the assistance of Mr. Tyler Brock, the Weather Civilian Career Team lead at AFPC, we published a weather civilian Career Field Education and Training Plan in September 2018 patterned after the officer and enlisted plans. You can find it at the AF e-Publishing website, drill down to the Air Force and Departmental page. Scroll to the bottom and select CFETP link.

We have also started a quarterly civilian newsletter to guide you through the calendar of due outs so guessing when windows of opportunity open and close are less likely to be missed. If you have not received this newsletter via your official email, please contact Mr. Brock to get added. This initiative is one really intended to spread the word so employees can make informed decisions about their future career path.

For all those in supervisory positions, there are a few accession programs of which you should be aware: the PALACE Acquire (PAQ) and Pathway Interns programs seek to bring in newly minted meteorologists--or in one case, a hydrologist-

-as career civilians (currently 88% of our civilians came from the veteran ranks, compared to 64% for the rest of the AF). The emphasis on career civilians does a couple of things: it brings in fresh energy and ideas from academia and/or industry to our tactical levels, and it populates the entry-level GS grades with individuals with diverse backgrounds to develop over time to become strategic thinkers. This strategy and methodology will hopefully foster future senior civilians with a deeper knowledge of the AF's civilian culture. A great example of the success of one of these programs is in a later article from the 45th Weather Squadron. See the new AFI 36-130, Civilian Career and Developmental Programs, published 27 Sep 19, for more details.

There are many opportunities to get the force development within the AF civilian system. Please ensure you and any civilians you supervise are getting in on the deal. From civilian developmental education to tuition assistance to attending the OPM-sponsored courses, the AF is putting its funding where its speech is. The next step is yours!



Senior Enlisted Advisor



CMSgt Randy Sabin - Senior Enlisted Advisor

This issue of Thor’s NOTAM is focused on the topic of force development. I’d like to take a few moments to highlight the great strides we have made in the focused, deliberate development of our enlisted Airmen. AFH 36-2618, paragraph 5.1.6 of “The Little Brown Book” calls upon SNCOs to “Deliberately develop junior enlisted Airmen, NCOs, and fellow SNCOs into better followers, leaders, and supervisors.” The Weather Chiefs and I have laid a solid foundation for deliberate development that can take a Weather Airman from technical training to the rank of Chief Master Sergeant.

The publication of the current enlisted CFETP is the culmination of the recent work towards enlisted deliberate development. You may have noticed the restructure of training requirements to align with codified capabilities. It is imperative that we all internalize what capability we are assigned to and train to the specific capability and skillset needed. Train as we Fight should lead us in this regard!

As a result of the capabilities-focused training standard, we will concentrate on assigning our 3-level Airmen to the B0S/B01 capabilities first. The Initial Skills Course will prepare Airmen primarily on these two UTCs. This will allow a new weather Airman in 5-level upgrade training to obtain a solid foundation in weather support by focusing on observations, TAF production, and resource protection as their initial primary capability. Allowing First Term Airmen the ability to focus on a narrower skillset will build confidence and allow Airmen to be deployment ready in a more efficient and effective manner.

7-level upgrade training will prepare more experienced weather Airmen for integrating weather and environmental information into the planning and execution of operations. The UTCs available to these more experienced Airmen are much more diverse and capitalize on the experience

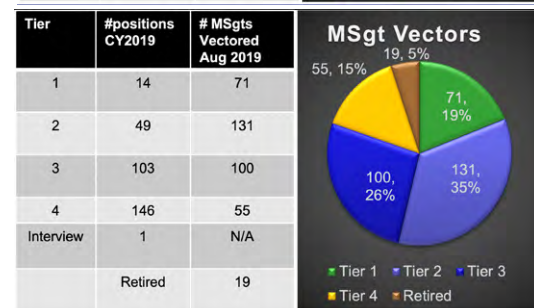
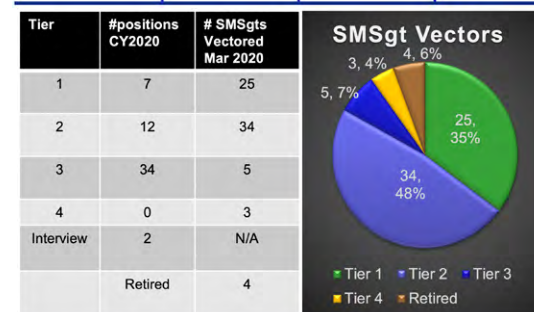
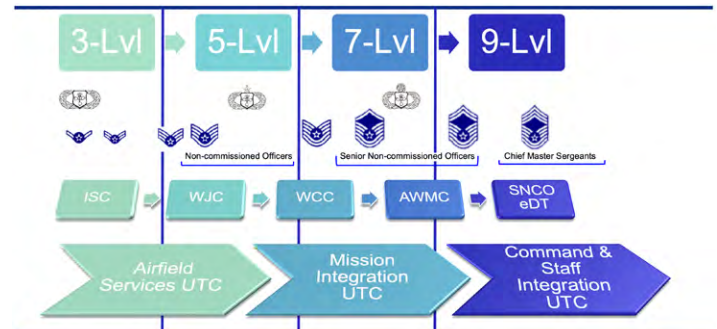
Airmen have first obtained through the B0S/B01 capability. Additionally 7-level upgrade training will prepare new

NCOs on their training and leadership skillset required by the enlisted force structure guidance.

The Advanced Weather Management Course at Keesler Air Force Base has been an Air Force benchmark, showcasing our development of future Flight/Det Chiefs and CGOs. The blended learning course prepares Airmen with the essential skills to run a basic weather organization, teaches the CGO/SNCO teamwork concept, and creates networking opportunities that are invaluable to accomplishing the mission. This has been a resounding success!

Finally, MSgts and SMSgts are guided by the Weather Enlisted Development Team for their development. Vectoring SNCOs has proven very beneficial in that we are putting highly qualified SNCOs in front of our most valuable resource, our Airmen. By placing quality SNCOs into leadership positions we are helping to ensure our junior Airmen are led, developed, and trained properly. Additionally, by vectoring SNCOs we, the Chiefs, are providing feedback to the individual on recommended future roles or assignments that would develop them on their way to achieving Chief Master Sergeant.

I am very proud of the work and efforts the Weather Chiefs have put in toward the development of our Airmen. Now, more than ever, we have a deliberate process that can take Airmen from Tech School to Chief. This process is essential in ensuring our enlisted force will be able to meet the demands of the future and I am confident that our Airmen are ready for the challenge!



Chief Scientist



Dr. Mike Farrar - Chief Scientist

The history of weather in the USAF is replete with a legacy of scientific excellence. One of the most memorable cases occurred on 25 March 1948, when Maj Ernest Fawbush and Captain Robert Miller took their expert knowledge of severe weather to the next level by issuing the very first tornado forecast in history from Tinker AFB, OK, which successfully verified. Today the Fawbush-Miller Award is presented each year to the most outstanding Operational Weather Squadron in the Air Force, with a nod to our heritage and the importance of the science of meteorology to our profession.

While the science of meteorology is crucial to our weather operations, its place in the organization of Air Force Weather has taken many twists and turns. In September 1948, the Air Weather Service (AWS) established the Scientific Services function at HQ AWS under Dr. Sverre Petterssen, the famed Norwegian meteorologist who played a pivotal role in the successful D-Day forecast in 1944. Then in 1952, Dr. Robert Fletcher assumed the position of Director of Scientific Services at HQ AWS, which he held from 1952- 1971. In 1971 a new Chief Scientist position was created with Dr. Fletcher as the one in this key role. Three more people would hold the position of AWS Chief Scientist until October 1978, when the position was eliminated and the billet was used to provide additional manpower at the Environmental Technical Applications Center (ETAC), the forerunner to today's 14th Weather Squadron.

While the Chief Scientist position was eliminated, the Scientific Services directorate continued through the life of AWS, noting that it was re-designated as Aerospace Services in July 1965, with the office symbol "DN" which many old-timers will remember. When AWS was re-designated the AF Weather Agency (AFWA) in October 1997, the HQ AWS functions (including DN) moved from the old HQ AWS at Scott AFB, IL to the new HQ AFWA at Offutt AFB, NE. While the DN organization moved to AFWA, it immediately lost much of its prior scientific critical mass and was reduced to focus primarily on modeling and associated product development and visualization, along with training.

During that same critical time frame in the 1990s, the science of weather in the USAF endured another blow when the predecessor to today's AF Research Laboratories (AFRL) eliminated all funding for the weather research program. This action required the AWS, and later AFWA, to obtain its new scientific developments by leveraging capabilities from the Navy, NOAA, NASA, and other partner agencies. While this attrition of scientific critical mass certainly had a negative impact on our technical capabilities, it also opened the door for new collaborations, particularly in modeling where AFWA (and later the 557th Weather Wing) partnered first with NCAR on MM5 and WRF for regional modeling, and then most recently with the UK Met Office for global modeling with GALWEM.

With an eye towards our increased investments in weather modeling with GALWEM and the associated acquisition of a new supercomputer that will greatly increase our capabilities, Mr. Ralph Stoffler (former AF Director of Weather) decided that the time was right in 2018 to reinstitute the position of the AF Weather Chief Scientist. In addition to exercising scientific leadership and oversight of technical capabilities such as modeling, climate, satellite-based environmental monitoring, and space weather, the Chief Scientist is also charged with building research and



development (R&D) collaborations to help address the scientific and technical gaps of AF Weather to meet our future operational needs.

