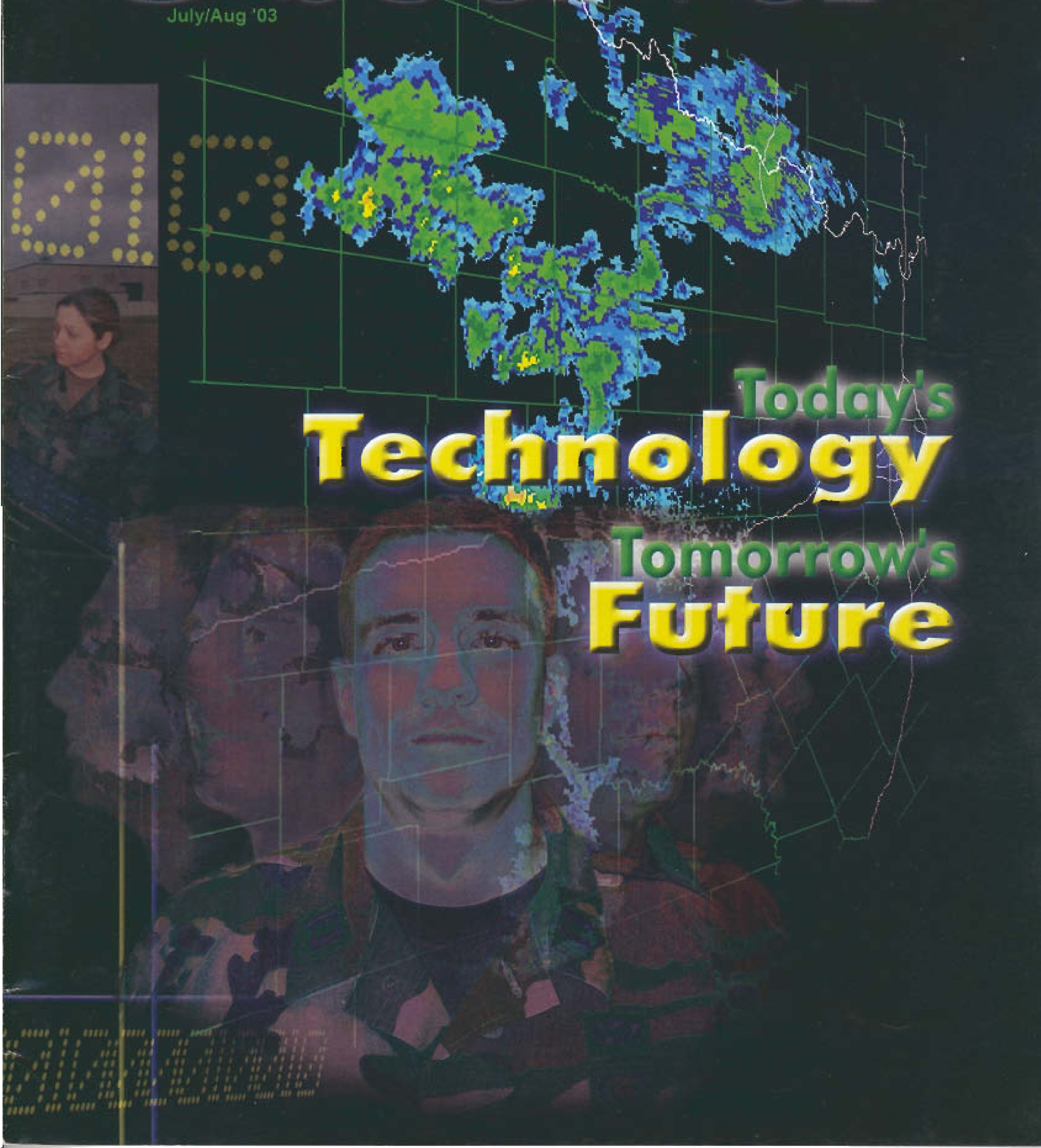
Observer

The Magazine for Air Force Weather

July/Aug '03



Today's Technology Tomorrow's Future

Observer
The Magazine for Air Force Weather

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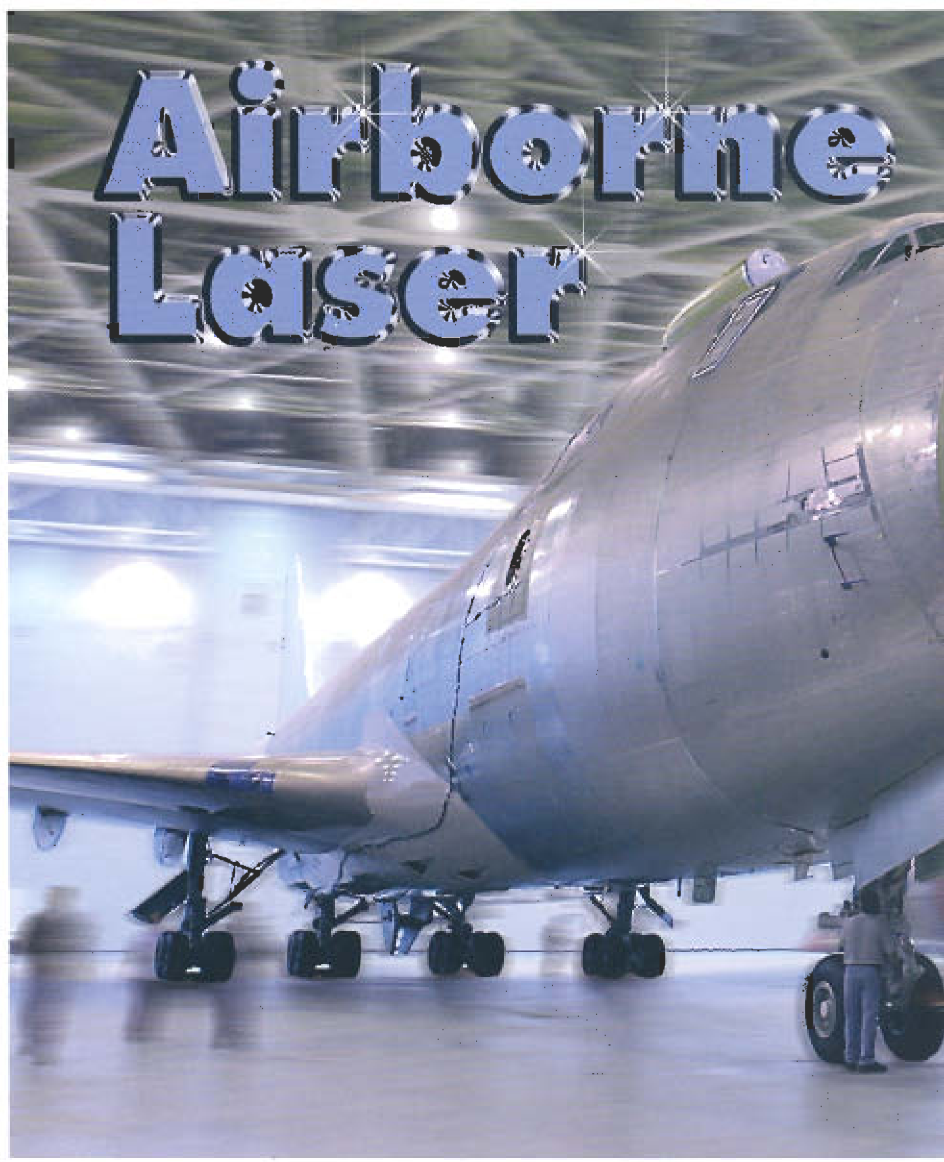
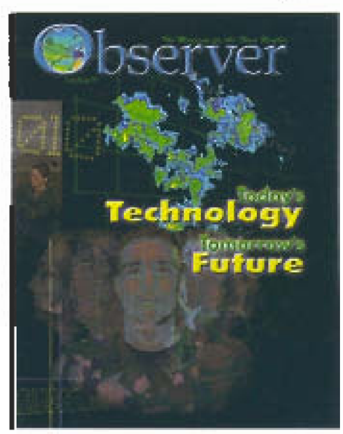


Editorials

On the Cover

Air Force Weather incorporates state-of-the-art science and technology into every aspect of daily operation, ensuring operators are armed with the world's best terrestrial and space weather information, giving them the combat winning edge. This issue of the *Observer* highlights just a few of Air Force Weather's latest achievements in equipment, computer modeling and systems, and the forever essential training techniques.



Testing Training Technology

By Maj. James O'Connor
Air Force Combat Weather Center

This month's OBSERVER magazine focuses on technology innovation. The Air Force Combat Weather Center targets that focus daily through our mission. Beginning with our *"Investigation"* role, we look for new processes and

Photo by Staff Sgt. Scottie [illegible]d

technologies to improve Combat Weather Team operations. We use requirements captured in Operational Requirements Documents and similar sources to select candidates for review as CWT operational gap-fillers.

In our *"Test and Evaluation"* role, we put potential as well as programmed solutions through the paces. We not only examine the technology to assess how well it supports known requirements, but also run the gamut from simplicity of use to durability to determine if it is appropriate to support deployed operations. Whether a piece of equipment is new or already in the inventory, we *"Integrate and Develop"* the technology for employment with the other systems. Our emphasis is on ensuring the system fits neatly and cleanly into operations. At the same time, we want to guarantee the needed capabilities are delivered while minimizing the operational burden on the CWT.

In our *"Exploitation"* role, we examine existing equipment to make operations simpler for the CWT. We try to find tools and techniques to get the most "bang for the buck" out of fielded systems. Finally, we target our *"Training"* role to address specialized just-in-time training needs that have been closely coordinated with the Air Force Weather Agency's Training Division.

You will find several articles detailing recent AFCWC efforts in this issue. The N-TFS article highlights new capabilities of the latest software version for that system, including the deployed network configuration that is attributable to our integration and development role. The article on the TMQ-53 details how AFCWC NCOs, in our exploitation role, are looking beyond the system as we know it to extend the operational use. The Leica laser range finder article highlights our investigation role – in this case, our search for a technology refresh for the currently-fielded laser range finders. The FMQ-19 article highlights the status of the automated observing systems being installed at garrison locations worldwide – AFCWC put the system through an involved test and evaluation process before fielding began.

To satisfy the varied roles AFCWC fulfills for the CWT, we count on the collective skill sets of communications, meteorological/navigational aids, and weather personnel inside our doors. However, we must also rely on our CWTs to supply us with their concerns: from addressing operational needs to identifying problems with fielded systems to the offering of potential candidate technologies for investigation.

The creativity and innovation of Air Force Weather in the field often identifies problems and finds candidates for new technologies to make meeting your mission easier. We take seriously our role as the "conscience of the CWT" and ask for your continued assistance to bring CWTs the best systems and processes.

Tech. Sgt. Wayne Hardesty, right, and Staff Sgt. Tim Dixon, Air Force Combat Weather Center technicians, adjust positioning of a collapsible T-VSAT.

AETC Weather Operations:

The First in First Command

By Lt. Col. Charles Davenport
HQ AETC Weather Operations

As everywhere, times are challenging and demanding in the Air Force's "First Command," Air Education and Training Command. And, as noted throughout my career, our Air Force Weather people in AETC and across AFW continue to carry the day. Day in and out, they and their families meet the ever-increasing demands of global contingency operations like ENDURING and IRAQI FREEDOM while sustaining solid, 24/7 support at home.

The Mission

AETC's mission is multi-fold and far busier than most think. Just as weather impacts most every mission, education and training are fundamental to make any mission go. AETC is responsible for much more than initial flying and navigator training, handling all basic military and technical training, advanced education, professional military education, and recruiting. Of note and surprising to many, AETC owns the world's largest fighter wing and C-130 fleet; the Air Force's largest numbered air force and training wing; the first F/A-22 unit; and the Air Force's only space and ICBM mission and survival training units.

Aircraft

Most don't know AETC owns more aircraft and flies more sorties and hours than any command, by far. AETC supports some 1,800 aircraft and 22 diverse types – trainers from T-1s to the new T-6s; venerable T-37s, T-38s and T-43s; the gamut of airlifters from C-21s to C-130s, C-17s and C-5s; KC-135 tankers; SOW MC-130s and M/H/UH-1s/-53s/60s and MV-22s; and fighters from F15s and F16s to the newest F/A-22. Our Combat Weather Teams safeguard more than $12 billion worth of aircraft alone – now flying well over 1,500 sorties daily and 580,000 hours yearly. This total will soon climb markedly as F/A-22s hit the Tyndall ramp.

The AOR and Weather

AETC's Area of Responsibility, bases and units stretch across much of CONUS; for some strange reason, the bulk of those bases and units spread across the tornado alley and hurricane haven states of the southern CONUS. In recent memory, 'quiet' Keesler tangoed with four tropical terrors; record rains/floods inundated Lackland and Randolph; tornados twisted and tickled Columbus, Tyndall and Little Rock; hail rocked Laughlin, Sheppard, Altus and Little Rock; snow and ice frosted Vance (worst in century) and Little Rock; and Columbus quaked.

Still, the biggest payoff in AETC, as elsewhere, is forecasting the basics – ceilings, visibilities, winds and flight hazards. When an AETC base goes below ceiling and visibility minimums, exceeds crosswind limits or faces even light ice, its 100s of sorties are potentially lost or saved based on the CWT's forecast. The ops reports, customer feedback, and latest metrics bear out this simple assessment – our CWT-OWS teams have excelled.

In that light, we're highly dependent on and indebted to our Air Combat Command partners. AETC relies on ACC's 25th, 26th, and 28th Operational Weather Squadrons, teaming with our

CWTs, to provide 24/7 resource protection and support to AETC's 13 bases. These OWSs have rapidly stepped up to the added demands of reengineered operations across AETC.

More AORs

Though AETC owns no AEF wing leads, our people are fully committed to and meet increasing AEF demands. At any time, up to 10 percent of AETC weather warriors are deployed supporting operations worldwide, like IRAQI and ENDURING FREEDOM, NOBLE EAGLE and SOUTHERN and NORTHERN WATCH. We're proud of our record of no shortfalls or reclamas. This leads to kudos to our invaluable Total Force partners, who've consistently stepped up to fill many AEF tasked positions or to augment our CWTs, sustaining garrison operations and allowing our AEFers to deploy.

The People

There are only 215 weather warriors in AETC – over a third at the Schoolhouse, supporting 12 major installations. Our CWTs are definitely light and lean, with continuing manning shortfalls, AEF demands, and cuts. They're often led by Lieutenants and Technical Sergeants and run by bare bones crews of NCOs, airmen and savvy civilians, all stepping up to meet redoubled mission and contingency demands – and excelling. And, they support each other, with units readily supplying TDY help to leaner units and sharing best practices.

"As always, it's our outstanding people –first and foremost – who make the mission go, and make life good."

Lt. Col. Charles Davenport

Here are just some examples of our people's outstanding work: Bridging a critical manning shortfall, 1st Lt. Barbara Costa and team Laughlin kept doors open with only four personnel. She and her skeleton crew worked every job and support didn't suffer – aircrews named them "best wing support agency" again and again. The team safeguarded people and property as 100-plus year floods hit the area and they briefed air evacs returning wounded heroes from Iraq. Sheppard's team secured two weather best practices while taking multiple awards for community/volunteer service. They repeated as AETC's Grimes-Williams Award winner with top company grade officer honors for 1st Lt. Chris Lovett and senior NCO honors for Master Sgt. Brad Wasson. The Altus team's MEF process was adopted for the 7-level course thanks to the work of AETC's top NCO, Staff Sgt. Shaun Wallace, and top airman, Senior Airman Chris Mullen. Luke's team recorded remarkable accuracy rates in the high 90s for MEFs at Luke and for air warrior operations, while supporting the heaviest Air Force flying-hour schedule (37K sorties/year). Tyndall's team met redoubled demands of 1 AF/CONUS air defense operations for NOBLE EAGLE and the beddown of the first F/A-22s – taking top civilian and CGO awards were Dan Sheldon and 1st Lt. Scott Avent.

We can't forget our weather teams at the Schoolhouse and AFIT, covered in separate articles. As noted at outset, training and education are fundamental to success of any organization, including AFW, and they set the standard.

With the summer cycle in full swing, we salute and thank those carrying their skills elsewhere and welcome those bringing new insights and experiences to our First Command team. As always, it's our outstanding people – first and foremost – who make the mission go, and make life good.

AFMC Perspective:

CWT Operations and Staffmet Support

By Lt. Col. David W. Goe
HQ AFMC Operations Support Division

Air Force Materiel Command weather operations provide a wide range of missions including traditional support to flying operations, acquisition support to current, as well as new weather systems, and support of cutting-edge research and development projects. The command has two weather squadrons and seven Combat Weather Teams located throughout the CONUS. Additionally, AFMC has staff meteorologists at nine military and civilian sites.

This is indeed a varied group of professionals. Not only do we have a highly trained and motivated enlisted and officer corps to support flying operations, AFMC also utilizes numerous advanced academic degreed weather officers and civilians to support the acquisition side of the house. The total authorized manpower strength of AFMC weather is 122 - 31 officers, 67 enlisted, and 24 civilians.

AFMC weather operations units continue to meet their mission requirements, manage a changing operational environment, and continually look forward to the future. Like the rest of the reengineered weather community, we've had our share of challenges to overcome.

The re-gearing of our CWTs' mindsets from that of old base weather station operations has been somewhat of an issue. The XOW staff's policy of "Big S-Little E" for the first round of the Stan/Eval process greatly aided in changing the old business mindset. It allowed our HQ staff the opportunity to help the CWTs focus on conducting reengineered operations.

AFMC CWTs are spread out across the CONUS and receive support from four different Operational Weather Squadrons. Robins and Eglin AFBs receive their support from the Shaw OWS, Wright-Patterson AFB from the Scott OWS, Tinker AFB from the Barksdale OWS, and Kirtland, Hill, and Edwards AFBs are customers of the Davis-Monthan OWS. While we have seen some growing pains through the transition, the overall relationship among the CWTs and their OWSs has been very good. The support received from the Hubs has been excellent!

The missions of the AFMC CWTs are quite varied. Not only do we have test and evaluation missions to support, we have tenant units from ACC to support as well. Several teams have challenging tasks to support the peacetime and wartime operation of ACC warfighters. The Wright-Patt CWT provides support to a squadron of C-21s and a Wing of reserve C-141s. At every location in AFMC, the troops have done a marvelous job of integrating themselves into the local mission. While the Hill CWT is our only unit that has lead wing status, every unit has been directly affected by recent deployments and wartime taskings.

Since June 2002, AFMC has deployed approximately 20 troops in support of Operations ENDURING FREEDOM and IRAQI FREEDOM, as well as other steady-state operations. We have taken great pride in not short-falling any tasking the AEF Center has levied on us. Our CWTs and staffmets have been deployed for a total of 1,672 man-days during this period. As team players, we've helped out our weather brethren in other MAJCOMs when they had manpower shortages due to taskings or other unforeseen problems.

Another challenge AFMC has dealt with over the recent months is managing an aggressive out-sourcing and privatization efforts. Since the beginning of 2001 two CWTs have been affected by A-76 actions. Eglin AFB's observing function was transitioned to a contractor. Also, the entire weather station at Wright-Patterson was contracted out in

February 2003. Presently, Edwards is in the late stages of an A-76 effort. In October of 2003, an A-76 study of the weather operations at Kirtland will begin.

While at first glance these actions seem threatening to the weather community, in the long run they will allow us to more effectively place our limited weather manpower assets against wartime missions. At each of our locations that have been involved in or are presently involved in A-76 actions, they have done an outstanding job of managing the process and ensuring mission requirements are transitioned to the contractors.

The biggest difference between AFMC weather operations and those of the other MAJCOMs is our employment of staffmets. No other command has as many or as varied uses for them.

The 88th Weather Squadron staffmets support numerous Special Program Offices at Wright-Patt. They are closely integrated with the F-22, B-2, C-17, and unmanned aerial vehicle SPOs, plus involvement the Air Force Research Laboratory. The 88th staffmets played a huge role in the testing and deployment of the Global Hawk UAV. Two staffmets were deployed to Australia when the Global Hawk made its record-shattering voyage. Also, when the Global Hawk was first utilized as a wartime asset for the warfighters, our staffmet corps was there as well.

The 46th WS staffmets has an important and challenging mission in supporting the Air Armaments Center and other unique activities at Eglin. All the impressive weaponry/munitions you saw on TV during Operation IRAQI FREEDOM were developed under the control of AAC. Our staffmets played a vital role in the success of these systems.

At Kirtland, we have Staffmets that work for AFRL and for the Airborne Laser SPO. The Starfire Optical Range operations support is one of our most unique areas of Staffmet support. The development and testing of lasers and other optical systems is a challenge for any environmental scientist support.

The staffmet work being done with the Airborne Laser SPO is critical to the success of the entire program. One of the greatest challenges to the program is the effect of the atmosphere on the laser when it is fired from the nose of the 747 at a moving target. Clouds are not the only problem; optical turbulence also degrades the effectiveness and range of the laser. These staffmets are working to field a forecast decision aid to help operators and weather personnel to predict the effects of optical turbulence on the systems and hopefully information mitigate them all together.

At Hanscom AFB, we have two contingents of staffmets. One group supports AFRL and the other works for Electronic Systems Command. Our AFRL staffmets support various research and development activities managed by the lab. Presently, they are leading AFRL's project on researching stratospheric turbulence. With the advent of UAV systems such as the Global Hawk and the Predator, stratospheric turbulence has become an increasing threat to operations.

The ESC system program office staffmets make a direct contribution to the weather community. They are involved with managing the acquisition and fielding of weather systems such as the AN/FMQ-19 Automated Observing System and other systems utilized by AFW personnel to do their daily mission support. This is a most challenging job and requires not only an in-depth knowledge of meteorology, but also a mastery of budget processes, acquisition processes, and planning processes. Our troops there do a great job of working with the AF/XOW and AFWA staffs to ensure the AFW community have the best tools possible to do their jobs.

We have five other locations that have only one staffmet assigned. The staffmet work done at Edwards AFB, Holloman AFB, Tyndall AFB, Rome N.Y., and Arlington Va., each provide an invaluable service to the units and programs they support.

Lastly, I'd like to discuss the HQ AFMC weather staff. We were recently reorganized into a structure unique to how MAJCOM DOWs have been traditionally aligned. On May 15, 2002, the Weather Operations and Air Traffic Services were merged into a new division, Operations Support, DOB, headed by a GS-15 with an O-5 as the assistant division chief. This was done to enhance our support to our operational customers in the field – mainly the Operational Support Squadron and Weather Squadron commanders.

The most apparent success is how we do Stan/Evals. By evaluating weather, air traffic, and airfield operations at one time, by one team, we reduce our footprint to the field commanders and are much less disruptive to the AEF process. Another area of success is in resource management – MONEY. By combining these areas, budgeting duties are better managed. In other areas, we're finding we can reduce duplication of effort and learn from each other's perspective on similar tasks.

HQ AFMC and the entire command have begun the long journey down the road of transformation. They are going through the challenging process AFW experienced over the last decade. The weather community demonstrated its flexibility and ability to adapt to change, both organizationally and operationally. Now, our challenge is to maintain our positive, can-do attitude and be ready for more changes. In the 21st century military, the only constant is change.

Latest in technology upgrades ensures AFW will Train as we fight

By Master Sgt. Bill Anders
Air Force Combat Weather Center

Photo by Staff Sgt. Scottie McCord

Air Force Weather recognizes the need to train as we fight, supporting our customers "same in peace, same in war." With hardware and software changes provided with the latest version of the New Tactical Forecast System, Version 3.1, Combat Weather Teams will be able to offer the same support, in-garrison and deployed.

While the deployable laptop server/client is perhaps the most significant enhancement, in-garrison hardware, software and client interfaces have also changed significantly. In garrison, Dell servers running Linux Red Hat Operating System replace the Sun Microsystems' Sparc servers and Sun Solaris UNIX Operating System. Even though the OS has changed significantly, the system manager interface remains the same.

Networked customers will now tap into the Local Weather Network System through the Local Operations Client software to receive more timely, robust support. The software change gives the customer the flexibility to view relevant graphics products, alphanumeric bulletins and alternate base information. Additionally, automated advisory, watch and warning alerts to the local network at Operational Weather Squadron issuance eliminate the need for the local pyramid alert notification process.

Further, when a customer acknowledges the alert, the OWS receives a Rapid Acknowledgement Report, indicating user receipt. All these changes mean CWT members have the freedom to conduct in-person support with their operational customers with the assurance that alert notification is made. For non-networked customers, N-TFS 3.1 will support the legacy terminals through the Communications/Data Manager.

Once the AN/FMQ-19 fixed base observing system is fielded locally, a connection between the FMQ-19 and N-TFS server will allow OWSs to monitor near real-time weather conditions at CWT locations through Automated Observing System software. This capability offers the OWS forecaster "eyes forward" on changing weather conditions without direct contact with personnel at the CWT. Use of these systems also enables the CWT more time with their customers.

A robust terminal with display of graphics and alphanumeric data for five alternate bases replaces legacy terminals for Air Traffic Control and Radar Approach Control operations. Additionally, RAPCON users receive regional radar and satellite loops for better situational awareness in the local area.

While these changes greatly improve garrison operations, the enhancements to deployed support are even more dramatic. The new client/server means deployed users with a robust network capability or within the Tactical-Very Small Aperture footprint can receive the full range of support in the field as experienced at home.

The laptop server/client performs both the server and client functions on the same computer. The database and communications tasks of the N-TFS server are running continuously in the background while running Windows NT in the foreground

At left, members of the Air Force Combat Weather Center work on a TMQ-53 and TMQ-53P. AFCWC examines technology to assess how well it will support known requirements and appropriateness to support deployed operations. Below, Capt. Erin Willingham, Air Force Weather Agency, Offutt AFB, Neb. takes a reading from a TMQ-53.

Photo by Paige Hughes

allows the CWT to use N-TFS client software to access the full graphic and alphanumeric functionality of N-TFS.

While deployed, your CWT can connect the AN/TMQ-53 to the laptop server/client and run the AOS in the Windows NT environment. This capability eliminates the need to deploy with yet another laptop. Two computers now provide the same level of support that T-VSAT, N-TFS Server, N-TFS client and AOS had provided.

Finally, in the unlikely event of a software failure, server/client software Image Disks are provided. These disks allow the CWT member to install the entire N-TFS server/client environment.

With the capabilities that N-TFS 3.1 provides, the war fighter is better informed and better equipped, both at home and away. With the fielding schedule already well underway, we hope you are quickly getting acquainted with the improvements fielded with N-TFS 3.1. If you find problems or have suggestions for additional improvements in future software releases, please pass those comments to the program office through your MAJCOM representatives. In-garrison or deployed, supporting the war fighter is job one!

Combat Field Skills Training

By Master Sgt. Karl Kleinbeck
Air Force Combat Weather Center OL-A

The Florida Air National Guard Weather Readiness Training Center conducts a two-week tactical weather operations class at Camp Blanding, Fla., near the town of Starke (between Jacksonville and Gainesville). Training consists of 23 items under the Combat/Field skills portion of the STS at the 2b skill level. Additionally, training covers the AN/TMQ-53, MOS kit/Kestrel, Tactical Very Small Aperture Terminal, and the SINCGARs radio system. The two-week training period culminates with a three-day field training exercise.

During the FTX, students produce mission-tailored weather briefings, perform night land navigation, and conduct site defense against the "opposing forces." To add realism, students use the M16A2 rifle outfitted with a laser emitter. When the user shoots the target, an audible beep indicates an enemy "kill." Students also drive HMMWVs on a tactical convoy/confidence course, including water crossings and night convoys with blacked-out lights.

The WRTC conducts ten classes per year with the emphasis on Air National Guard units. However, active duty Air Force and Navy personnel have attended the course in the last two years. Unit training managers can assist in scheduling any active duty personnel who wish to attend. Feedback from recent course graduates who have deployed in support of Operations ENDURING FREEDOM/IRAQI FREEDOM indicates the training helped prepare them for their duties.