Given that the USAF provides weather support to the Army and the Space Force, one central responsibility of the Chief Scientist was the creation and leadership of the new Weather Science Collaboration Committee (WSCC). The WSCC brings together the weather-related R&D capabilities of the AF and Army (AF Research Lab, AFIT, Army Research Lab and Corps of Engineers' Engineering R&D Center), the operational users, and supporting program offices to ensure the Air Force, Space Force and Army are optimally aligned and working together towards common goals. One way the WSCC aligns these activities is through an annual AF-Army weather R&D workshop, the first of which is scheduled for later this year. In addition, the WSCC also works together to propose and evaluate Small Business Innovative Research (SBIR) projects, as well as to collaborate as an integrated team to develop an annual list of thesis topics for AFIT students that are recommended to best meet USAF and Army needs.

Another core responsibility of the Chief Scientist is to provide scientific inputs and insights into the development of the current and future AF Weather workforce. One of the most interesting developments from a science perspective is the transition of the 15W officer career field from our legacy of Weather to one of Weather and Environmental Sciences. This means that in addition to meteorology, we will be assessing, educating, and training professionals in other environmental sciences (e.g., hydrology, oceanography, etc.) as well as mathematics, data analytics, machine learning/artificial intelligence, and other related fields. In addition to the traditional advanced degrees through AFIT, I encourage you to explore other opportunities to broaden your horizons and educate yourself in some of these emerging areas of importance. One superb opportunity is the formation of new AFIT certification programs that can be earned through distance learning, such as a new certification program in data analytics; for more on this program, please see the flyer on the AFIT website (<https://www.afit.edu/docs/Data%20Analytics%20Flyer%202020.pdf>) or [contact the AFIT data analytics program at afitensdataanalytics@afit.edu.](mailto:afitensdataanalytics@afit.edu))

In addition to broadening your horizons beyond meteorology, I also encourage you to expand your knowledge in our core area of meteorology. A great way to do that, in conjunction with building your professional network, is to engage with your peers at other weather-focused peer organizations, such as interagency partner agencies in the US, international weather organizations if assigned overseas, and through professional societies such as the American Meteorological Society (AMS) and the National Weather Association (NWA). For those of you assigned in the CONUS, there are several AMS and NWA local chapters located near several AF, Space Force and Army installations, some of which are joint AMS/NWA chapters.

For a listing of chapters near you, please see the following sites:

AMS: <https://www.ametsoc.org/index.cfm/aMS/about-ams/ams-local-chapters/>

NWA: <https://nwas.org/membership/local-chapters>



(credit USAF photo) Maj E.J. Fawbush (left) and Capt R.C. Miller (right)

Whether it is expanding your horizons into the other environmental sciences and related computational sciences, or a renewed deep dive into a new area of our core science of meteorology, I hope you take the challenge to continue to build your scientific skills, both for your own professional development and to help AF Weather meet our evolving needs.

To tie together the themes of AF Weather history, role of the Chief Scientist, and scientific development of our work force to meet our emerging needs, I will bring us back to Fawbush and Miller. Flashing forward 63 years later in 2019, the USAF Director of Weather visited the Cray production facility to ceremonially take possession of the new supercomputer that would soon be shipped to Oak Ridge National Lab to become AF Weather's System 11, the newest high performance computing (HPC) system to run our latest version of GALWEM and other weather modeling applications. One item of business was to select a name for the primary and backup HPC computers that code developers and system operators would use and no doubt type in thousands of times during the life of the system. In recognition of the vital importance of science and to honor our heritage, the new system names should come as no surprise: Fawbush and Miller.

AFW Force Management Division – Latest News

We refer to ourselves as WT but for the majority of the career field we are either known as the training division or “those training guys” at HAF. Officially, we are the Force Management Division (AF/A3WT) here at the AF Weather Operations Directorate and our primary mission is to develop the force through training and education management. The division works with AETC, the MAJCOMs and the Army on new and revised education and training for the field. The division manages career field development through development teams and career counseling and are concerned with all things manning and manpower. The division participates in working groups that affect the career field as a whole and individual development. Examples are the new Information Warfare promotion categories and enlisted and officer career development opportunities such as advanced degrees, support to the USSF, and career development course conversions. Additionally, as we posture our manpower against Unit Type Codes (UTC), A3WT is working closely with the Policy and Readiness Division to ensure the right training can be provided to meet each UTC requirement.

While the list of career field items we are working on is long, we’ve highlighted a small sample of items the Division is working for the career field.

AF Training Record transition to Total Force Training Records (TFTR)

As you know, the Air Force has been working to transition the multiple training records systems utilized by different AFSCs into a single database. The new system, TFTR, not only streamlines all AFSCs into one management system for everyone, but it also contains all individual training records, starting with Basic Military Training. This allows members to access their training records instantaneously, from a single source. In order to complete this action, all records will be migrated from AFTR to TFTR. Each unit must maintain a master training plan and continue to plan, conduct, and document training. During this transition, one widely used method to document training is maintaining a master excel file that mirrors the CFETP STS appropriate for your unit. Your unit’s master training plan and STS can be exported from AFTR, in either excel or pdf format. Localized and mission specific tasks/capabilities can then be added. Additionally, this will help to ensure no individual training data is lost when the system transition is complete. Please work with your MAJCOM and unit leadership for guidance on specific training documentation policies.

AFTR/TFTR Help Desk FYI

Several members in A3WT hold administrative permissions for AFTR, however, there is no dedicated help desk section. We are able to edit master catalogs, unarchive members’ records, approve 1098 catalog requests, help with new unit set up, and provide technical website assistance. Your Unit Training Managers and/or supervisors can assist with account issues such as profile updates/changes and task signatures.

When members are due to PCS, it is the responsibility of the losing unit’s training manager to correctly transfer members’ records to their new unit.

AF Officer Classification Directory Change (AFOCD)

The AFOCD that will be published in Oct 2020 contains a significant change that will allow some prior enlisted Airmen to enter the weather and environmental sciences (WESO) career field. Airmen or civilians may enter the CF if they possess a Bachelor’s of Science degree and have AF weather experience or civilian weather career experience. Waivers are not guaranteed and are limited to twenty percent of the total accessions per year or approximately four to eight applicants. Those interested individuals should contact A3WT at the organizational email below for more details on submitting their request.

Army Weather Support Course (AWSC)

The Army Weather Support Course continues to train Airmen headed to Army weather support assignments. Three A3WT members stationed at Ft Huachuca, a Lt Col and two TSgts, who coordinate and oversee the flow of students into the AWSC, provide Subject Matter Expertise and assist with instruction of the course and student administration. This year the course received additional seat allocations to cover the backlog of individuals who were still in need of the course. Circumstances based on the global pandemic response unexpectedly limited the seats throughout the early part of the year, and the team is working with MAJCOMs to prioritize those members who require the course. While the team continues to work on seat allocations, it is also preparing for the Critical Task Site Selection Board (CTSSB) to be held at Ft Huachuca in August 2020. The CTSSB will review the course curriculum and use inputs from the Army, MAJCOMs, and Army weather support squadrons to modify and update the curriculum as needed. If you have suggestions to improve the course based on your mission needs, forward your inputs through your MAJCOMs for CTSSB consideration.

WAPS Tests Rewrite

The velocity of operations and decision-making has increased exponentially over the last decade and policy and training must keep pace. Therefore, over the last 15 months, the Weather Directorate has completely overhauled our Weather Publications as well as our Upgrade Training Process to include the elimination of CDCs. As a result, the Promotion Testing process also had to be reviewed. Weather Airmen testing in FY 2020 are SKT exempt, however in FY 2021, SKT testing will resume with questions derived from policy versus the CDCs of the past. This focus on policy will prepare our Airmen to meet the requirements of our operators and commanders, help keep our policy and training relevant, and focus our operations into lethal efficiency.

Forecast Challenge

Our annual forecast challenge that began in 2017 will kick off again this November. In October, look for an A3W Gram and email with instructions on registering your team

to participate. This year's scenario will again focus on expeditionary forecasting to challenge your team's expertise. Get ready to display your skills during our 2020 Forecast Challenge!

Contact your A3WT team using this organizational account:

usaf.pentagon.af-a3.mbx.af-a3wt-weather-force-management@mail.mil

A3WT - Force Management Weather Officer Course Modernization

As any Air Force Weather Airman can affirm, the weather career field is continuously evolving; whether we consider technological advances, operational requirements, or even the day-to-day changes in the weather, our profession is

in a constant state of flux. While change is often difficult, it also provides the opportunity to assess, improve, and modernize – all of which are necessary to remain relevant in today's Air Force.

As HQ USAF/A3WT plans for the future of the Weather Officer corps, initial efforts have been focused on the Weather Officer Initial Skills Course – the Weather Officer Course (WOC). Over the past 20 months, A3WT has spearheaded a comprehensive rewrite of the WOC, combining Director of Weather guidance with Subject Matter Expert (SME) input to modernize the course and align its content and learning objectives with the future direction of the career field. After multiple rounds of development and review, the course received final Director of Weather approval in March 2019, and is currently being validated by the 335th Training Squadron. The weather schoolhouse graduated the first of three test classes in August 2019, and the course is expected to be fully validated with the graduation of the third test course.

The revised WOC takes a strategic approach to educating our newest Weather Officers; the focus has shifted from basic meteorology to a Weather Officer's roles and responsibilities – both to their weather unit and to the wider military community at their installation. While still covered in the course, traditional weather-centric tasks (such as issuing TAFs and conducting Flight Weather Briefings) have been de-emphasized, and areas such as mission integration, limited data forecasting, and weather impacts to military operations have been brought to the forefront of the course. The new WOC is designed to get the students thinking about how to integrate with warfighters and support unique mission requirements, in unfamiliar areas of the world, in austere conditions, and in a limited or data-denied environment. The most significant changes to the course are summarized below.

Officer Roles and Responsibilities: The first week of the WOC now covers basic roles and expectations of the officer and enlisted forces, and then moves on to a discussion of Air Force Weather Mission, Policy, and Organization. Students will learn details of Air Force Weather doctrine and policy, and be introduced to Doctrine Annex 3-59 and the 15-series publications that govern weather operations. They'll also

become familiar with the Weather Operations Flight Plan and Road Map, and learn the basic structure and organization of weather operations.

Integration: As the most critical focus area for the entire WOC rewrite, integration was added into the course curriculum at every opportunity in order to stress its importance to military operations. From the start of the course through the CAPSTONE lab, integration is emphasized throughout as one of the key responsibilities of a Weather Officer. The new course emphasizes that officers must learn the details of their supported units' operations, and continuously work with them to determine how best to provide weather support that meets their specific requirements.

Limited Data Forecasting: A new chapter on limited data forecasting was added to the WOC in order to better prepare students for the realities of forecasting in austere, deployed locations. Drawing heavily from legacy Air Weather Service forecast memos and Air Force Weather Qualification Training Packages, the new limited data forecasting course material emphasizes the importance of understanding climatology and local terrain before you deploy, as well as the criticality of local weather observations when operating in a limited data environment.

Space Weather: The space weather block of the course was completely rewritten, with a focus on how space weather phenomena impact military operations. A team of Air Force Research Laboratory scientists and 2nd Weather Squadron experts modernized and expanded the course content, updating the WOC's space weather content to current standards and technological capabilities.

Numerical Weather Prediction: The numerical weather prediction portion of the WOC was thoroughly revamped with a comprehensive update on GALWEM products and capabilities.

Environmental Sciences: The future of the Weather Officer corps will involve more than just meteorology; the WOC now reflects this reality. Students are now provided with general information on other environmental sciences (such as hydrology), and are taught to expect questions outside of the traditional weather realm. Several vignettes, detailing real-world situations where weather officers provided support relating to operations such as dam breaches and humanitarian planning, were also added to the curriculum to provide concrete examples of environmental science support.

CAPSTONE Lab: Serving as the culmination of the course, the CAPSTONE lab has been completely re-written to provide a more integrated, comprehensive experience for the students. The legacy lab consisted of several stand-alone performance tasks (write a TAF, issue a WWA, conduct

a staff weather briefing, etc.), with each task unrelated to the others. The new CAPSTONE lab begins with a mission integration exercise, where students must determine warfighter requirements. The remaining lab performance tasks will all flow from the initial requirements discovered during this exercise, so each product produced (and student task evaluated) will be part of a comprehensive and consistent scenario.

| | |
|---------------------------|-----------------------|
| Lt Col Mark Allen | Lt Col Bryan Mundhenk |
| Mr. Shane Castle | Mr. Jon Natalle |
| Maj William Clements | SMSgt Jennifer Nuy |
| Lt Col Jeff Cunningham | Dr. Mark Pesses |
| Col Jay DesJardins | Capt Tracy Pete |
| Mr. Bob Dickinson | Capt Elizabeth Ramoso |
| Maj Chris Dyke | SMSgt Travis Rieken |
| Capt William Graff | CMSgt Jason Ronsse |
| TSgt Joshua Greene | MSgt Mike Rosales |
| Mr. Rob Harrell | Capt John Ross |
| MSgt Brandon Healy | Mr. Steve Rugg |
| Mr. Thomas Herb | MSgt Kyle Schmidt |
| Capt Jeff Herrera | Capt Mike Snyder |
| Dr. Rachel Hock-Mysliwicz | Dr. Michael Starks |
| Maj Lauren Hogg | MSgt Joseph Trudel |
| Mr. Jim Hoy | Lt Col Bob Wacker |
| Mr. Alex Hubert | Maj Matthew White |
| Maj Angela Joy Radden | Lt Col Jason Wild |
| Col Brian Kabat | MSgt Jeffrey Williams |
| Mr. Marty Kaczmarek | Capt Benjamin Wood |
| Maj Kalen Knippling | Lt Col Kait Woods |
| Mr. Bob Martin | Ms. Allison Wreath |
| Mr. T.C. Moore | |

In closing, A3WT extends individual thanks to the SMEs listed above; these volunteers provided hours of review, rewriting, comments, and edits to their areas of expertise, and provided their time and effort from locations across the globe. The WOC modernization effort was only successful because of their hard work and dedication; we couldn't have done it without them!

2019 Thor's Legions Forecast Challenge

Written by: SMSgt Christopher Gilbert, A3WT

Congratulations go to our 2019 Thor's Legions Forecast Challenge champions! The 26 OWS Civilian Trainers from Barksdale AFB, LA: Mr. Todd Preimesberger, Mr. Jeffrey Robbins, Mr. Daniel McCabe, Mr. Thomas Herb, and Mr. Frederick Fowler.

The previous Director of Air Force Weather, Mr. Stoffler, recognized their accomplishment during the Functional

Review in front of our senior leaders and commanders by presenting them with the Thor's Hammer Trophy. Their commander, Lt Col Wiremen took home Thor's Hammer to display until next year's champions claim victory. Rounding out the top-ten are:

It Could Happen / 26 OWS, Barksdale AFB, LA
Thunder-Cat5 / 146 WF, Coraopolis
PA Goats1 / 618 AOC, Scott AFB, IL
Cat 5 Purricanes / 618 AOC, Scott AFB, IL
High Rollers / 57 OSS, Nellis AFB, NV
SWO Team 6 / 607 WS, Camp Humphreys, RoK
General Galwem / 319 OSS, Grand Forks AFB, ND
Fighting Florida Fujiwharas / 159 WF, Camp Blanding, FL
And In Second Place / Det 4, 2 WS, Holloman AFB, NM

The 2018 National Defense Strategy lists objectives with a strategic approach to prepare us for future conflicts. In the 2019 Air Force Weather Operations vision, SECAF and CSAF said, "AFWO provides decision makers with relevant and necessary environmental information". Now in the third year, our annual exercise challenged Airmen based on guidance from those documents.

Our challenge lasted 4 days and consisted of 75 teams competing - a total of 410 Airmen participated. The forecast challenge focused on two notional/simulated PACOM exercises. The scenario had teams provide leaders in J37 Exercise Division daily updates with 24-hour forecasts across four locations (two joint combat training locations in Alaska and two combined combat training locations in the South China Sea). Teams accumulated points over the 4 days by accurately predicting wind, visibility, ceiling, present weather, and temperature.

Thank you to all the Airmen who participated while continuing to support your daily operations across the globe. Keep your forecast skills honed sharp, and get ready for the 2020 Forecast Challenge!



(credit USAF photo)

Air Combat Command (ACC) 18WS-Securing Environmental Supremacy: The Mighty 1-8 is Ready to Win Our Nation's Next Big War

Mr. Miguel Rosado, Training Flight, 18 WS, Ft. Bragg, NC
SMSgt Patrick Brennan, Detachment Chief, 18 WS, Ft. Drum, NY



An organizational vision provides direction and unites a team by illustrating the future of that team. For the “Mighty” 18th Weather Squadron (WS) that new vision is, “Integrating Environmental Supremacy to Win Our Nation’s Wars”. To accomplish that vision, the men and women of 18 WS who have been fighting in the War on Terror for nearly two decades, now look to the future. Guided by squadron commander Lt Col James C. Caldwell, the 18 WS has a footprint all along the eastern seaboard of the United



(credit USAF photo): MSgt Daughtrey oversees, TSgt Psculkowski and SSgt Culbertson as they evaluate injuries to AIC Anderson (combat casualty) during the Tactical Combat Casualty Care (TCCC) part of the EFEX.

States at nine Geographically Separated Units (GSUs). The Total Force Airmen of the Mighty 1-8 support the conventional Army units of the XVIII Airborne Corps and subordinate divisions, both in-garrison and across the globe. Headquartered at Pope Army Airfield, NC (formerly Pope AFB), the 18 WS produces some of the world’s most elite Army Weather Support (AWS) forecasters, also known as Staff Weather Officers (SWOs).

While a vision provides the team’s direction, a mission statement provides the “how”. The 18 WS mission statement is to “Train and Equip Courageous, Credible, and Combat-Ready Army Weather Support Airmen”. The most critical component of that mission statement is training. Before 18 WS SWOs are ready for deployment, they must attend a number of different formal training courses, such as the Army Weather Support Course (AWSC) and Evasion and Conduct after Capture (ECAC). Additionally, SWOs must also complete Airfield Qualification Training (QT) and M4 and M9 qualification, and provide weather support in both Army and Air Force training and certification exercises.

Some of the more robust exercises in which SWOs participate are at the Joint Readiness Training Center at Fort Polk, LA and the National Training Center at Fort Irwin, CA, but SWOs also support various live-fire exercises and aircraft gunnery exercises. These exercises prepare the Army, and our embedded SWOs, for current and future warfare. In addition, each GSU conducts local exercises with supported Army units, including Unmanned Aerial System (UAS) weather support, but the training does not stop there.

At the 18 WS, SWOs may also have the opportunity to become a paratrooper by attending the Army Basic Airborne Course, or train on aircraft orientation, sling-load operations, and rappelling and fast-rope techniques at Air Assault School. If motivated enough, a SWO may also earn the Pathfinder badge by learning dismounted navigation, and establishing and operating helicopter landing zones and parachute drop zones. To fully embed with our Army units, SWOs require these extra skills to maneuver with their aligned elements and make the difference when the call comes for accurate environmental predictions.