In addition to the two-week course, the WRTC offers just-in-time training on the Ellason Tactical Weather Radar. The two-day class teaches set-up, teardown and operation of the radar. Also conducted is training on other specialized system, like the MARWIN. For more information, please call the WRTC at DSN 960-3388.

AN/FMQ-19 Fielding Expands World-wide

This AN/FMQ-19, located at McChord AFB, was one of the first to be fielded.

Photo by Master Sgt. Todd Allen

By Master Sgt. Todd Allen
AFWA Field Programs Division

The AN/FMQ-19 is an integrated weather system consisting of multiple weather sensors and information technology components that continually measure the environment near the surface of the earth. It automatically generates surface aviation weather observations based on user-defined events, either by time or occurrence of a particular weather element or category.

The FMQ-19 was designed to satisfy Air Force Weather's requirement for a system to provide current weather information and generate Aviation Routine Weather Report and Aviation Selected Special Weather reports automatically when conditions warrant. This information is essential for safe and efficient aviation operations and force protection. The sensors continuously sample and measure the ambient environment and derive raw sensor data.

At larger airfields or where the operational need is justified, additional sensors may be strategically located at other locations to provide additional weather information. On-site weather personnel may also augment and/or backup the fixed observing system meteorological Aviation Selected Special Weather report data at selected locations. Combat Weather Team specialists are very important for safe and efficient operations in the airfield area and provide backup observations for those elements that the fixed observing system normally reports. Examples of this information are severe weather reports, snow depth, and other remarks that are appended to the METAR/SPECI report. The system will automatically sense, collect, display, and transmit data to standard forecast/analysis systems (i.e. New Tactical Forecast System) via cable or wireless. The system will also possess the capability to transmit data to Weather Products Master Distribution System at strategic weather centers in case of an N-TFS outage.

The FMQ-19 will replace aging legacy equipment and eliminate labor-intensive methods of generating aviation weather observation reports. It will play an essential role in the successful execution of AFW reengineering by automating the collection of real-time environmental data for war-fighter information systems, thus enhancing mission execution and operations success.

The full system includes nine different types of weather sensors comprised of a visibility/ambient light sensor, freezing rain sensor, precipitation identification sensor, lightning detector, ceilometer, relative humidity and ambient temperature sensor, precipitation gauge, wind monitor and barometer.

Sensors are typically deployed as one primary (basic) group with a secondary (discontinuity) group at the opposite end of the flight line and, in a few locations, a mid-field group for each airfield runway. Individual installations may vary depending on site requirements. Each sensor group has a local Field Data Collection Unit installed in conjunction with it. The FDCU collects and processes associated sensor data, and sends the data to the Terminal Data Acquisition Unit, normally located in, or very near, the CWT.

After a new AN/FMQ-19 is installed

and checked-out, the contractor will conduct a two-day weather operator course and a three-day maintenance technician course at each installation location. Follow-on training for the weather operator will consist of an equipment training workbook and certification checklist. For the maintenance technician, the Keesler Q-Flight will prepare a Qualification Training Package for follow-on training. Curriculum development has begun for inclusion in the formal maintenance and operations technical training schools by the 338th TRS/VEBE and 335th TRS/UOA. An initial information block is expected to be included in the maintenance course by October 2003, expanding to a full maintainer-training course when the system is 50% fielded. The operator training should begin shortly.

This weather observing system will help minimize the pinch of manning shortages by automatically producing METAR and SPECI reports and reducing weather personnel involvement in augmenting the observation before it's transmitted. Worldwide fielding of this system will replace aging legacy systems and restore flight operations confidence in the accuracy of critical airfield parameters. The AN/FMQ-19 will provide a reliable, easily maintainable weather observing system for years to come.

AN/FMQ-19 formal testing was conducted at the factory in Seattle, and on McChord AFB, Wash., and Spangdahlem AB, Germany. Additional testing is occurring at the AFCWC on Hurlburt Field, Fla. To date, McChord, Spangdahlem, Hurlburt, Keesler AFB, Miss., and the Maintenance and Weather schools have received the FMQ-19. Dover AFB, Del., is next on the list. Once a full fielding decision is made we intend to install four systems a month.

Leica Vector Laser Range Finder makes the grade

By Master Sgt. Cary Fitzsimmons
Air Force Combat Weather Center

The Air Force Combat Weather Center, Hurlburt Field, Fla., recently evaluated the Leica Vector Laser Range Finder as a possible replacement for the Litton LRF fielded with the Manual Observing System. The Leica can be used to measure cloud heights in a tactical environment. Although our main testing objective was accurate cloud height detection, we also evaluated the Leica for use in construction of a visibility chart and for various other operational uses.

The Leica Vector LRF is an eye-safe, range-finding system that operates using a single 6-volt battery. In addition to its distance detection capability, the Leica features a digital compass that displays magnetic or grid azimuth in degrees and allows the user to determine direction in a 360° radius. The combination of azimuth and distance on a single system makes the Leica useful in constructing visibility charts while in a field environment.

Several other features make the Leica LRF a solid performer. After firing the laser at your chosen target, the LED readout can be set to display in either meters or feet, eliminating the current need to manually convert units for operational use. The Leica does not require a recharge before firing and can give users an instantaneous readout. The Leica also shuts off automatically, eliminating the possibility of excessive battery drain. Even when the Leica's battery runs down, it uses a standard 6-volt camera battery, making logistical support much easier.

For testing, we compared the Leica's cloud height observations against the tactical standard for cloud height detection, the AN/TMQ-53. Our goal was to determine if it might be a reasonable replacement for the currently fielded, but aging Litton LRFs. The Leica LRF outperformed the Litton LRF during Instrument Flight Rules and Marginal Visual Flight Rules conditions. While the Litton LRF performed slightly better under Visual Flight Rules conditions, the Leica still performed very well during these conditions.

We've tested four other laser range finders in search of a suitable replacement option for the aging Litton LRFs. As a result of these evaluations, AFCWC has recommended the Leica to the Air Force Weather Agency Plans and Programs Directorate as a potential replacement for the Litton LRFs. Any further recommendation for fielding will come from AFWA.

The TMQ-53: Enhancing Operations

By Tech. Sgt. Ronald Richards
Air Force Combat Weather Center

Most Combat Weather Teams are familiar with the AN/TMQ-53 Tactical Meteorological Observing System and its capabilities. From the feedback received by the Air Force Combat Weather Center, CWTs find the TMQ-53 to be an invaluable tool and many CWTs are using the system beyond its intended use.

Originally conceived to support sustained airfield operations in a deployed environment for limited periods of time, CWTs now use the TMQ-53 at drop zones, landing zones, and at bed-down sites. This has forced it to be set up and torn down many more times than ever anticipated. In other instances, TMQ-53s have been in place for extended periods of time. Under these unexpected wear and tear conditions, the instrument has performed very well; however, we believe we can squeeze even more out of the system.

For example, AFCWC is evaluating a satellite communications capability to allow AN/TMQ-53 deployment anywhere in the world. This capability would allow its operations without the limitations of the five-mile operational range of the radio modems that restricts placement of the sensors. A SATCOM solution could allow a CWT to place the AN/TMQ-53 at an LZ on a remote ridgeline, receive the data and remotely provide accurate weather to any team dropping into that LZ.

Additionally, AFCWC is evaluating alternatives like the AN/TMQ-53P, essentially a pole-mounted AN/TMQ-53.

Photo by Staff Sgt. Scottie McCord

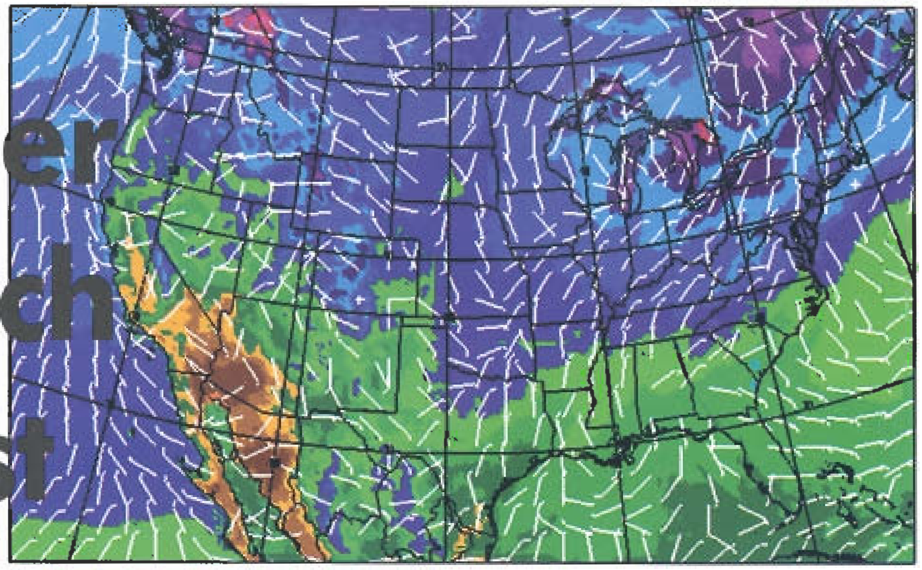
Tech. Sgt. Ron Richards, an Air Force Combat Weather Center technician, checks readings on a TMQ-53 display pod.

While most CWTs are slated to receive the state-of-the-art fixed base automated observing equipment, the FMQ-19, the fielding plan does not provide for FMQ-19s at every observing location.

The P-model is being considered for installation at non-Category I/II airfields, ranges, and LZs; i.e., those locations that may not receive an FMQ-19. The P-model uses many of the same sensors as the TMQ-53 and provides the same data, but is also built to withstand continuous operation, unlike the standard unit.

In-garrison and deployed, whether supporting a semi-permanent location such as Tuzla Main, LZs in the Afghanistan or hopping with your brigade in support of Operation IRAQI FREEDOM, the AN/TMQ-53 gets the job done. AFCWC will continue to improve the system for your operational needs.

Weather Research and Forecast model



By Capt. Kevin LaCroix
AFWA Meteorological Models Branch

Numerical weather prediction has advanced at an amazing rate since the first pioneering efforts of the 1940s. Often, these advances have occurred in technological leaps, including the development of limited-area, mesoscale weather models such as the Mesoscale Model 5. While this model has served us well, improvements in science, communication, and computing are leading to the next leap in NWP technology.

The Weather Research and Forecast Model is the next-generation mesoscale model for the nation. Drawing from the latest atmospheric and computer science technology, the WRF development community is constructing a more accurate, high-resolution weather forecast model that is also user friendly and portable.

Numerous organizations, including operational centers such as the National Centers for Environmental Prediction and Air Force Weather Agency and research labs such as the National Center for Atmospheric Research and the Forecast Systems Laboratory, are partnering in this effort, maximizing use of scarce development resources and ultimately accelerating the transition of new NWP technology from research into operations.

What makes WRF different from MM5? The dynamic core, or weather forecasting engine, of WRF is built on top of a numeric base, or framework, that separates the meteorological model from the underlying supercomputer that runs the model. The WRF framework provides maximum portability to many different supercomputer platforms and allows easy integration of new model physics. This "plug-and-play" versatility is WRF's key to the development of new capabilities and the rapid transition of these capabilities into operations. For example, plugging state-of-the-art physics into the first release of WRF will allow us to accurately forecast at scales reaching one to 10 km, which is nearly five times better than what is provided by MM5 today.

Just how much better will WRF be over MM5? There are many ways to answer this. From an architecture standpoint, MM5 has been taken to its design limit and isn't easily adapted to today's standards for interchangeability. The WRF architecture is current and offers outstanding potential for growth. From a data assimilation standpoint, our operational MM5 is limited to a few data types.

WRF, however, will be our gateway to currently untapped data sources, such as QuickSCAT winds, Special Sensor Microwave Imager winds and precipitation, and eventually the suite of NPOESS data! From a forecast quality standpoint, we expect significant gains, especially for surface temperatures, winds, and moisture. From our preliminary testing with a bare-bones configuration, the 24-hour surface cold bias over the Southwest Asian theater has been reduced by more than one degree Celsius. Relative humidity errors between 900 and 700 mb have been reduced by up to five percent, which will improve low ceiling forecasts.

Real-time WRF forecasts generated at NCAR show improved precipitation forecasts, with more accurate coverage and accumulation. The bottom line is that the warfighter will have better forecasts for weapons and sensor selection, more reliable winds for airdrops, and superior weather information for ISR – a clear win for the Air Force, DoD, and our nation!

How will WRF change AFWA's data and products? Initially, the model output will have the same look and feel as MM5, but will be created using improved physics. These improvements, combined with numerical enhancements, will allow more accurate forecasting at higher resolution. As we migrate to finer resolutions and turn on new options, accurate prediction of topographically forced weather such as valley fog, drainage winds, sea breezes, etc., will be within reach. Imagine the impact of such detailed weather intelligence on your customer's mission.

Look for WRF to replace MM5 operationally early in 2005. To learn more about WRF, check out the WRF web page at www.wrf-model.org.

DCF AFWA's Diagnostic Cloud Forecast Application up and Running

By Capt. Robert Evans
AFWA Meteorological Models Branch

Typically, when forecasters think of cloud cover, they think in terms of cumulative obscuration from the ground up – the clouds are broken at 10,000 feet, for example. Another way to think of cloud cover is through the cumulative obscuration looking down on the clouds from above. Flight operations such as ground surveillance, in-flight refueling, close air support and weapon selection for surgical air strikes all benefit from this type of cloud information. One of the Air Force Weather Agency's core missions is to provide cloud analysis and forecasts of this type.

Accurately forecasting clouds is a challenge. The AFWA Cloud Depiction and Forecast System II produces a World-Wide Merged Cloud Analysis by merging data from five geostationary and up to seven polar-orbiting satellites. It then uses the WWMCA to initialize an Advect Cloud model that produces cloud forecasts out to 48 hours. As the name implies, ADVCLD simply advects, or blows, the clouds around using winds from a global weather forecast model. Clouds can only be generated or dissipated in the model through large-scale ascent or descent of air, respectively. An example of this is given the lack of detailed physics used in the model, it does not produce convective and orographically-forced clouds. As a result, accuracy of the ADVCLD model rapidly declines beyond the 12-hour forecast.