As a capstone to the training, 18 WS SWOs must complete an annual, unilateral Combat Mission Readiness evaluation called the Expeditionary Field Evaluation Exercise (EFEX). During the EFEX, SWOs are evaluated on all Air Force Career Field Education and Training Plan AWS items, including land navigation, tactical visibility charts, field condition manual observations, convoy procedures, evaluating and transporting a casualty, Tactical Meteorological Observing System operations, AWS mission weather briefs, and many other tasks. Upon successful completion of the EFEX, 18 WS SWOs are then certified to execute the mission downrange.

While the basis of effective weather support is accurate, timely, and relevant weather products, SWOs go far beyond just creating weather products. SWOs must be able to tailor products to best support command and control, identifying potential environmental impacts to friendly and enemy forces, while providing means to mitigate or exploit conditions to

the advantage of friendly forces or disadvantage of enemy forces. Being able to equip decision-makers with decision-grade intelligence to accomplish mission objectives is what truly separates a SWO from a weather forecaster.

Despite the grinding deployment schedule over the last twenty years, our mission is now changing. The Airmen and families of the Mighty 1-8, guided by the renewed vision and mission statements mentioned above, are adapting to the current state of global affairs. No longer do we solely prepare for Counter-Insurgency (COIN) operations, rather, following in the footsteps of the Army, we're bending our focus each day more towards the high-end fight. State-on-state warfare, as outlined in the National Defense Strategy and the Air Force Weather Functional Concept of Operations, requires a deeper look at our ability to shoot, move and communicate on the battlefield. Just like our Army counter-parts, SWOs must train even harder now to ensure they can operate safely and effectively in the wars to come. The culture is shifting away from traditional thinking, and moving out to answer non-traditional requirements that encompass the entire scope of the environment, from the bottom of the ocean floor all the way to the reaches of space. There's no doubt that the victor in the next big war will require every advantage, especially those found in Mother Nature. We take this obligation seriously and know full well that the Mighty 1-8 is required for victory. We must be ready!

When you receive an assignment to the 18 WS, you shoulder a great deal of responsibility. You will be called upon to serve like never before. You will be expected to train and perform at the highest level. Not many assignments will prepare you or test you like the 18th Weather Squadron -- "All The Way!"



(credit USAF photo): SSgt Culbertson (front) and A1C Anderson (next to HMMWV) dismount a High Mobility Multi-purpose Wheeled Vehicle (HMMWV) and conduct 5, 25, and 200 meter scans in accordance with CFETP. Rear: SSgt Hobbs and MSgt Daughtrey evaluate and give guidance over speaker about the current scenario.

A5W and SMC - MARK IV-B Update AN/UMQ-13 "MARK IV-B": Out in the Field and Back in the Schoolhouse

MARK IV-B's Forecaster Viewer application is heavily used OCONUS, but not as much CONUS. This may be partially due to there being numerous public "other" weather imagery options to choose from in the U.S. However, another contributing factor may be that introductory training for MARK IV-B has not been taught at the Weather Schoolhouse at Keesler for many years. Now, the latest MARK IV-B Forecaster Viewer app is loaded on nearly all the schoolhouse computers and is available to access live polar and geostationary METSAT imagery for real-time weather events during the school training. While not taught as a unit lesson at the schoolhouse, access to this unique AF capability for students increases awareness for officers and enlisted. It also helps to show some of the multiple uses the Forecaster application has for those in the field, both CONUS and Globally.



(credit USAF photo) A5W SMC MARK IV-B - Caption: US Air Force NCO utilizes MARK IV-B to brief weather in a joint environment.

1) Already have the Forecaster Viewer application and love it, but want to learn and do more with it? MARK IV-B has built a collection of GOES East and GOES West (GOES-16 and GOES-17) Multi-Spectral Image (MSI) command strings using Full Disk scan and CONUS scan imagery, taking advantage of the increased number of channels available from the latest NOAA GOES imaging instruments. These MSI command strings are available for you to install and run on the latest version of the MARK IV-B Forecaster Viewer application.

- True Color
- True Color with hot-spots (fire)
- Fire Detection
- Day / Night Cloud Phase Distinction
- Night Snow-Land MSI clouds
- Night Snow Clouds MSI

Authorized users can contact the Systems & Programs Office (SPO) MARK IV-B Program Manager at: jennifer.valentine.2@us.af.mil to obtain a copy of the command strings file via the Army SAFE site AMRDEC.

2) Does your unit need training on MARK IV-B? For needs not currently met by the AETC weather training program, the AF Program Management Office can provide training opportunities upon request. Units wanting to explore this opportunity should coordinate a request with their unit

training manager, through ACC/A3WT (ACC.A3WT@us.af.mil) and the AF Program Management Office.

3) How do I get the Forecaster Viewer application? Contact 557ww.fssc@us.af.mil for access to a copy of the application. Most users can download/save it to their computer (government computers with a .mil address only). To install it, an individual must have “admin” privileges for the computer or computers targeted for its use. Technical support may be available from the program supporting contractor.

In the right hands and with the right training MARK IV-B can be a powerful forecast tool to ensure the safety of our people and our assets. At JTWC we use MARK-IVB to perform tropical cyclone reconnaissance across the Pacific and Indian Oceans. We have global scale water vapor loops running 24/7/365 on our operations floor to get a broad picture of what is happening across our AOR. We use visible and infrared imagery on a one-to-one scale to monitor position, intensity, and structure of individual tropical cyclones and disturbances. We also use polar orbiting data from MARK-IVB to see through dense upper level clouds in order to find an even more accurate position. Every 3 hours we use MARK-IVB to determine (aka “fix”) the position/intensity of a storm; this 3 hourly information is put into a fix bulletin which is then made available to the military units that we support, as well as to other U.S. and international weather agencies. In 2017, the information pulled from MARK-IVB allowed us to issue 3,415 of these fix bulletins. Tropical cyclone reconnaissance is the first and most crucial step to building an accurate tropical cyclone forecast. It is critical that we have MARK-IVB data as it is our primary tool that we use to complete this mission 24hrs a day, 7 days a week, 365 days a year!” SSgt Cheyenne Lembke, JTWC

Air Education and Training Command (AETC) Weather Visualization for Force Development

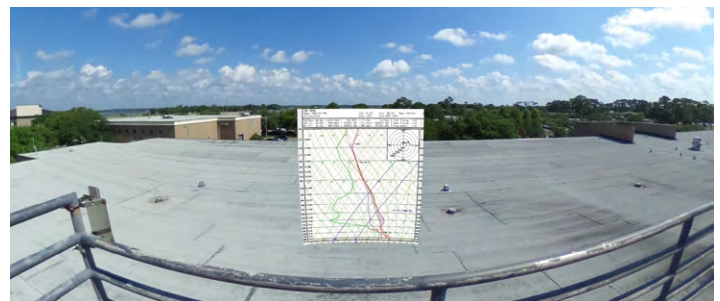
Written by TSgt Lorenz and TSgt Cross, 335th Training Squadron

When it comes to force development in a joint environment, the weather training school at Keesler is where it begins. The science (and art) of weather forecasting is abstract and, although it has been taught and refined for generations, it still proves to be one of the most difficult skills to attain. One of the greatest challenges we face as instructors is helping our students understand how the atmosphere works in three dimensions. That is why the use of visualizations in weather training such as Science on a Sphere and NextGen Environmental Weather Training System (NEWTs) in virtual reality (VR) are exciting advancements. So how is the 335th Training Squadron beginning to explore and implement these training methods?

It starts with the curriculum. Before deciding on what the best phenomena for students to visualize, we have to match it with specific tasks in the Specialty Training Standard (STS) which governs what is taught in the Initial Skills Course. This ensures that procurement directly adds value to the training process.

As new systems have come online in the past two to three years, we have been working to find the highest and best use of the resources to match them to as much applicable curriculum as possible. This included reviewing simulations included in Science on a Sphere and assigning them as material that could be included with classroom instruction. The same has been done with NEWTs as VR has come online in the school house. In addition to some of the more costly approaches, we have also been able to capture weather events using a 360 degree camera and have edited the imagery to include products we teach for forecasting. For example, a VR image was taken and a skew-t was overlaid on the picture so students can correlate what they see on the chart with the sky condition for that time. The camera was used at no cost from the local Public Affairs flight on base, and the imagery was edited in-house. The same process could be done across the Air Force to compile imagery into a website for all to access for training purposes or even for upgrade training.

The next logical step for weather visualization technology is to create a unified place for the information to be hosted for use across the enterprise. Whether the use is for initial training, annual refresher, or deployment readiness, enabling our force to be more prepared for the battlefield of tomorrow is a force multiplier. Being able to show 3D simulations of mechanisms as simple as hot air rising to the introduction of long wave features would be a massive leap in visualization capability compared to diagrams we use on a PowerPoint today. The ability to show the typical weather patterns and local effects for deployed locations in 3D in addition to NEWTs and related 360 imagery is the ideal combination of readiness training that would make the most prepared weather forecaster for any situation. If we can use some initiative while the technology is new, we will be able to incorporate all of our collective needs into one ecosystem that could be used for the duration of an Airman’s career. The content we need is generated every 12 hours with the soundings, 6 hours with a model run, and down to every 30 seconds with some of the newest satellite imagery. All we need is some creativity in the way we perceive the data. Harnessing the data will allow us to unlock potential that has been shown in 2D charts for generations and it will allow us to increase efficiency of training and proficiency of forecasters we have positioned across the globe which directly contributes to the lethality of the warfighter. If this sounds like something you want to be a part of, reach out to one of us and we can work to collect imagery so it can be used to develop the force of tomorrow.