In contrast, numerical weather prediction models, such as the Mesoscale Model 5, include more sophisticated cloud physics but generally are also unable to forecast clouds with sufficient accuracy. Another approach is needed to produce accurate cloud forecasts beyond 12 hours.

The Diagnostic Cloud Forecast application, developed by Air Force Research Lab, produces improved cloud forecasts by combining MM5 output with CDFS II cloud analysis using a technique similar to Model Output Statistics. DCF statistically relates past MM5 output parameters such as relative humidity, winds, cloud water, etc., to WWMCA cloud parameters valid at the same time. Assuming that the statistical relationships do not change significantly from day-to-day, we can use them to generate cloud forecasts from future MM5 output. Computing statistics each day, DCF "learns" or "remembers" cloud trends.

DCF has demonstrated improved skill over cloud forecasts derived from ADVCLD and MM5, but Air Force Weather specialists must understand how to use the output effectively. Real-time subjective verification reveals that DCF provides more accurate cloud structures; however, objective verification has shown only about a five-percent improvement in absolute error beyond the 12-hour forecast. While cloud structures are more accurate, the fine details are highly variable thus contributing to the small decrease in overall error. As forecasters apply DCF, they should keep this in mind.

AFWA is running DCF operationally for a limited set of MM5 domains, but intends to expand its application globally. Currently, DCF is run for the CONUS, Central/South America, Europe, plus South West and South East Asia MM5 45-km domains out to 72 hours. Output is available through IGrADS on JAAWIN and is input into the Target Acquisition Weapon Software. A version of DCF capable of running on the MM5 15-km domains is in development testing and evaluations, and a version that runs globally with Global Forecast System input is under consideration.

DCF provides a more accurate, long-range cloud forecasting capability to strategic and tactical mission planners. Because DCF is based on MM5, it complements other theater forecasting tools to provide a more complete picture of the operational weather environment.

Improving **Satellite Information**

CSU Center conducts research to increase weather satellite capabilities

By Ken Eis
Center for Geosciences/Atmospheric Research Director

Colorado State University's DOD Center for Geosciences/Atmospheric Research has been conducting weather research for the DOD since 1986. Although CG/AR has been under Army Research and Development management, its research goals have had a tri-service focus since the early 1990s.

CG/AR management continually searches for DoD requirements that match its scientific capabilities, and research opportunities are identified through the close collaboration of university scientists and DOD weather management.

As a multi-disciplinary center, CG/AR often includes electrical engineers, physicists, statisticians, and even sociologists to extend its intellectual skills beyond meteorology to meet the identified scientific needs of the three services. Currently CG/AR is addressing AFWA's research requirements matrix.

So what does CG/AR actually do? The main research themes are:

Cloud dynamics and atmospheric water vapor – Activities include the development of advanced cloud and water vapor detection from satellites. Currently CG/AR is focusing on over-land water vapor retrievals.

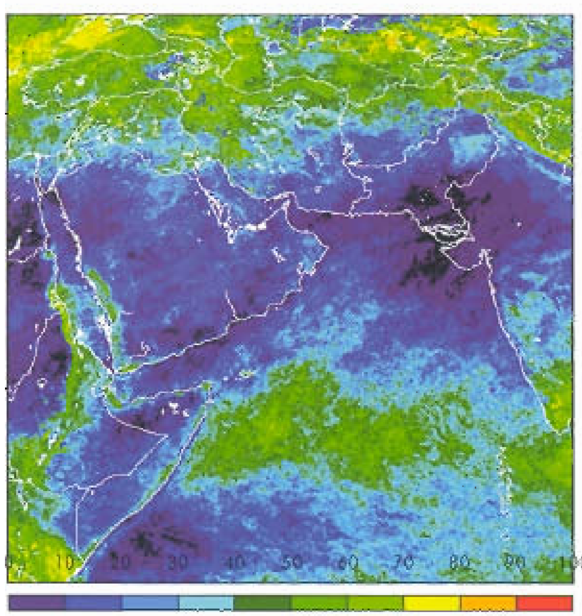
Data Assimilation – Developing advanced 4-dimensional satellite data assimilation methods that will be able to specify battlespace environmental condition even in the presence of dense clouds. Also evaluating cutting-edge statistical ensemble technologies for possible DoD application.

Hydrometeorology – This work includes detection and measurement of soil moisture to about 1 meter deep from satellite observation.

Remote sensing of the battlespace – Advanced methods of detecting cloud bases, optical depth, and ice/water phases in clouds are being investigated.

Aerosols and Atmospheric Chemistry – Polarimetric and multi-channel approaches to aerosol detection are being explored.

CG/AR works on these research themes as a university center of excellence in satellite meteorology. What this provides the DOD is a research effort capable of addressing research themes through a multi-disciplinary approach but with a focus on the full exploitation of U.S. and foreign satellite assets.



A Frequency of Occurrence of Cloud product. Colors represent the percent of the time that clouds were detected at 0900 UTC (near noon local time) during January of 2001.

Precision weather helps deliver the goods

By Maj. Henry Voegtle
HQ AMC Weather Systems
and Requirements

Mobility Air Forces will soon receive a new capability, known as the Precision Airdrop System, that will enable more accurate location and delivery of airdrop loads from higher altitudes. Data provided by Air Force Weather is an integral element in the development and operational application of this new technology.

PADS is a portion of the Joint High Altitude Precision Airdrop. The Air Force's requirement is employment above and/or outside of the primary threat envelope, while the Army and Marine requirement is accurate delivery of airdropped cargo for employment and sustainment of combat operations.

A precise method for aerial deliveries is needed to keep up with U.S. military forces that are growing faster, more mobile, and more widely dispersed. Precision airdrop is envisioned to meet the growing requirement for resupplying dispersed military forces and some humanitarian missions.

PADS is a laptop based airdrop planner with two integrated systems. Draper Laboratory is responsible for the simulation model for aircraft dynamics and payload release, and the descent trajectory to the planned Point-of Impact through a high-resolution, three-dimensional wind and density field. Planning Systems Inc. provides systems engineering, hardware/software development, and flight test evaluation support for the PADS program. PSI is responsible for the real-time production of the 3D wind and density field, either aboard the airdrop aircraft, or at other communications nodes in the modern net-centric battlespace. The key to producing the 3D field is data assimilation using a PADS-tailored version of the Local Analysis and Prediction System developed by the NOAA Forecast Systems Laboratory.

The U.S. Army Natick Soldier Center and Air Mobility Command have joined forces to implement this program. The PSI representative most involved in the weather portion of PADS is Air Force Weather's own retired Col. Bob Wright. Dr. John McGinely leads LAPS development at FSL for the PADS program.

PSI designed and built a man-portable, snap-on/snap-off engineering development prototype to operate aboard

Photo by Senior Airman Bethann Hunt

At left, a dozen C-17's from the 437th Aerial Wing, Charleston AFB, S.C., perform an airdrop while flying in a "multi-ship" formation on May 14, 2002. Right, an airdrop full of food and supplies descends steadily as trainees at Phoenix Readiness training recover the cargo during a simulated deployment at Phoenix Readiness training on Oct. 7, 2002.

Photo by Staff Sgt. Matthew Hannen

the airdrop aircraft. The system receives and assimilates atmospheric data in real-time. Resultant high-resolution 3D fields are applied to a 3 Degrees Of Freedom ballistic fall trajectory model to update the Computer Air Release Point in-flight just prior to load release. PADS also produces error probability ellipses around the PI to aid mission-planning decisions.

Air Force Weather Agency's MM5 model data can produce nested grid areas covering the area of airdrop operations at a horizontal grid resolution of 5.0 KM. The fields are assimilated with real-time atmospheric measurements and 1.0 KM topographic fields to produce high-resolution, terrain-driven flow fields.

PADS is being developed to automatically assimilate atmospheric measurements from multiple sources – hand-launched dropsondes from the airdrop aircraft, tactical dropsondes from Unmanned Aerial Vehicles, ground-based radiosondes, at-altitude navigation system winds, pilot report winds and remotely-sensed satellite-derived Feature Track Winds. If model data and in-situation data are unavailable, the Air Force Combat Climatology Center's Advanced Climate Modeling and Environmental Simulations data fields at 11 KM resolution are being tested as a "first/best estimate."

PADS airdrop C-130 flight-testing at the Yuma Proving Ground, Ariz., has produced a Circular Error Probable of less than 180 meters from 10,000 feet using High Velocity Container Delivery System with 26-foot Ring Slot canopies. Prototype PADS are now being delivered to AMC for training and operational use.

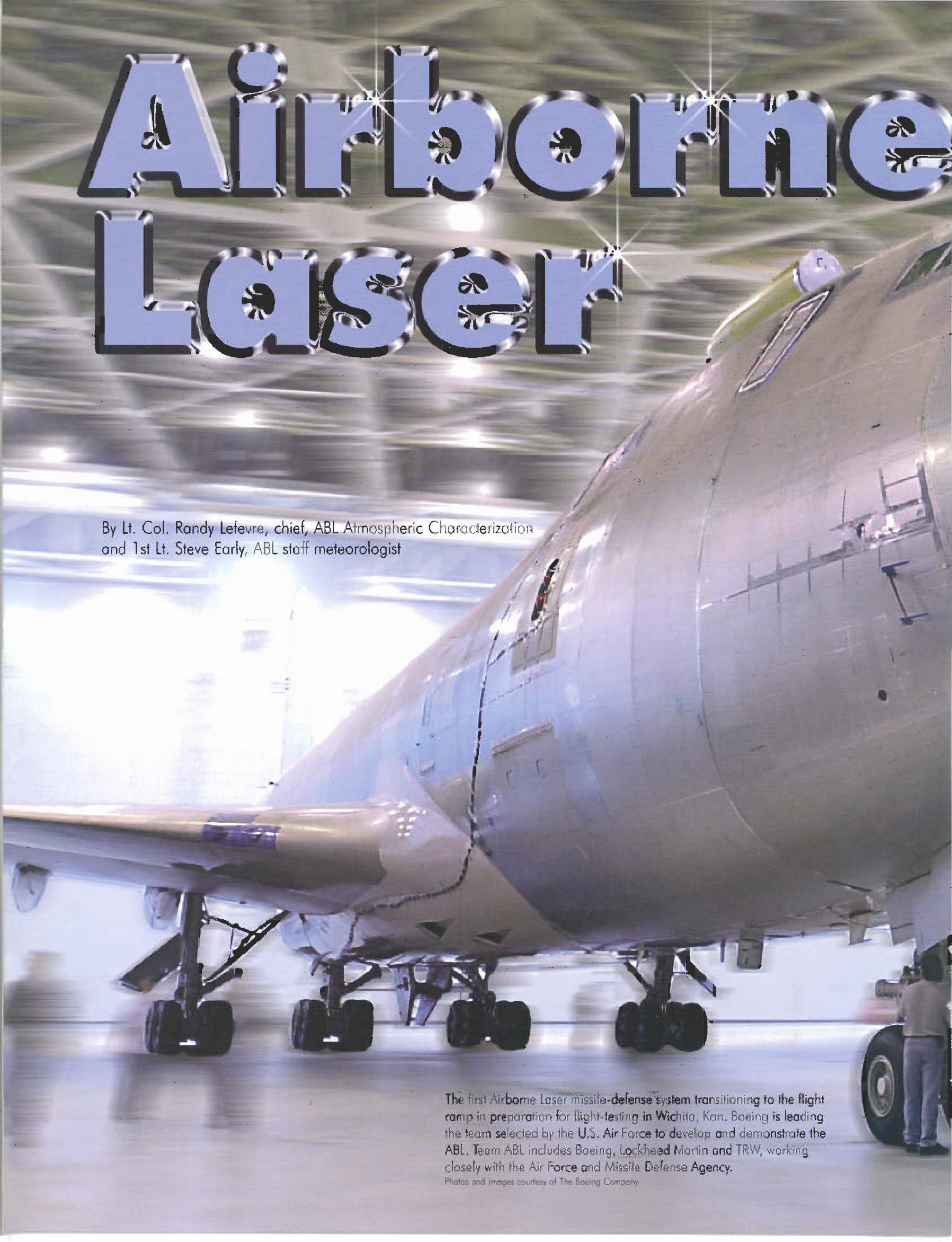
Planned development includes: adaptation of PADS for C-17 high-altitude airdrop operations; refinement of the assimilation algorithm for complex flow fields driven by very high resolution topography; PADS airdrops up to 35,000 feet MSL; and development of mission planning interfaces for guided parachute and parafoil systems in development by the Natick Soldier Center.

Guided paradrop systems will apply 4D atmospheric fields produced by PADS to determine the CARP and the optimum flight profile to the PI, similar to computer flight plan operations using MM5 4D fields.

The PADS program again demonstrates a healthy history of integration of weather data into future technologies of the Mobility Air Forces. PADS, along with the crucial AFW data inputs, establish potential for growth as a DOD-wide resupply tool.

Airborne Laser

By Lt. Col. Randy Lefevre, chief, ABL Atmospheric Characterization and 1st Lt. Steve Early, ABL staff meteorologist



The first Airborne Laser missile-defense system transitioning to the flight ramp in preparation for flight-testing in Wichita, Kan. Boeing is leading the team selected by the U.S. Air Force to develop and demonstrate the ABL. Team ABL includes Boeing, Lockheed Martin and TRW, working closely with the Air Force and Missile Defense Agency.

Photos and images courtesy of The Boeing Company

The battlespace environment of tomorrow will likely be much different than yesterday and today. High technology weapon systems will dominate the scene from the surface of the Earth into space. A crucial component of our nation's defense will include the latest technology packaged in the Ballistic Missile Defense System. The BMDS includes several different elements being developed by the Missile Defense Agency. The Airborne Laser, or ABL, will be one of the first BMDS hi-tech defense elements to enter into America's operational inventory.

The ABL, a highly modified Boeing 747-400 containing a megawatt-class Chemical Oxygen Iodine Laser, is presently undergoing component integration at Edwards AFB, Calif. The aircraft will loiter above the clouds at approximately 40,000 feet scanning the battlespace environment using infrared search and track technology – looking for hot ballistic missile plumes. When one, or more, plumes are detected one of several laser pointing and tracking systems will engage the missile.