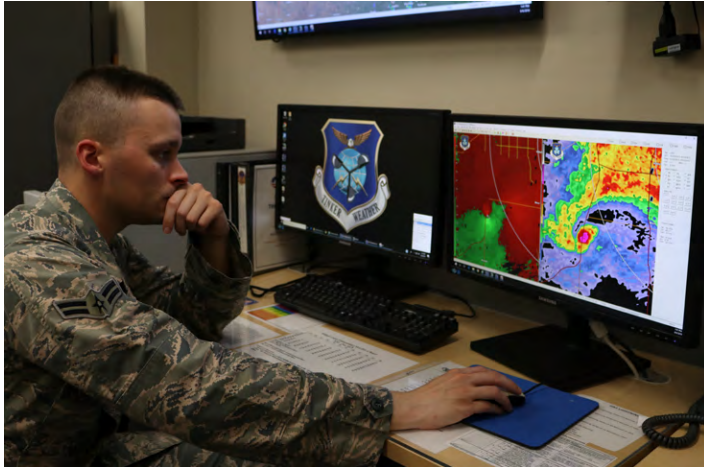


(credit USAF photo) Skew-T overlaid over virtual reality image

Air Force Materiel Command (AFMC)

A1C Race Gardner, 72d Operations Support Squadron, Tinker Air Force Base, Oklahoma was one of only a handful of Airmen given the opportunity to “beta-test” the new Blackboard Online Upgrade Training Program. This new program was designed to give trainees a more hands-on learning experience while also fostering a better

relationship between the trainee and their supervisor. With this new program, the supervisor can see exactly what information the trainee is learning, how far along in their training they are, and can take the time to show the trainee how this information applies in the operational Air Force.



((credit USAF photo)) AFMC A1C Race Gardner demonstrates hands-on weather radar application after beta-testing a unit of training in the Weather Journeyman Course, through Blackboard

When asked his opinion as a supervisor observing the new program, SSGT Brandon Feister, 72d Operations Support Squadron, stated “One of my favorite parts of Blackboard is being able to track A1C Gardner’s progress much closer throughout his training. I also enjoy being able to show him how what he’s learning (for example, radar products) applies to our operational mission here at Tinker AFB. The airmen are no longer just memorizing information for a test. Now, they’re learning and applying concepts from the information to better instill the knowledge; ultimately making them more confident forecasters down the road.”

The old 5-Level CDC’s were a great training resource when they were first implemented, however, they suffered numerous technical flaws over time. These included outdated training information, and a lack of interaction between the trainee and their supervisor throughout the

UGT process. The trainee was getting the minimum amount of necessary training, but wasn’t being shown how what they’re learning fits into their day-to-day duties until after completing CDCs during the certification process. These along with other flaws were fixed with the implementation of the new Blackboard Training program.

With the new program being completely online, the process to update training information has been expedited. What took months and years to update in the past, can now be

accomplished in days or weeks, assuring our 3-levels

are being taught the most relevant information possible. This is imperative as new forms of technology continue to influence and supplement Air Force Weather observing and forecasting processes. Active duty trainees will have up to 9 months to complete the training, but can expect to complete the course in about 4 months, significantly

reducing the time to make them deployment-eligible. When SMSgt Philip Mohr, Flight Chief for the 72d Operations Support Squadron Weather Flight, was asked his opinion on the switch to Blackboard, he stated “I believe Blackboard will effectively enhance the overall training process for new 3-levels, as well as help foster stronger working relationships between airmen and their supervisors.”

As a retired Air Force Weather Forecaster and Observer now working as a civilian, Mr. Matt Albertson, training manager for the 72d OSS Weather Flight, has seen many changes in how training is conducted throughout his career. When asked his opinion on the new Blackboard program, he stated “I’m very impressed with how closely

the program’s web page lines up to that of an online college course. This different setting should make for a much more enjoyable learning experience throughout the airman’s training. If the airman decides to pursue a CCAF degree, this also lightly introduces them to the processes of reading and completing assignments for an online class.”

During the beta-test, A1C Gardner carefully read through one of the 10 training units as if he was completing this for his actual training, and completed each of the three Progress Checks at the end of the unit. SSGT Feister was able to monitor A1C Gardner’s progress throughout the test, and used unit radar training scenarios to instill the information learned. A1C Gardner commented “I really enjoy the organized structure of the training material, and

how easy it is to navigate the Blackboard site. The material was incredibly informative as well, and prepared me well for the progress checks.”

Throughout the test, A1C Gardner took extensive notes; identifying areas of improvement and/or typos in the training material, as well as identifying a PC question whose correct answer was marked as incorrect. Once he completed the test, A1C Gardner and SSGT Feister forwarded all feedback to the 335th Training Squadron

Upgrade Training POC’s including MSgt Edward Schafer Jr., who welcomed all feedback provided. A1C Gardner enjoyed the privilege of being able to test a program that will be used by many 3-levels in the future.

Air National Guard (ANG) Weather Journeyman Course

The Air National Guard's 131st Training Flight (131 TRF) at Camp Blanding, Florida is designed primarily to take Guard airmen who have graduated from initial skills training at Keesler AFB and build upon their core task knowledge and performance to enable them to become certified weather journeymen. This need exists because once a Guardsman returns to their respective weather flight, they typically only perform their duties one weekend per month. The training provided by the 131 TRF ensures these airmen have a more thorough understanding of weather processes and how they are applied to military operations prior to their return to the home unit. A graduate of the flight's Weather Applications Course (WAC) has completed all of the mandatory 5-level STS items in the CFETP. In addition to teaching the WAC, the 131 TRF provides Guard weather units nationwide with annual training opportunities, recertification/refresher courses, and support assistance visits—as well as performing in-state domestic operations missions when called upon by the state of Florida. In order to accomplish this unique mission set, the 131 TRF is manned entirely by full-time personnel, a rarity in the ANG.



(credit USAF photo) 131st Training Flight, Camp Blanding, Florida

Recently, the 335th Training Squadron's Weather Training Flight began developing what is now known as the Weather Journeyman Course (WJC). Active duty counterparts at the schoolhouse brought management from the 131 TRF in the loop on how the course would be implemented and wanted to know if there were any potential failure points that would apply not only to the ANG, but to the entire Air Reserve Component (ARC). One potential failure point was a blended learning model applied across the weather Total Force without considering ARC-specific challenges. In that model, all participants in the WJC would be required to have contact hours with an instructor at the 335 TRS during specified time blocks. This is similar to how the current Advanced Weather Management Course is operated. The challenge is that ARC weather forecasters have a detached life from the Air Force-

-and typically weather forecasting in general--for a majority of the month, and their civilian employers do not have to guarantee them time off in order to attend a teleconference.

Likewise, it would be unreasonable to require 335 TRS instructors to make themselves available over every ARC drill weekend in order to maintain contact hours with ARC airmen. The next challenge was that while the WAC covers the same tasks in the WJC, it does not do so within the WJC unit structure. For example when an AD airman enrolls, they take one unit at a time and cannot move on to a new unit until it is completed. At the 131 TRF, any given block of instruction could cover CFETP items spanning across several WJC units. With those challenges identified, it was decided that active duty and the ARC had to have separate but mirrored WJCs, and the contact hour requirement with 335 TRS instructors was dropped. As students attend the WAC, the ARC-specific Blackboard allows them to move in and out of WJC units while completing the WAC curriculum. 131 TRF students complete all of the progress checks (PCs) with in-house instructors, then when a full WJC unit has been completed they access Blackboard to take their AETC proctored test and end of unit survey. This is a great solution!

As of August 2019, two recent WAC graduates began testing the ANG instructor driven WJC, and every new class coming into the WAC will concurrently complete the WJC. The staff will solicit feedback from the students every step of the way, as well as from the field after they graduate, in order to identify and address any issues. This will ensure the sharpest possible airman, ready for any weather mission--federal or state--is delivered to weather units nationwide, and the 5-level upgrade is accomplished on time in accordance with the CFETP. The ANG weather program would like to thank CMSgt Randy Sabin, CMSgt Todd Carballo, SMSgt Fred King, SMSgt Chad Helmer, MSgt Garrett Palmer, and MSgt Ed Schafer for their continued support and success in this process.



US Air Forces Europe -Air Forces Africa (USAFE-AFAFRICA) USAFE Africa SWO Academies



(credit USAF photo) USAFE Africa SWO Academies

The operating environment is changing and now is a pivotal time of adaptation and preparation for Multi-Domain Operations (MDO). The National Defense Strategy is resolute in the nation's focus, placing the 7th Weather Squadron (7 WS) and 7th Expeditionary Weather Squadron.

(7 EWXS) in a unique position to lead the Army Weather community in pursuit of a more lethal and higher readiness MDO force. To achieve a holistic appreciation of the impact Weather Airmen bring to the fight, the 7 WS hosted SWO Academics, or "SWAcademics," in July 2019. Held at the 7 WS headquarters in Wiesbaden, Germany, the event leveraged expertise from subject matter experts (SME) on history, intelligence, plans, and current operations. Discussions ranged from weather operations spanning battalion to Army Service Component Command echelons, radar, airfield, and weather systems (RAWS) force-multipliers, joint partners from United States Army Europe, and collaborative weather teammates from the 21st Operational Weather Squadron, and the United States European Command (USEUCOM).

With a new generation of Airmen entering the force, many new to Europe, the academic session walked through key historic events that brought Europe to its current geopolitical climate. Topics included, but were not limited to: Germany's forward lines in WWII, notable outcomes of the Potsdam Conference, Cold War frictions and post-Cold War drawdown, the evolution of the North Atlantic Treaty Organization (NATO), and revolutions ending communism in Eastern Europe to name a few. Moreover, the discussions involved the 7 WS's specific history and involvement through these major events. This backdrop provided context for a more robust understanding as the academics transitioned to Operational Plans (OPLANS) relevant to MDO.