Sophisticated battle management software will determine the missile characteristics as well as the projected launch and impact points. This missile trajectory information will be relayed to the rest of the BMDS "family" to initiate action. One of the lower-powered ABL lasers used in the tracking process will also measure the optical turbulence characteristics of the atmosphere. This atmospheric information will be used by the advanced ABL adaptive optics system to correct for atmospheric effects – similar to how eyeglasses correct vision. While the ABL adaptive optics system continuously corrects for atmospheric disturbances, the high-energy laser will fire at the boosting ballistic missile until the pressurized fuel tank ruptures and the missile explodes, dumping the contents of its warhead on or near the launch site.

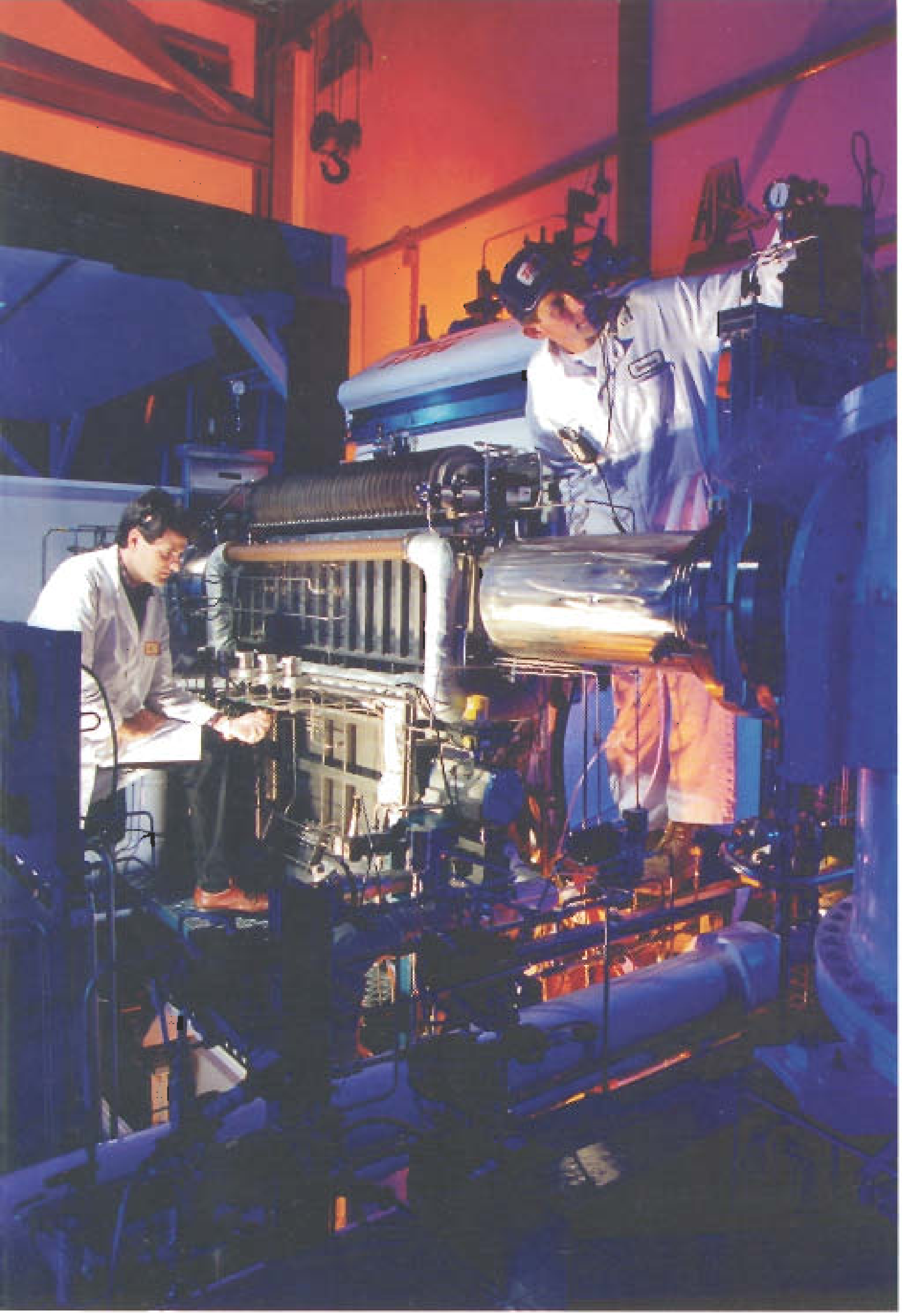
Weather sensitivities and atmospheric characterization issues have been key aspects of directed energy development since the ideas were a "twinkle" in the eyes of researchers decades ago. Staff meteorologists at Kirtland AFB, N.M., working with our nation's leading scientists and engineers, are attempting to mitigate the impacts of the atmosphere on directed energy weapon systems like the ABL. A team of meteorologists at Kirtland and the 88th Weather Squadron, Wright Patterson AFB, Ohio, have focused on techniques to analyze and forecast the optical turbulence and high cloud (cirrus and sub-visual cirrus) environment for ABL operations.

Atmospheric optical turbulence manifests itself as small-scale temporal and spatial fluctuations in refractive index. One experience we all have with optical turbulence is the twinkling of stars when viewed through the clear night sky. The starlight is constant, but the scintillation due to optical turbulence in the atmosphere varies the light intensity at our eyes. The atmosphere's effect on starlight is picturesque, but when the ABL is radiating weapons of mass destruction the atmospheric transmission path needs correction. Optical turbulence is not the only weather sensitivity, however.

In general the ABL will operate in the upper troposphere and lower stratosphere – above the normal altitudes of clouds. There will be times when the path between the ABL and potential targets contains thin cirrus or sub-visual cirrus clouds. There are at least two challenges associated with high clouds: accurate cirrus detection and forecast, and the transmission and scattering impacts on laser electromagnetic radiation.

The staffmets at Kirtland AFB, as well as scientists and

Airborne Laser First Flight - Artist concept, artwork by Mike Casad.

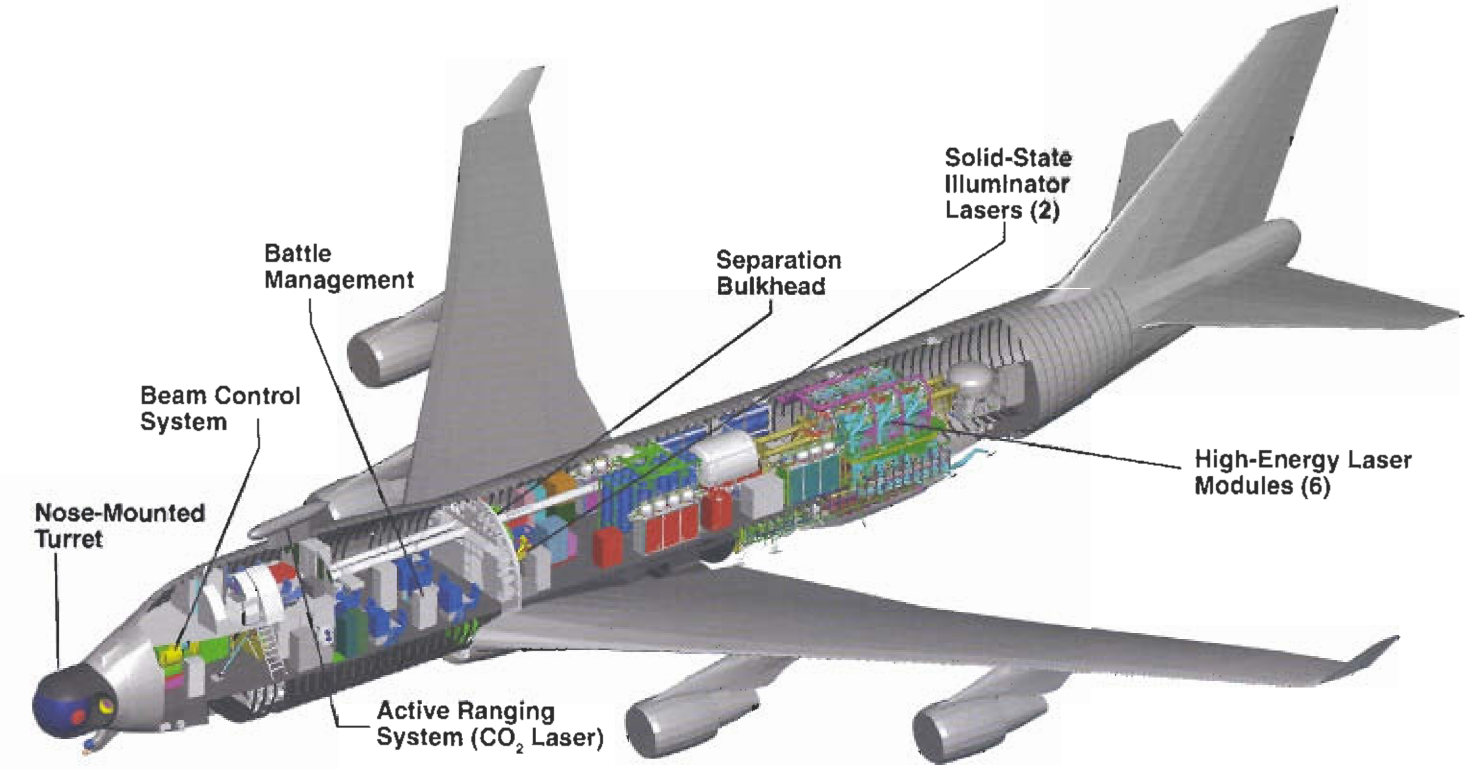


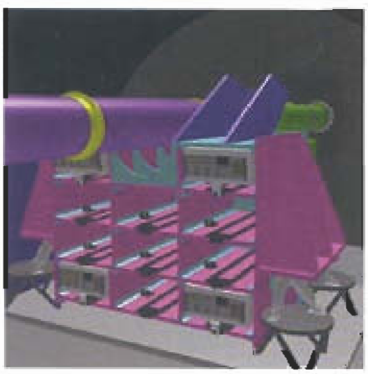
TRW technicians prepare the Airborne Laser program's flight-weighted laser module for the first of several tests of the laser's power and lasing efficiency. "First light" for the FLM was achieved June 3 at TRW's Capistrano Test Site in Orange County, Calif. The FLM is the fundamental building block for the ABL megawatt-class being developed by Team ABL for the U.S. Air Force.

engineers from Kirtland AFB and Hanscom AFB, Mass., have been involved in worldwide and CONUS atmospheric data collection campaigns over the past decade. The results of these campaigns yielded quantitative information about the nature and frequency of occurrence of optical turbulence and cirrus clouds. This atmospheric information coupled with world-class research by government laboratories and universities has lead to the development of an Atmospheric Decision Aid to help forecasters diagnose and forecast optical turbulence and cirrus clouds.

The prototype ABL ADA will ingest numerical weather prediction information from the Air Force Weather Agency and the Navy's Fleet Numerical Meteorology and Oceanography Center, and combine this information with real-time meteorological satellite information to help forecasters analyze and forecast optical turbulence and cirrus clouds. The ADA will employ a graphical user interface to allow input of ABL-to-target geometry for mission-specific assessment of the atmosphere on ABL operations – functioning similar to the Target Acquisition Weapons Software for air-to-ground operations. Kirtland meteorologists are also involved in an extensive Verification and Validation effort to quantify the accuracy and precision of ADA analyses and forecasts. The V&V efforts include leveraging 50 MHz atmospheric radar profiler systems at Vandenberg AFB, Calif., the Kennedy Space Center, Texas, and balloon-borne measurements of optical turbulence from several locations around the country. The V&V for cloud diagnostics in the ADA include ground-based lidar analyses and cutting-edge observations from both geostationary and polar-orbiter satellites – for example, data from the NASA's latest Earth Observing System platforms.

The future of the ABL ADA includes fully integrating it within the Air Force's command and control architecture as planned and acquired by AFWA and the Electronic Systems Center, Hanscom AFB. There are also plans for an on-board ADA that will provide real-time analysis and forecast of the atmosphere specific to the ABL during real-time execution. The Airborne Laser is cutting-edge technology, and Staffmets here are working to ensure the future of weather support for ABL is likewise state-of-the-art.

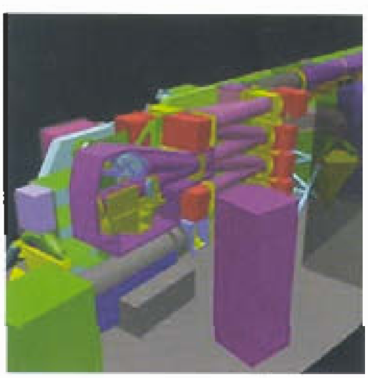




Illuminator Laser (Lockheed Martin)
- Tracking illuminator laser
- Beacon illuminator laser
- Lasers are state-of-the-art diode-pumped, solid state devices

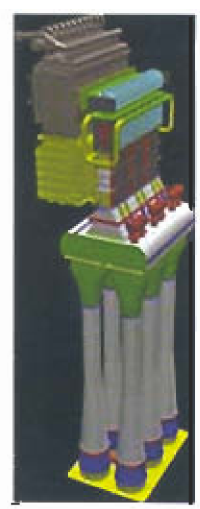
Active Laser Ranger
- Modified 3rd generation LANTIRN with high-power CO2 laser
- Acquires target from IRST sensor cue, tracks target, and points CO2 laser for ranging
- Helps determine missile launch point and impact point

Nose-Mounted Turret (Lockheed Martin)
- 1.5m telescope in turret focuses beams on missile and collects return image and signals
- ±120 field-of-regard (azimuth)
- Extensive wind-tunnel tests by Boeing validate the design
- Flight weight composite construction
- Window stows until on cloud and dust-free aircraft orbit
- Protected against bird and lightning strike



Beam Control System (Lockheed Martin)
- Target acquisition and tracking
- Fire-control engagement sequencing, aim point-and-kill assessment
- High-energy laser beam wavefront control and atmospheric compensation
- Jitter control, alignment/beam-walk control, and beam containment for HEL and illuminator lasers
- Calibration and diagnostics provide autonomous real-time operations and post mission analysis

High-Energy Laser (Northrop Grumman)
- Chemical oxygen iodine laser technology
- World record for chemical efficiency set by Northrop Grumman
- Advanced materials-plastics, composites, titanium-used to reduce weight
- Modular design allows for graceful degradation
- Closed chemical system with recirculating reactants
- Designed for aircraft safety and field maintainability



Comparing Weather Research in 1954 to 2003:
Buck Rogers of the 25th Century

Tales from the bombing ranges of Eglin AFB in the 1950s

By Martin Hershkowitz
Former Air Weather Service observer

I have enjoyed reading the Observer over the last many years; however, these past two years have contained articles on current weather observing and forecasting technology that appears like science fiction to this old weatherman. As I read these articles, my mind skips back to cutting-edge weather research of the 1950s and the comparison suffers .....

It was June 1954, and I was a recent graduate of Chanute AFB's Weather Observer School and on my way to my first weather duty station at Eglin AFB, Fla. – off to a major weather station and ready to "fly."

I was very disappointed when the personnel office informed me that I was not assigned to the base weather station, but to a weather research unit on the other side of the base – in the "boonies" past the B-29 and B-50 hardstands.

Once I arrived at Eglin, and after a long drive through a pine forest, on sandy roads, past numerous old bombers, I came to a clearing with a small, two-story block house in the middle of a grass circle and surrounded by a small desert. Off to one side was a 10-foot high wire fence enclosing two large Quonset huts and a motor pool of many jeeps, pickup trucks and 2-1/2 ton trucks – hardly a weather station or a research laboratory.

When I reported in for duty, the 1st sergeant read me the riot act that he saved for newly reporting observers and told me that I was required to attend every Wednesday formation when he practiced his Sunday sermon on the assembled troops. Then he assigned me as Team Leader of a three-man team and put us into an intensified training program, teaching us to be Observers in a research environment.

Photo courtesy of the AFW History Office

Two weathermen preparing to track a pilot-balloon with a theodolite, an F-84 can be seen in the background. This photo was taken in the1951, at an unknown location.

Eglin AFB's "Site 23" as seen from the air in the mid 1950s.

We learned how to maintain instruments for measuring pressure, temperature and wind, loading and unloading paper, filling ink reservoirs, and adjusting the equipment. Sounds easy until you try to do it on a desert with the winds blowing or on top of 10 and 30-meter towers with the winds really blowing. We also learned to do theodolite readings every 30 seconds, double-theodolite readings every 15 seconds and triple-theodolite readings every 10 seconds. The latter two took two and three teams, respectively, with headsets to coordinate the timing. Finally, we learned how to coordinate the multiple theodolite readings to obtain a highly accurate picture of low level winds from two meters to 300 meters, needed to determine wind shift impact on low level ground support and special bomb release techniques - toss-bombing, skip-bombing, and roll-bombing. Little did we realize at the time that we were looking at surface level micro-burst wind shear impact.

During our training period, we learned that the Quonset huts housed a huge production laboratory where the NCOs spent their days inventing, modifying, bench-testing, configuring and redesigning recording anemometers, thermometers, hygrometers and barometers. This was all the traditional weather equipment that we naively took for granted at Chanute and when I worked at the New York University weather research station.

At first sight we were mystified by our new world. Fortunately, our guides for this part of our indoctrination into "modern" weather research were Tech. Sgt. "Buck" Rogers, you got it, right out of the 25th Century, and Staff Sgt. Fannin. When it came to knowing weather equipment, its uses, and the plans for modernizing and improving the equipment, they were the best in the shop. We field crew observers learned how to make the equipment perform at 100 percent under exposure to some of the worst surface weather conditions – wind, rain, sand storms, fog, hail, lightning and thunder.

Thanks to that phase of our training we were ready to start our field training. At first, it sounded exciting, working with fighters and bombers, testing their combat techniques at altitudes from two meters to 300 meters above the surface. However, the first phase was nothing like that. We had to install and maintain wooden footlockers full of weather research equipment on towers in the middle of the North Florida desert.

Now, I can fly upside-down with no concerns whatsoever, but I can't climb five feet off the ground without the beginnings of vertigo freezing me to the ladder. Fortunately, my teammate, Roy, was a powerful young man with absolutely no fears at all. Nothing was too difficult for him and he helped me conquer my fear of heights.

Now we were ready for the real fieldwork and received a long and detailed exposure to each aircraft we would support, their bombing, strafing and rocketing techniques, and the kind of things that could go wrong during these field tests. With extraordinary precision for wind speed and direction, temperature, dew point and pressure obtained by our crews and the results of the aircraft's gunnery and bombing accuracy, Combat Testing was able to determine the best close air-to-surface combat support capability for each aircraft type tested and each combat load used by those aircraft.

Actually, strafing and rocketing was dangerous to the weather crews because we had to be just off the line of flight taking readings as the aircraft flew past at 5 to 30 meters firing its weapons. The pilot's accuracy was typically great; however, his control of the aircraft could be slightly off even though the aircraft was well within the envelop. Onetime, a slight wind shift caused a wingtip to take our wind mast along with it as we stood within five feet of the equipment.

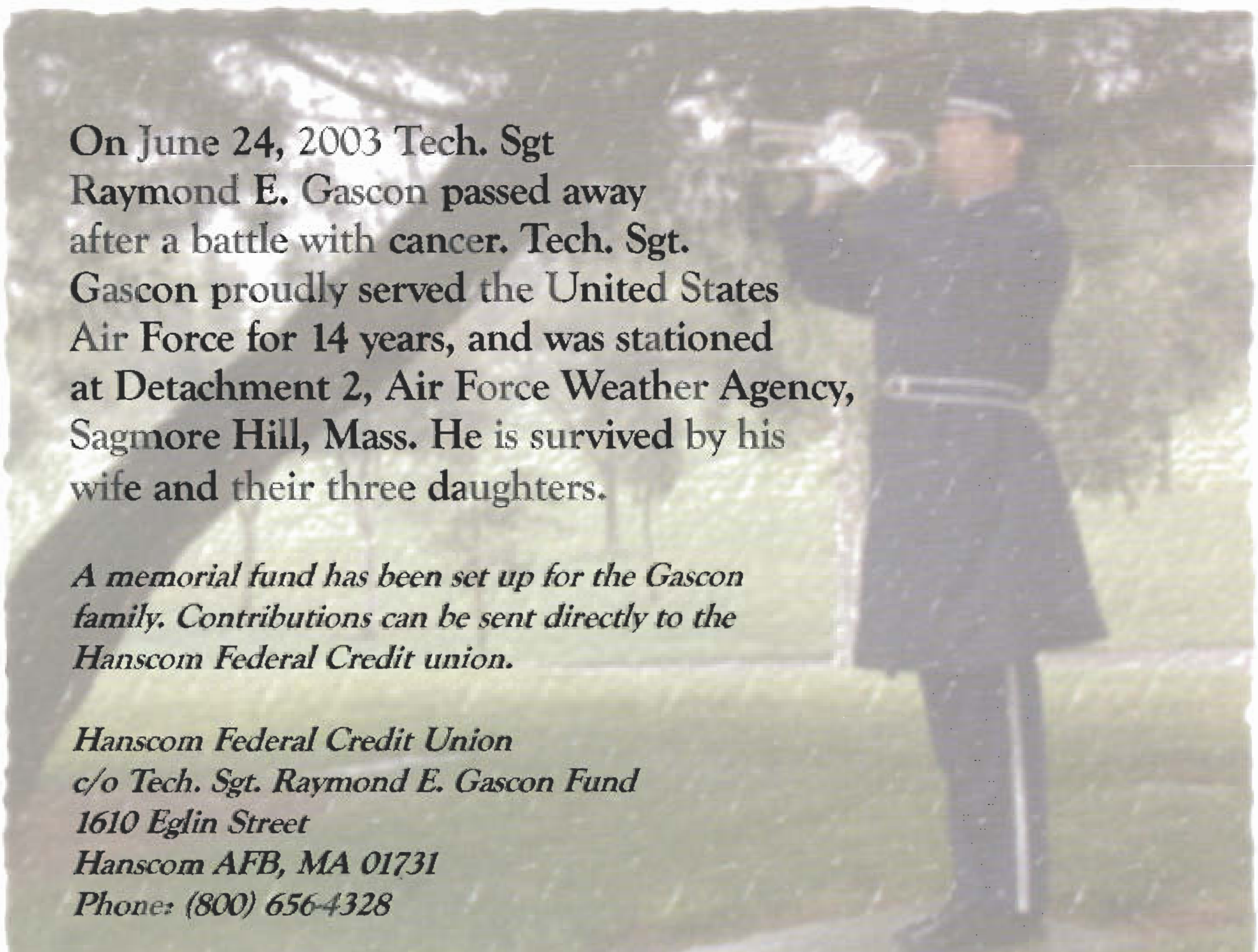
Still another time, while we were having some lunch in the shade of a control blockhouse. We felt the wall convulsing, and pieces of concrete showered on us followed by a very loud noise. It seems that a pilot mistook the other side of the blockhouse for his target. Fortunately, the rocket was a dud; however, the controller was still most unhappy.

After some four months of training and fieldwork, and the transfer of another weather specialist, I was selected to work in the Climatology Laboratory. I studied the effects of wind, temperature, dew point and pressure on the dispersal of particles – bullets, rockets, bombs – and the possible development of mathematical equations for predicting the envelop of dispersion. The data was gathered from the test equipment on the towers and the readings taken on the ranges. The techniques used were statistics, physics, chemistry and mathematics.

One intriguing aspect of working in the Climatology Laboratory was the data we received from Goat Island in the Gulf of Mexico. There they were dispersing a different substance than that on the ranges of Eglin. We then studied the impact of surface weather on two kinds of dispersions, the heavier objects of bullets, rockets and bombs from the ranges, and the very much lighter substances from Goat Island.

In February 1955, I received orders to report to a traditional weather detachment at Kirtland AFB in Albuquerque, N.M. The training and experience I had at Eglin served me very well in the deserts of New Mexico and later in French Morocco. I was able to train my teams in techniques they had never heard of at Chanute, which made their observations very valuable to the forecasters. My experience in the Climatology Lab provided me with greater insight into surface weather patterns and enabled me to provide my teams with tips about what to look for when they went outside during rapidly changing weather conditions.

Yet, with all this great exposure to the cutting edge of weather research, I read about the new Air Force Weather technology and the advanced forecasting techniques and I am humbled. I came out of the "Stone Age" and now read about you in Buck Roger's "25th Century." *Vaya con Dios!*



Technology is "In The House"

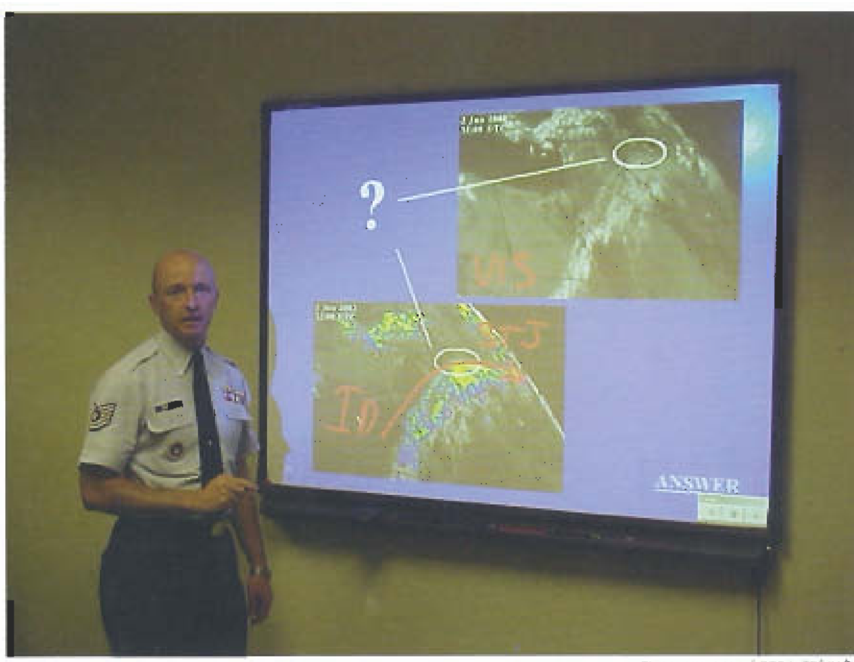
By Tech. Sgt. Richard Riter
Weather Training Flight

There is a saying that the only thing that remains the same is change, and that has certainly been true at the Weather Training Complex, Keesler AFB, Miss. During the past three years the advances in computer technology and instructional tools have allowed the Weather Training Complex to transition from archaic classrooms to fully modern learning environments. Gone are the days of long-winded lecture coupled with meticulous note taking. Chalkboards, overhead projectors and slides, and simplistic mock-ups have given way to new technology, interactive presentations, and realistic training on the equipment actually used in the field. Classroom instruction has been so positively affected, today's students are much more receptive to lecture and are fully engaged.

The most significant change to our classrooms has been the equipment used to facilitate learning. Not too long ago, any type of multimedia in the classroom was considered innovative. Satellite slides viewed on 35mm Caramate was considered "high tech," even multi colored chalk was once considered state-of-the-art. This is no longer the case.

Powerful computers used in conjunction with high-resolution one-gun projectors provide extremely interesting and interactive instruction. When these are paired with the latest Smartboard technology, the potential for learning skyrockets. Such technology is a far cry from multi-colored chalk and entices students who have grown up on interactive video games and high-quality DVDs. In addition to an interactive visual array of lecture tools, entire classrooms have been dedicated as computer labs ensuring that each student has a computer to work on and to practice hands-on application.