Each SWO and RAWS presenter was the expert in their field or Unit Type Code capability and demonstrated the leading edge of their craft in support of unique mission sets i.e. Tactical Road March (TRM), Wet Gap Crossing (WGC), Split/Concealment Ops, Joint Forcible Entry (JFE), Air Assault (AASLT), Theater Logistics, etc. Additionally,

presenters focused on best practices scalable in an OPLAN environment, providing European-specific challenges faced by their supported combat units. The presentations effectively educated a general SWO audience on these unique supported missions based on Army doctrine. The information that was conveyed highlighted specific METOC impacts, challenges, opportunities, and lessons learned from operations in Europe over the past 3-5 years.

If an Airman was unfamiliar with a supported unit's unique mission (e.g., WGC), he or she was then able to understand what a WGC is, the meteorological and oceanographic considerations for effective WGC support, and how a successful or unsuccessful WGC could impact the overall joint operation. Airmen were brought to understand the unique challenges and limitations for the SWO in effectively enabling the success of that operation (i.e. lead weather unit (LWU) coordination, river depth, flow rates, frozen trafficability, etc.), many of which are on the cutting edge of Air Force and Joint capability to predict and exploit.

The Mission Weather Element SME's message provided a holistic understanding of the various combat units' missions, focusing on how their teams deliver the best weather support to Army units. These SMEs highlighted best practices specific to European operations that dialed-in the focus on OPLANS in a scalable way should the geo-political climate in Europe devolve. These SWOs and RAWS professionals demonstrated how 7 WS and 7 EWXS are at the leading edge of readiness for Multi-Domain Operations, and how their actions contribute to the overall peace reassurance and deterrence mission across 51 countries. The process these SWOs take, with each forecast, ready EUCOM and NATO partners to deter aggression from potential adversaries.



United States Space Command (USSPACECOM) Palace Acquire Success at 45th Weather Squadron



Mr. Brian Cizek

The 45th Weather Squadron (45 WS) provides 24/7/365 weather operations supporting the Eastern Range (ER), which includes Patrick AFB, Cape Canaveral Air Force Station, and NASA's Kennedy Space Center. With multiple commercial space partners expanding or beginning launch operations, NASA preparing to launch their new Space Launch System (SLS), and the return of manned space flight, the "Premier Gateway to Space" is busier than ever. As the ER drives to 48 launches per year (and beyond), the 45 WS is finding unique ways to increase its operational capabilities and manpower to maintain its integral support to launch generation, execution, and recovery activities.

In 2017, the Air Force Weather Career Field (WCF) began utilizing the Palace Acquire (PAQ) Program as a force development option. The purpose of the 3-year WCF PAQ Program is to recruit and select high-caliber candidates and develop them into well-rounded weather professionals. The PAQ recent graduate joins the unit as a GS-07 and promotes each year to GS-09 and GS-11, with an outplacement at GS-

12. When 45 WS leadership learned of this unique program, they quickly jumped at the opportunity to hire the second-ever WCF PAQ recent graduate, with a plan to train and develop a new Launch Weather Officer (LWO) to support ER operations. After a recruiting trip to Penn State University in early spring 2018 and a follow up interview, Mr. Brian Cizek was hired into the PAQ Program. Brian graduated from Penn State in May 2018 with a B.S. in Meteorology and joined the 45 WS a few months later.

In the months leading to Mr. Cizek's arrival, the 45 WS developed a training plan that would serve unit needs while producing a well-rounded individual for the WCF. Building a plan for a new college graduate with no experience or history of military operations was daunting. The plan had to incorporate a wider scope of weather and military operations as a whole. Working closely with AFPC, the 45 WS training team devised a developmental timeline combining On the Job Training (OJT), academics, and TDYs to maximize career development.

Upon joining the 45 WS in August 2018, Brian was quickly humbled by the level of knowledge, expertise, and professionalism of the unit's members. He had a lot to learn, and quickly felt like he was drinking from a firehose. However, "Everyone at the 45 WS was extremely welcoming and eager to help me as I assimilated into the squadron and tried to absorb as much information as I could," Brian said. His training process started with Computer Based Training (CBTs) and local training material which covered overall military organization, terminology, and capabilities. He also learned how weather affects military operations across all warfighting domains.

Once he was comfortable with basic military knowledge, Brian began technical training. The 45 WS utilized a similar process that is used for new 3-level forecasters. This included an Initial Plan of Instruction (IPOI) with CBT modules, OJT with certified forecasters, and other local training materials. Brian completed training lessons quickly and grasped Air Force weather concepts easily. After completing half of his forecaster training, Brian attended the Weather Officer Course (WOC) at Keesler AFB, where he reinforced his understanding of the Air Force structure and weather products, and tied the scientific principles he learned in college to operational meteorology. Brian learned the operational significance of observing, METSAT, radar, forecasting techniques, and space weather. He also trained on how to apply this new knowledge to operational products, such as TAFs, MEFs, WWAs, and Flight Weather Briefings (FWBs). Brian successfully completed the WOC, graduating

#1 of 6 in his class, and was honored as a Distinguished Graduate (DG).

Shortly after returning to the 45 WS, Brian enrolled in the Tropical Weather Analysis and Forecasting Course, taught via Distance Learning. Brian really enjoyed this course since, "coming from the Northeastern US, I did not have as much knowledge in tropical meteorology as I did in the mid-latitudes." This was a unique opportunity to provide additional training for a new forecaster in Florida. Once again, Brian showcased his academic abilities by finishing the 6-week course 2 weeks early and earning a 100% test average. The instructor commented, "I've been doing this for years and only remember a handful of aces...AETC policy doesn't allow Distinguished Grad certificates for online courses, but you deserve one."

After completing the Tropical Course, Brian continued his OJT with the 45 WS range forecasters. "After going through

the formal AF weather training, I had much more confidence and knowledge on the ops floor than I did prior to attending WOC,” Brian stated. He worked several different shifts with the enlisted range forecasters and, after several weeks, passed his check ride and became a certified forecaster and observer.

Part of Brian’s training plan includes TDYs to specific weather units as an immersion into all aspects of Air Force weather operations. During his first year in the program, Brian spent 3 days with the 15 OWS, which put together an amazing orientation. Brian shadowed key positions on the ops floor, learned about the unit’s primary mission, and saw how the unit provides backup capabilities to some National Weather Service (NWS) centers. While at Scott AFB, Brian also visited the 618 AOC weather team and the 375 OSS weather flight. This one TDY provided him with an orientation of multiple Air Force weather support capabilities. Before the end of Brian’s first year in the program, he will also spend a few days visiting the 2d Combat Weather Systems Squadron and 23rd Special Operations Weather Squadron to understand their unique mission sets.

In addition to his training and education, Brian provided weather briefings to the 45th Space Wing Commander on

multiple occasions and led 45 WS operations center tours for several groups and DVs visiting the ER. In addition, Brian is leading a validation study on a newly-developed convection initiation tool which will help 45 WS forecasters better predict which convective cells are likely to produce lightning, allowing greater accuracy and lead time on Lightning Watches and Warnings.

The incredible success of the 45 WS PAQ Program is due to two things: the overarching training plan developed by the 45 WS team and the intelligent, professional, and motivated individual hired into the position. Brian’s experience in this program is summarized best by his own words:

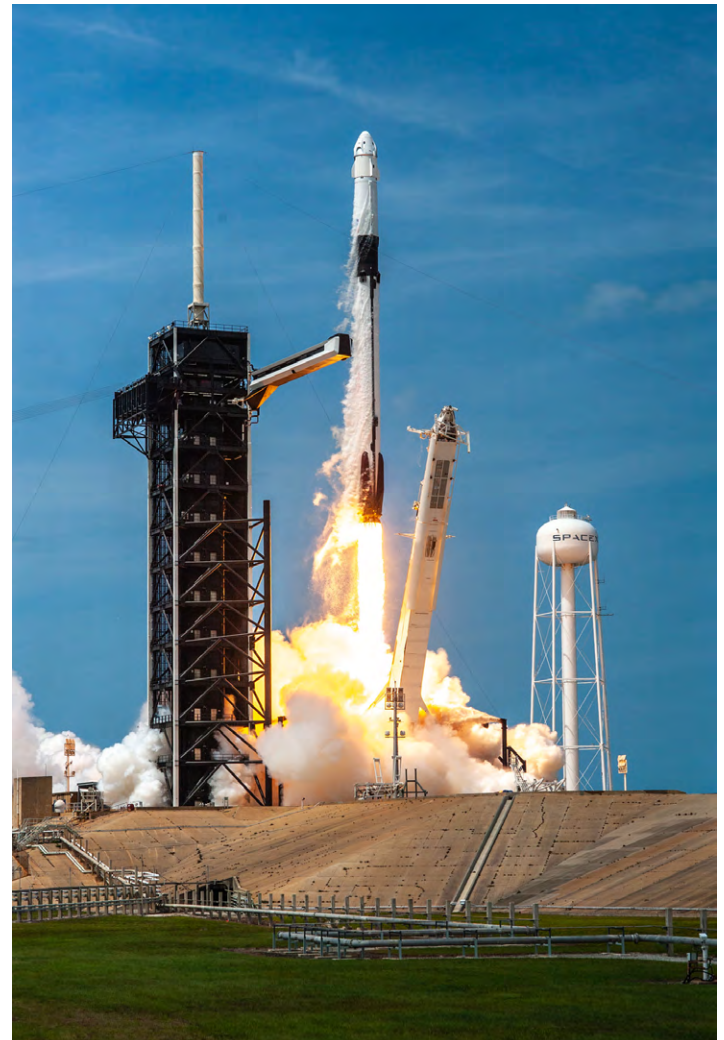
“Overall, I could not be more pleased with my first year in the PAQ Program. In just under a year, I learned an incredible amount, and I feel like I had a huge amount of growth both professionally and personally. I truly enjoy being a part of the 45 WS, and the team/family mentality that we have. I am excited to come to work every day for both the mission and the people. I have great mentorship from so many people here, from the officers, to the enlisted, to the civilians. I am extremely excited about what the next two years in the program will bring.”