Chart analysis, meteorological satellite analysis and operational weather squadron emulation are just a few of the subjects using fully automated computer labs. Students no longer look at fuzzy photocopies of ancient satellite images – images that have long lost the detail necessary to determine the difference between stratus and cirrus. Today's labs display canned and real-time data. Chart analysis, radar analysis and satellite analysis are accomplished using canned data to illustrate the "perfect textbook" scenario, and real-time data is used to illustrate the fact that "perfect textbook" scenarios seldom occur in the real world. Instruction goes beyond mid-latitude forecasting in Illinois where all the rules appear to work. We can now go anywhere in the world and lead students through



Tech. Sgt. Scott Bradley, weather instructor with the 335th TRS/UOA, Keesler AFB, Miss., displays the many uses of the smartboards located in nearly every classroom. The instructors are able to display presentations, edit them on the fly, and add to each slide by drawing on it as one used to draw on transparencies. Finally, with a program called schematic power browser instructors will soon be able to overlay multiple slides (e.g., satellite on charts) and zoom in and out to see greater detail in each slide.

Photos courtesy of 335th TRS/UOA

Instructor Staff Sgt. Robert Knight helps student Airman 1st Class Callie Andersen with weather chart analysis.

the pitfalls of rules that don't always work, anywhere, anytime. Reality is key to our labs and the technology in place provides that capability.

Classrooms have been further enhanced by the installation of a Local Area Network. LAN connectivity allows each classroom to freely store and share information as well as have instant access to multiple weather resources via the World Wide Web. Instructional materials used in one section of the building can now be utilized in any classroom. Also, through the use of LAN connectivity, instructors have the means to quickly access and display a multitude of images, graphics, and weather products. This instant access to current weather data in a multimedia format brings a high level of realism to the classroom environment and liberates the instructor from a hardened set of tools to explain complex atmospheric dynamics.

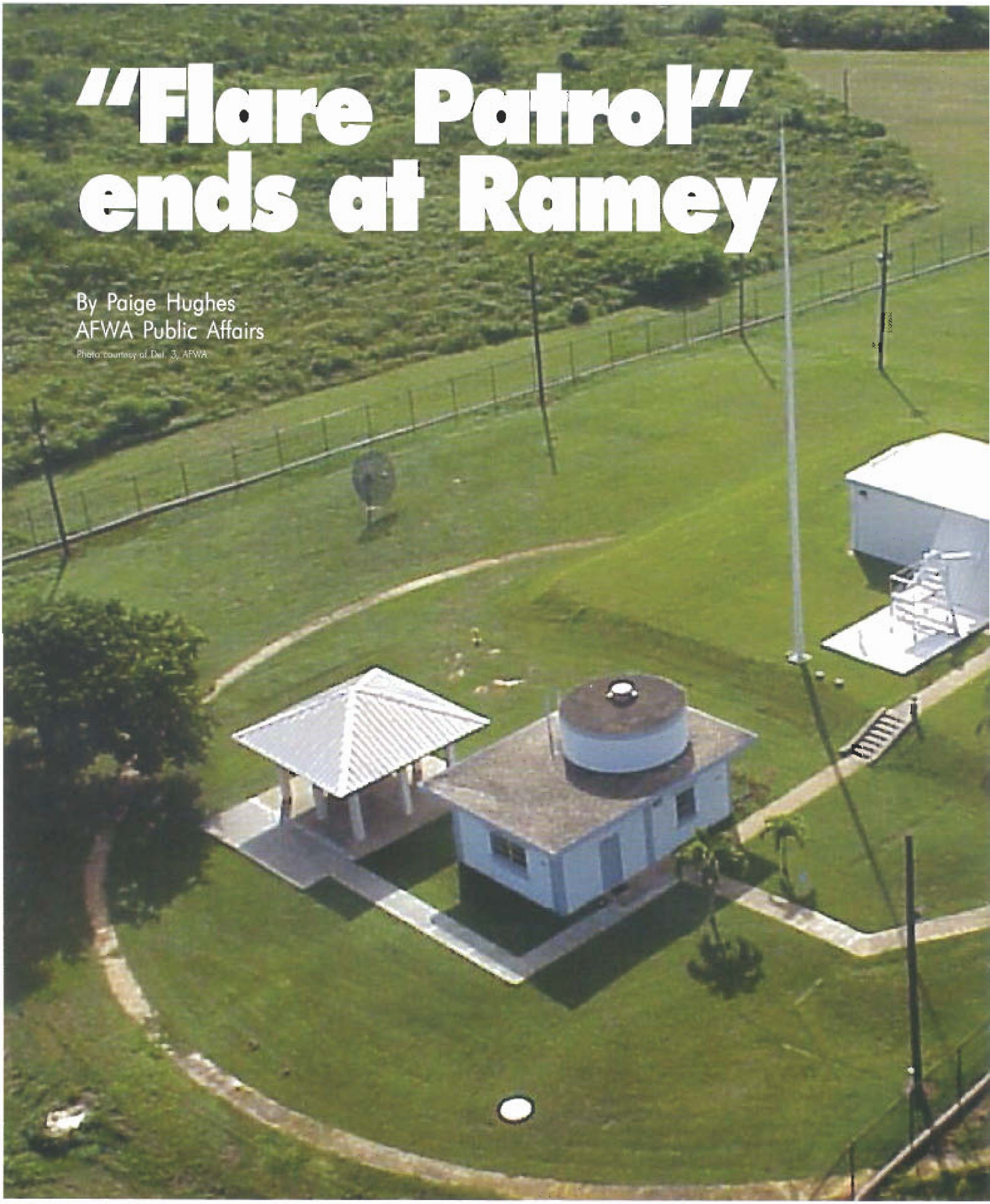
The newest equipment used in the classroom has freed the instructor to use his or her imagination and allow the instructor to move away from the lectern and lesson plan. Simple lecture has transformed into an engaging weave of audio, video, and even tactile media. The instructor no longer has to be the "song and dance" for the curriculum – the material can now "speak" for itself. In addition to the improved way we present the material, instructors and technical development personnel can more precisely gauge test and student performance, update curriculum nearly on the fly, and develop new courses as they are needed using the latest course design and monitoring software.

Your schoolhouse is ready to serve your training needs with engaging instruction and realism. Future enhancements are sure to improve on the exciting training atmosphere currently available. As the formal instruction of years past cannot hold a candle to the instruction available today, anticipated technological advancements will continue to improve instruction delivery and methodology. The prospects are exciting, and the investment in the future invaluable.

"Flare Patrol" ends at Ramey

By Paige Hughes
AFWA Public Affairs

Photo courtesy of Det. 3, AFWA



Detachment 3, Ramey Solar Observatory, Puerto Rico, celebrated the last day of operation May 1, 2003, with an inactivation ceremony officiated by Lt. Col. Wendell T. Stapler, director of operations, Air Force Weather Agency. The unit will officially inactivate later this year.

"The efforts of the professional assigned to Detachment 3 have been instrumental in helping mitigate the impact on satellite communications, space vehicle operations, ground-based radar systems, and precision guided weapons systems," said Lt. Col. Stapler in his remarks.

For the past 37 years, the detachment has been providing real-time solar and near-earth geophysical data to AFWA Space Weather Operations Center forecasters and the jointly operated U.S. Air Force and NOAA Space Weather Operations Center in Boulder, Colo.

AFWA is the sole DoD provider of solar optical and radio observations analysis and forecasting. The inactivation of the Ramey telescope will leave three optical telescopes operational in the Air Force Weather inventory.

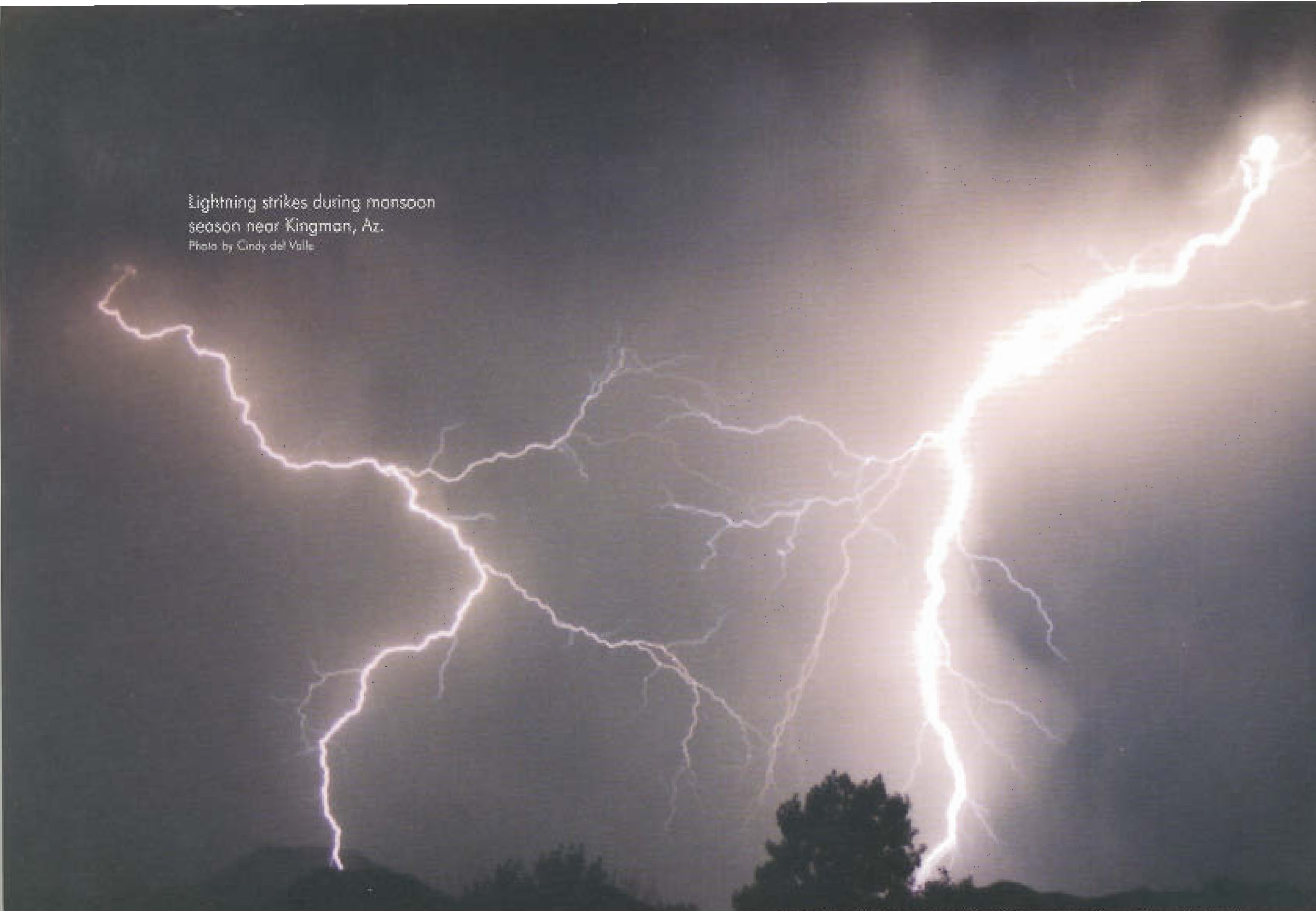
Closing the solar observatory will eliminate the current redundant solar observing pattern and provide savings to fund improvements to the Solar Electro-Optical Network.

Additionally, recent advances in technology have brought improved capability to the space weather community. The space based Solar X-ray Imager provides constant, real time, X-ray images of the Sun and does not have to contend with clouds or sunsets.

"Space weather and our mission of solar observing isn't any less important because we are inactivating, it's just becoming more effective," said Capt. Frank Tersigni, Det. 3 commander.

The nine members currently assigned to the observatory will assist in the dismantling of the specialized equipment and then transition to other Air Force assignments as the unit shuts down. The observatory is situated on the cliffs of northwestern Puerto Rico and occupies roughly 77 acres of land on a site near the former Ramey Air Force Base.

"Captain Tersigni and his unit have been on the forefront in evolving our ability to better analyze and forecast solar activities," said Lt. Col Stapler. "We salute them for their commitment and service."



Lightning strikes during monsoon season near Kingman, Az.
Photo by Cindy del Valle

By William P. Roeder
45th Weather Squadron, Chief Staff Meteorologist

What is the most cost-effective action military meteorologists can do to reduce weather deaths and injuries for our customers, and for our families and friends? Lightning safety education is the answer!

Lightning is the second leading cause of weather deaths in the U.S., killing more than tornadoes or hurricanes. Lightning also inflicts life-long debilitating injuries on many more than it kills.

Both the American Meteorological Society and the National Weather Association have issued lightning safety policy statements recently calling for meteorologists to proactively engage in lightning safety education. Lightning kills, play it safe - learn more about lightning safety at the provided website table.

The military is especially at risk for lightning casualties, according to a 2002 report from the Center for Disease Control And Prevention. That should be no surprise given all the mission training, fitness workouts, and recreation we do outside. Before you decide to stay outside a little longer when thunderstorms threaten, ask yourself if it is worth destroying your career and devastating your life and the lives of your family?

While no place in the U.S. is risk-free from lightning, some places have more risk than others, especially the Southeast, Gulf States, Mississippi and Ohio Valleys, and the Front Range of the Rocky Mountains. Fortunately, most lightning casualties can be easily, quickly, and cheaply avoided. While 100% guaranteed lightning safety is not possible, teaching the

Lightning Safety: *It could save your life*

following few simple guidelines will provide a high degree of safety. On-base, follow your local procedures. React to the local lightning watches and warnings immediately. Off-base, proper personal lightning safety is a five-level process. **NO place outside is safe near a thunderstorm!**

LEVEL-1: The best level of lightning safety is to avoid the threat in the first place. Use the local weather forecast and know your local weather patterns to schedule your outdoor activities to avoid thunderstorms.

LEVEL-2: If you have to be outside, use the '30-30 **Rule.**' If there is 30 seconds or less between lightning and its thunder, go inside. Stay inside for 30 minutes or more after hearing the last thunder. The safest place from lightning is inside a large fully enclosed building with wiring and plumbing, such as a typical house. Once inside, don't use a corded telephone, keep away from electrical appliances and wiring, and don't use plumbing. Don't watch lightning from windows, doorways, or breezeways. In a large building, inner rooms are generally safer. If you can't get to a good building, a vehicle with a metal roof and metal sides offers some lightning protection.