(Credit USAF photo): 45th Weather Squadron Launch Weather Team during historic return of manned launches from USA.



(credit Isis Valencia/Spaceflight Now): Return of SpaceX Crew DM-2 first stage to the Cape.



(credit NASA): SpaceX Crew Demo-2 launch 30 May 2020 – return of human spaceflight to the United States.

Enlisted to Officer Corps



Lt Bryan G. Castro

I enlisted in the Air Force in August of 2009 as a Weather Technician (1W0X1). After graduating the weather technical training school at Keesler AFB, MS in May 2010, I was stationed at the 25th OWS at Davis-Monthan AFB, AZ from May 2010 to January 2015. Then I was stationed at the 341st OSS in Malmstrom AFB, MT until I entered Officer Training School in September 2017. In total, I had eight years of active duty service prior to commissioning, and my highest rank held was TSgt. I was in the weather career field for my entire enlisted time, and I'm definitely proud of it. Some of my fondest memories were from working in an OWS, as the experiences and knowledge I gained from there really set the foundation for my weather assignments thereafter. Overall, I'm very grateful that I was able to stay in the weather career field as an officer.

I earned a Bachelor of Applied Science in Meteorology from the University of Arizona in Tucson, AZ. Due to the length of time I was stationed at Davis-Monthan AFB, I was able to finish much of the physics and math requirements, including math up to Differential Equations through Pima Community College prior to transferring to the University of Arizona. The University of Arizona accepted my CCAF credits and Pima Community College credits, which effectively eliminated the first two years of the four-year Bachelor of Applied Sciences program.

Being active duty while going to college part time was very difficult. As a forecaster working rotating shifts, finding a way of going to school either before or after work was

complex, and exhausting. I remember many times coming off of a mid-shift at 0800L, driving to school to get to a 0900L physics class, and then hitting the gym afterwards to get a workout in. On the day when my second daughter Melanie was born, I remember spending the night in the hospital to take care of my wife and newborn, driving to school the very next morning to take a physics test, and then driving back to the hospital. That was a very tough time, and I actually almost dropped out of the meteorology program. My wife and God really convinced me to stay with the program and to see it through to the end. During those years of going to school while working, I found that taking one or two classes at a time was enough to keep my life balanced. I would say that even taking two classes is a stretch, given how hard some of the weather courses were (such as Dynamics).

My wife Racquel and our three children were my greatest support system, and my greatest motivators. Racquel never stopped believing in me, and encouraged and motivated me through the toughest aspects of finishing that program and keeping our lives in balance. Looking back on those years, my only regret with trying to commission while on active duty was the strain it put on my family. I wish I could have spent more time with Racquel and the kids, but unfortunately, that was the cost of trying to balance work with school and family life. When airmen ask me for advice on commissioning, I always tell them of the journey that I went through, but I also recommend they consider going through ROTC as an option, as it's a much more straightforward way of commissioning rather than trying to do it while on active duty.

Ironically, I became a weather officer because I loved doing weather; however, being a weather officer is all about leading people. After graduating OTS, I was stationed at the 23rd Special Operations Weather Squadron (SOWS), and I was immediately put in charge of leading a flight of 29 airmen. Being a flight commander for the past year and a half has been an eye-opening experience for me and I've learned and grown a lot in terms of leading people and managing operations. I would also say that my career prospects are better now that I've finished a bachelor's degree in meteorology. As a 2Lt, I have an entirely new career path of progression as a weather officer, and I hope to make it to Major one day. On the civilian side, I have the possibility of working as a 1340 GS series meteorologist if I choose to separate from the Air Force.

Finally, if had to give any advice to those who are currently enlisted weather and are considering commissioning as a weather officer, it would be this: If you want to lead people and be a decision maker, then become a weather officer. If you enjoy more of the technical aspects of producing forecasts and translating those relevant impacts down to an operator, I suggest staying enlisted or pursuing a career as a civilian meteorologist. There is nothing distinctly better about being a weather officer versus being enlisted weather; it's more about which role you want to fill.

Enlisted to Officer Corps



Lt Greg Egger

My name is Greg and I am extremely humbled to be able to share my commissioning story with all of you! Whether you're unsure about taking the first steps or currently struggling in a program, I hope to offer some encouragement and perhaps motivate you to push through it.

I joined the Air Force in 2009 as a B-1 Bomber Communication/Navigation Specialist. Basically, I worked on the aircraft's radar and radios. I spent about four years at Dyess AFB in Texas with a few TDYs and a deployment sprinkled in. As satisfying as the job was at times, I couldn't see myself dragging knuckles on the flight line for the rest of my career. I felt that I could better serve the Air Force another way. Fortunately, my first-term retraining opportunity was approved and I got picked up for my first choice... Weather.

I had always dreamed of becoming an Air Force officer, but continually kicked the idea further down the road. It was too easy making excuses while I had been working long hours in a physically and mentally draining maintenance career field. As a young Staff Sergeant in my new profession, I finally felt a spark of motivation and told myself "No more excuses!" So, in 2014, when I arrived to my first weather unit, the 15 Operational Weather Squadron, I enrolled in the University of Arizona's online Meteorology Bachelor's program. Before joining the military I had two years of college completed that included Calculus 1 through Differential Equations, and

Physics 1 and 2. This gave me an advantage as far as my degree completion timeline, but I was a little worried how my memory would serve having not taken a math class in nearly 10 years. But, it was too late to turn back and that hesitation turned to excitement. I started with only one course my first semester to get a feel if it would work out. Remote Sensing turned out to be an awesome first course, so I decided to dig deep and knock out as many classes in as short amount of time as I could. For the next two years, I was taking two classes at a time almost every semester. As a heads up, if you plan to take a three-week condensed course be ready for three terrible weeks. But, aside from the additional stress during those condensed courses, I enjoyed the material and performed fairly well. I expect most weather officers will agree, Dynamics will likely be your most difficult classes, but don't get discouraged, just prepare yourself for memorizing information you'll never fully understand.

Finally, after 2 ½ years of constant coursework, I finished my degree and was accepted to attend Officer Training School. As you embark on the OTS application process, know that it's a beast of its own and constantly changing, so I advise you to start the application early. Anyways, I found out that I was picked to be a Weather Officer. I was thrilled to join the Officer Corps and even more excited to stay in Weather. I managed to survive OTS and graduated in early 2018, almost 10 years after my initial enlistment. Then, I got to spend a couple months down at Keesler AFB for Technical School. I'm now stationed at the 618th Air Operations Center at Scott AFB, working as the Weather Operations Chief, leading weather support for Air Mobility Command airlift, air-refueling, and aeromedical evacuation missions.

I don't mean to endorse University of Arizona, but their program worked for me and I know many enlisted weather friends who are in it now. If you decide to pursue a meteorology degree and an online one at that, it's hard to beat what U of A offers. I've heard that they now match what Tuition Assistance covers, meaning no tuition out of your pocket. Their advisors do their best to set you up for success. However, it's up to you to make a practical degree plan that you can stick with. Also, transferring prior course credits is painstaking. Each department will try to pick apart your hard-earned credits, so you may have to respectfully argue with them to get full credit transfer. If you don't already have your math and physics classes completed, I recommend you take them at a community college. They tend to be less difficult and usually meet university standards. I'd check beforehand to ensure they fully transfer. As like any degree program, U of A requires a certain amount of credits to be taken through them, so as long as you meet that requirement, make it easier on yourself and take local, in-class courses as often as you can. Most of my Arizona instructors were extremely helpful, but you're not going to get any assistance without asking for it. Being outside of a real classroom takes away from that easy hand-raise and immediate answer, so you have to get used to taking plenty of notes and asking questions after class. The online aspect of this program was definitely the most convenient, yet most difficult part. It really comes down to how you prioritize your time.

I could not have finished my degree program without the unwavering support from my wife, Anne. She encouraged me to start the program and motivated me throughout. If you have a family, I recommend that you all get on the same page because you won't be the only one making sacrifices. The time spent on classwork will absolutely take away from time spent with family. Ask yourself and significant other "Is this worth the time and energy?"

Making the switch from enlisted to officer was one of my most satisfying achievements. It required years of sacrifice, but was undeniably worth it. This path is not for everyone, but I highly encourage anyone who is truly determined to start and stick with it. Don't do this if you're just looking to get saluted or paid more. It's a serious commitment only for those wanting to serve in a higher capacity with the authority to get things done and responsibility to take care of your people.

I really hope my words offered some kind of usable advice or even just the knowledge that this is possible. Best of luck to all that take on this formidable voyage. You got this!

Enlisted to Officer Corps



MSgt David Drainer

For as long as I can remember, I've wanted to be a meteorologist. My first duty assignment was the 25th Operational Weather Squadron. I began the online operational meteorology program at Mississippi State University. My flight commander at the time encouraged me to pursue the degree and eventually apply to OTS.

I finished the requirements for the Bachelors of Geoscience degree from Mississippi State while on deployment to Afghanistan in 2014. Near the end of my program, I realized that requirements to become a weather officer had changed

to fall in line with World Meteorological Organization course requirements for meteorologists. Since I had been very close to program completion, I decided to complete my program

rather than switch degree plans. After multiple changes in duty station, two deployments, and the birth of my four children, finding time available to complete extra course requirements became extremely difficult. Over time, by taking additional math and physics courses from University of Alaska-Fairbanks and American Military University, I was able to finish the required coursework.

I owe a great deal of gratitude to my supervisors over the course of my career to this point, especially CMSgt Gary Lam, TSgt (retired) Matthew Bohlman, Capt Mark Taylor, and Capt Brandon Taylor. Their words of encouragement and mentorship through the years have been unmatched. I also owe everything to my wife. She has supported me from the beginning and been the constant at home to keep everything working in our personal lives, all while raising four children. Her encouragement and motivation has meant the difference in my decision to submit an application. I'm very excited to have this opportunity with her and to continue my career in the Air Force as a commissioned officer.

My approach to the application was fairly simple. I didn't review any previous packages from selectees because I wanted to have the most original information in my personal statement and letter of recommendation. I read the guidance provided in the active duty application guide and applicable AFIs along with information on the Air Force Portal page multiple times to make sure I understood the proper procedures. My recommendation for anyone wanting to apply would be to ask as many questions as possible to your leadership to make sure you understand the guidance that's provided, and get clarification on that guidance from Air Force Recruiting Service when needed. Highlight the best information from previous EPRs in the application profile. Think of it like a resume, and sell yourself. Everything about your application should illustrate your potential to lead as an officer. Put in the time and pay attention to every last detail in the application guidance. Little changes are routinely posted on the Air Force Portal page, so it's important to check it every day. Stay motivated, be confident, and don't give up if being an officer is important to you.



(credit USAF photo) General Leon Johnson

“The Meteorologist who won the Medal of Honor and became a four-star General” by Dr. Kent G. Sieg

One of the more venerated meteorologists in the Air Force was also a command pilot who was awarded the nation’s highest military honor. Leon William Johnson was a straight-shooter from America’s heartland. He was born in Missouri, but grew up in Moline, Kansas. Upon graduation from high school, he received an appointment to the U.S. Military Academy at West Point. At the academy, he was well-respected; he became cadet first sergeant and notably missed Christmas leave one year in order to assist a fellow cadet. He graduated in June 1926, and received a commission as a second lieutenant, branched infantry.

Following field service at Fort Crook, Nebraska, he transferred to the Air Corps and rapidly completed flight training. His follow-on assignments included duty with several squadrons and also deployment to the Philippines. He then received authorization to commence advanced study in meteorology at the California Institute of Technology, and graduated with a master’s degree in 1937 as well as a promotion to captain. Subsequently, he commanded the 3rd Weather Squadron at Barksdale Field, Louisiana.

As the United States was being dragged into World War II, Johnson was appointed to the operational staff of a bomber group, then to the staff of the nascent Eighth Air Force, and was promoted accordingly. He helped oversee its formation and relocation into the European Theater of Operations by

June 1942. Johnson took command of the 44th Bomb Group in January 1943 and soon received a promotion to

Colonel. On August 1, 1943, a day later more commonly known as ‘Black Sunday’, Johnson led his ‘Eight Balls’ out of Benghazi, Libya, into battle as part of a massive strike comprised of five bomber groups.

The Eighth Air Force wanted to target the German heartland to impair its industrial war machine, and most importantly the aviation sector. Johnson helped plan air raids aimed at crippling the Nazis by destroying a major source of petroleum. Thus, his group was seconded to the Ninth Air Force, and Johnson participated in Operation Tidal Wave, the most ambitious attack up to that time. It would be “one of the outstanding air operations of the war” and an operation that “had few if any equals” due to its planning and execution in the face of significant obstacles.

The plan was for a swarm of B-24s to fly at low altitude on a 2700-mile flightpath to strike the oil fields at Ploesti, Romania. It was there that 30% of the Nazi regime’s oil and 60% of its refined gasoline were produced. The formation would fly over the Dalmatian coast and under radar coverage over the Danubian plain. At that point, the lead group would break off to attack a more remote refinery, while the rest would hit all six targets located around Ploesti in near simultaneous fashion. It was believed that having between 140-170 bombers in formation would be an impregnable lattice, especially since they would entirely saturate enemy defenses and achieve total surprise. However, given the distance to be traversed, cloud cover was required as there would be no fighter escort, and strong headwinds coming or going would mean running out of fuel over occupied Europe. Forecasters determined that the optimal weather conditions along the route would occur in August.

Unfortunately, it seems that no military plan ever survives initial contact, and this mission was no exception. During the long flight over the Mediterranean, the cohesion of the formation was lost, and the groups spread out too far. In the lead group, the two planes with the route navigators both had to drop off of the flight path. The groups became further separated by ominous cumulus cloud formations encountered above the rugged mountainous territory which they overflew, and essentially had now re-formed into three widely dispersed elements. Fate again struck as the first wave mistakenly turned at the wrong Initial Point, necessitating the breaking of radio silence in an effort to get them back on target. Additionally, the lead group then bombed the specific targets reserved for a following group, thus confusing the aircraft behind it.

Col. Johnson and his team faced a tough task. The targets that the 44th and the 98th Bomb Groups were supposed to hit (both groups were now only a fraction of the original formation as some of each group’s bombers peeled away to strike other targets) were by now obscured with heavy smoke and explosions continuing from delayed action bombs. Only half the number of bombers planned to be over target remained. Thus, survivability was therefore deemed low, and they could have aborted and returned home had

Johnson given the order. However, it was apparent that “the rewards of success could be immeasurably high.”

Although the element of surprise had been lost, Johnson and Col. John Kane, the commander of the 98th Bomb Group, decided to carry on with the mission. They flew through intense antiaircraft defenses manned by 75,000 troops, a wall of 250 enemy fighters, and dense smoke coming from oil fires on the ground. From inside the center of this firestorm, the American planes dropped their bombs from altitudes as low as 200 feet. Casualties were high as “B-24s went down like tenpins”; overall, about 40-50% (depending on estimates) of the bombing force assigned to the entire raid did not return to base. But the end result was a successful mission that achieved its original objective by knocking out 42% of the refining capacity and most lubricant production in spite of its underlying plan having broken apart during execution. The losses were crippling for the strategic bombing campaign, though, as there would be no follow through attacks. In any case, the Germans did contrive to quickly make up for capacity lost in the raid.

Formal recognition flowed in the aftermath of the mission. Irrespective of outcome, these honors were well-deserved. Most of the 88 bombers that made it back to Benghazi had battle damage; between 54 (as publicly reported) and 77 (as later estimated by historians) aircraft and 532 airmen did not return from the mission. For their heroism, both commanders were awarded the Medal of Honor in November 1943. Three other Medals of Honor were awarded for this raid posthumously for the pilots sacrificing their damaged bombers and crews by remaining on target to aid following

bombers. Many other airmen received the Distinguished Flying Cross and other valorous awards.

Johnson never returned to weather. In September of 1943, Johnson took command of the 14th Combat Wing, and was promoted to Brigadier General by the end of the year. Following the war, he served in several personnel assignments at Army Air Forces Headquarters. In 1947, he joined Strategic Air Command and became Commanding General of the 15th Air Force in Colorado Springs. He then was assigned to organize a separate Air Force major command in England at the time of the Berlin Airlift. In February 1952, he became the commanding officer of the Continental Air Command, and concurrently served as an Air Force representative at the United Nations. He then assumed duties as the U.S. representative to the North Atlantic Military Committee.

Promoted to General in 1958, he subsequently became the air deputy to the supreme allied commander in Europe. His last assignment was at the Pentagon in support of the National Security Council, from which he retired in 1965. He thereafter became a popular consultant and speaker on national defense issues. He passed away over three decades later at the age of 93, and is buried in Arlington National Cemetery. He lived long enough to hear of one more honor - the 3rd Air Force named its command headquarters building at Mildenhall after him the year prior to his passing.

Kent Sieg is the wing historian for the 557th Weather Wing at Offutt Air Force Base, Nebraska.

Johnson's entry in *The Howitzer*, the U.S. Military Academy's Yearbook, for 1926, has him being lauded for having a “Keen File” personality.

“Background Paper on General Leon W. Johnson,” (undated), Biographies, Air Force Weather Agency Archive. Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II: Volume Two – Europe: TORCH to POINTBLANK*, August 1942 to December 1943 (Office of Air Force History: 1983), p. 477.

Charles C. Bates and John S. Fuller, *America's Weather Warriors, 1814-1985* (Texas A&M University Press: 1986), pp. 83-84.

See Geoffrey Perret, *Wing Victory: The U.S. Army Air Forces in World War II* (Random House: 1993), pp. 214-18. John L. Frisbee, *Into the Mouth of Hell: Losses on the First Large-scale Ploesti Raid were Staggering, Heroism Unsurpassed*, *Air Force Magazine* 71:9 (September 1988). See also the text for Johnson's Medal of Honor citation.

Craven and Cate, pp. 482-84. Note that bad weather circumscribing strategic bombing operations from mid- October 1943 through mid-February 1944 actually allowed for new bomber groups to form and for the introduction of a new long-range escort fighter. See John F. Kries, ed., *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II* (Air Force History and Museums Program: 1996), p. 206.

James Dugan and Carroll Stewart, *Ploesti: The Great Ground-Air Battle of 1 August 1943* rev. ed. (Brassey's: 2002), passim.

The general was unable to attend due to infirmity; his daughters represented him. Maj. Vic Warzinski, “3rd Air Force Dedicated Building for Air Force Legend,” USAFE News Service, 9 October 1996. A nascent effort to name after him the new headquarters building of the Air Force Weather Agency (known as Building 185) fell short of its goal a decade later, and was instead named after Lt. Gen. Thomas Moorman.

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