LEVEL-3: If you have to be outside with thunderstorms in the area, avoid the locations and activities that are the most dangerous. Avoid high elevations and open areas, like sports fields or beaches. Avoid tall isolated objects, like trees. Avoid water-related activities, like swimming, boating, and fishing. **Do NOT go under a tree to keep dry!** Avoid heavy equipment and farm equipment with open cockpits.

LEVEL-4: If you've made several bad decisions and find yourself outside in a dangerous location away from shelter with thunderstorms threatening, you can reduce but not eliminate your risk. It is much better to have planned ahead or stayed tuned to the forecast and moved to shelter sooner. Use the following as a desperate last resort only. Proceed to the safest spot possible. Get off elevated locations or open areas. Avoid tall isolated objects like trees. Get away from water. While moving to the safest spot, watch for the signs that lightning may strike in a few seconds. The hair on your head, arms or legs might start standing up. Or your skin might start tingling. Or light metal objects might start vibrating. Or there may be a static-like crackling sound. If you see any of those signs, react immediately. If you're in a group, spread out with several body lengths between each person. Then use the 'lightning crouch' – put your feet together, squat low, tuck your head, and cover your ears. After a brief wait, slowly stand-up, watching for the signs that lightning may still be about to strike, then continue towards the safest spot. Remember, this is for desperate last resort use only! No place outside is safe near a thunderstorm!

LEVEL-5: First Aid – all lightning deaths are from cardiac arrest, or stopped breathing from the cardiac arrest. Call 911, then apply CPR or rescue breathing, respectively.

Serve your customers and serve your community; teach lightning safety. The 45th Weather Squadron stands ready to help you develop your own lightning safety program. Remember the Lightning Safety Awareness Week motto – lightning kills, play it safe!

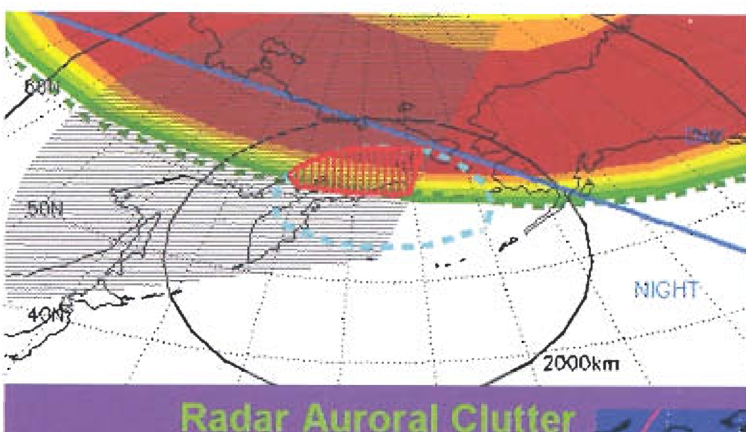
Educating today's Air Force space weather leaders

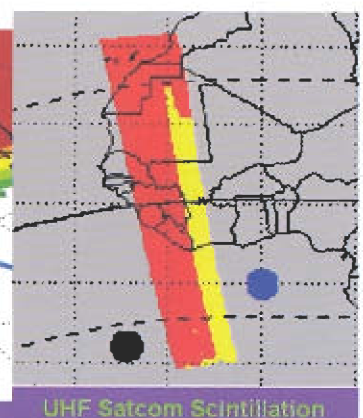
By the Air Force Institute of Technology staff

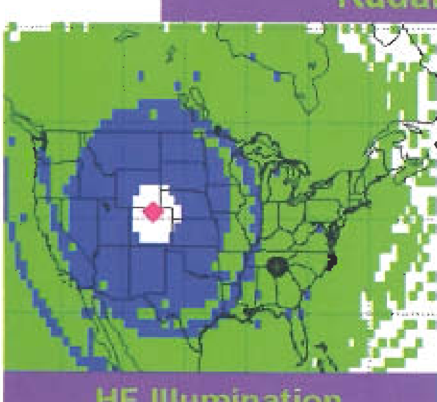
Even the visionary Sun Tzu, who said, "Know the weather and your victory will be complete," could not have anticipated the way our need for atmospheric awareness would expand in the present day. As military technologies become increasingly dependent on a space-based component, the art and science of forecasting space environment impacts come to the forefront.

In order to carry out its mission, the military has a growing need to determine "space weather." It's a difficult mission assignment, full of unknowns, yet it has a bright future. Paving the way into that future for Air Force Weather is the in-residence space weather graduate degree program at the Air Force Institute of Technology. A little on the why, what, and who of that program follows.

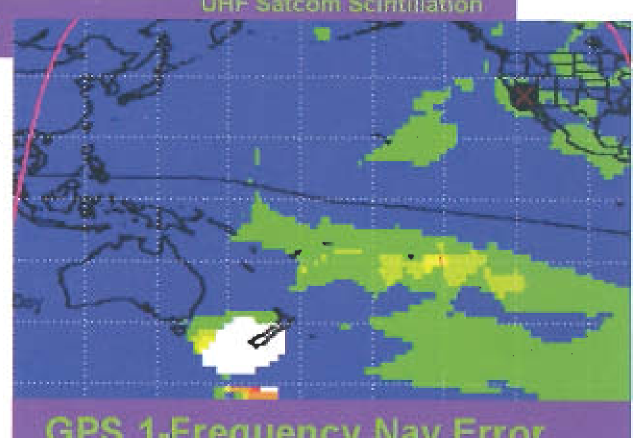
The vast regions of the heavens separating our planet from the other objects of the cosmos is far from empty, and the swirling gases filling that void can have a significant impact on human activities. Consider the presence of near-light-speed particles ejected from explosions on the Sun. These energetic particles reach Earth in a matter of minutes, with the power to disable satellite-stabilizing sensors, or to trigger unthinkable consequences for an astronaut performing a space walk. Consider also the Northern Lights. These are the auroral storms of the arctic circle – wondrous red and green curtains of light that can blind early warning radars and disrupt over-the-pole high-frequency communications. Imagine further the possibility of a cruise missile missing its target in the Middle East because of a Global Positioning Satellite guidance error created by churning bubbles of ionized gas in the evening atmosphere 100 miles high. The military







Sample displays of the Operational Space Environment Network Display suite of products. These products establish the first-ever operational space weather impact map products for specific communication, navigation, surveillance, and other DOD operational systems.



and political consequences of such an incident cannot be taken lightly.

The weather challenges of these situations, and many other space weather operational impacts, are the purview of Air Force Weather space science experts. Among other reasons, the task is daunting due to the volume of space we must model and forecast for (countless billions of times larger than the troposphere).

Additionally, the near-Earth space environment has only been studied systematically for about 40 years, making this a science in its infancy compared to meteorology. New and better satellites are helping matters, but predicting the timing and operational effects of a given space weather storm is still like forecasting thunderstorms for the entire U.S. based on one balloon measurement! The only way to improve our space weather capabilities is through education and research, and AFIT's space weather students and faculty are helping lead the way.

Unlike the AFIT meteorology program, which will soon transition to Monterey as part of the AFIT – Naval Postgraduate School alliance effort, the space weather master's program will remain at Wright-Patterson. In addition, a new "hybrid" troposphere-space weather master's program will now be offered at AFIT, which will complement XOW's "mainstreaming space" initiative. One student is already slated to enter the "hybrid" program in the fall of 2003.

The AFIT curriculum covers all areas of space weather, including studies of solar science, Earth's magnetic field, and upper atmospheric dynamics and chemistry. Operational consequences of space weather are stressed throughout the coursework, and then summarized in our "operational assessments" course near the end of the program. This "capstone" course allows the students to apply their acquired space weather expertise to the practical problem of space weather analysis, forecasting, and resulting operational impacts. Naturally the AFIT faculty responsible for this program must be highly trained in both the science and operational aspects of space weather. The current military faculty includes Majs. Devin Della-Rose and Clark Groves, and Air Force Reserve Capt. Stephen Quigley, all of whom have extensive operational space weather experience. This experience includes assignments at the 55th Space Weather Squadron and HQ Air Force Space Command. Groves is a graduate of the first in-residence AFIT space weather class of 1995. Both Della-Rose and

Call for AFW Thesis/Dissertation Research Topics

By Lt. Col. Ron Lowther
Air Force Institute of Technology

Each year, the Air Force Institute of Technology through the Air Force Weather Agency's Air and Space Science Directorate requests graduate student research topics from Air Force Weather organizations. These research needs are addressed by weather officers attending military graduate-level programs at AFIT and the Naval Post-Graduate School, as well as, various civilian schools offering meteorology programs.

The purpose is to focus these vital research efforts on solving critical needs of AFW and ensure they provide direct payback to AF operations. We request your input to ensure we provide AFIT students with research topics that are of direct applicability to your mission and operational problems.

Your submitted topics are first prioritized and then provided to all resident and non-resident weather students. All AFW master of science and doctoral students attending AFIT or NPS must choose topics from the list. The specific format for topics will be sent out via distribution by AFWA/DN this summer.

Please submit your topics to either AFWA/DNXT or AFIT/ENP no later than Sep. 15, 2003. AFIT and AFWA will consolidate a list and forward to AF/XOWX who will convene the Advanced Academic Degree Weather Research Review Board to prioritize the topics. The board consists of AF/XOW (chair), AFWA/DN, MAJCOM representatives, and an AFIT representative. All thesis topics are reviewed and rank-ordered based on current AFW needs and then sent back to AFIT for student use by Dec. 1 each year. All weather officers attending space weather programs in-residence at AFIT or meteorology programs at NPS are required to work high priority topics from the list and present their deliverables to AF/XOW when complete.

For topics chosen, AFIT students will work with you as their studies progress to focus the topic and maximize warfighter payback to your organization. All thesis/dissertation research is managed by AFIT either through the in-resident graduate school or Civilian Institute programs. We look forward to your research topics and working with you to optimize AFW's limited research resources. Both meteorology and space weather topics are encouraged.

AFW Briefs

Editor's Note

The 2002 Annual Air Force Weather Award information printed in the May/Jun '03 Observer, pp. 18-19, was incorrect. The corrected names and omissions are as follows:

Nominated for the Barney Award, outstanding AFW field grade officer, was Maj. Jay Des Jardins, Jr. (USAFE).

Nominated for the Best Award, excellence in weather staff support – enlisted category, was Master Sgt. Brad Kellaway (PACAF).

AFCCC/DON, AFWA, Asheville, N.C., is the Merewether Award winner for most significant technical contribution.

Additional nominees for the Moorman Award, outstanding weather unit providing specialized support, were the 88th WS (AFMC) and the 614th SOPG/AWT (AFSPC).

ACA/SO Reunion

The Air Commando Association/Special Operations Annual Reunion will be held in Fort Walton Beach, Fla., Oct. 10-12, 2003. The event will highlight 42 years of Air Force Special Operations around the Globe. For more information, please call (850) 581-0099, fax 850-581-8988, e-mail aircomando@aol.com or visit the webpage at http://home.earthlink.net/~aircommando1/ for more details.

Groves received their Ph.D.s in space physics from Utah State University as part of the AFIT Civilian Institute program. They are joined by three permanent AFIT civilian faculty members – retired Lt. Cols. William Bailey and Glen Perram, and Dr. David Weeks.

As the needs of our military, and the state of space science continue to evolve, the AFIT space weather MS program must keep pace with both! On the science side, computer modeling and simulation is the key to space weather analysis and forecasting—just as in tropospheric meteorology. Needless to say, computer capabilities have exploded over the past decades, and space scientists are making full utility of this growth. AFIT has responded by creating a space weather laboratory to expose students to state-of-the-art space weather computer models. This includes models that analyze and predict space weather conditions, such as the Ionospheric Forecast Model, as well as codes that convert this scientific output to operational forecast products, namely the Operational Space Environment Network Display software suite developed by the Air Force Research Lab. On the military side of things, AFIT must ensure that its students conduct research that benefits warfighter needs as directly as possible. To that end, AFIT and XOW have recently signed a memorandum of agreement to annually collect and prioritize space weather requirements from field agencies. Student research projects are then selected from this prioritized list. In addition to their standard thesis defense activities, student research culminates with an executive-level briefing to XOW representatives. The AFIT-XOW MOA process has drawn high praise from Brig. Gen. David L. Johnson and Col. Lawrence Key in its first two years.

Recent student research projects have highlighted the breadth and depth of space weather studies vital for our support of DoD operations. In 2001, Capt. Herbert Keyser, AFWA Space Weather Operations chief, and Capt. Bradford Green completed a much-needed study of space weather data provided by Defense Meteorological Satellite Program sensors. This data will be invaluable to initialize next-generation space weather forecast models – analogous to MM5 initialization by balloon data.

This year, Capt. Jose Harris, newly arrived at AFWA, completed a ground-breaking study to enable AFW forecasters to predict environmental conditions leading to buildup of dangerous electrical charges on DoD space platforms. This year's student projects include an improvement of our ability to predict the location of the auroral regions, methods to forecast ionospheric turbulence that can garble satellite communications, and a comparative study of electric field models used as drivers for ionospheric space weather simulations.

Space weather for the warfighter is one of the most challenging areas for AFW professionals. Make no mistake, this responsibility will only continue to expand as DoD operations become increasingly dependent on space-based systems. Successful weather support for these endeavors will require the cooperation of highly skilled individuals across many agencies, and AFIT is working hard to ensure that our space weather graduates are equal to the task. As far as the mission extends, even into space, we must continually meet the challenge set before us – "Know the weather and your victory will be complete."

From left to right, Staff Sgt. Richard Heruska, Senior Master Sgt. Robert Rios, and Staff Sgt. Jason Smith, deployed in support of Operation IRAQI FREEDOM at an undisclosed location. These AFMC weather specialists from the 46th WS, Eglin AFB, Fla., were deployed to Southwest Asia in February and March 2003.

Weather Warriors

Staff Sgt. David Fischer

325th OSS, Tyndall AFB, Fla.
Mission Execution Forecaster
Years in Service: 8
Hometown: Kenosha, Wis.
Role Model / Why? President George Bush, he's a very determined individual who isn't afraid to rustle a few feathers
Hobbies: Spending time with my family and sailing
Most Memorable Air Force Weather Experience: In June of 1996 I was stationed at Dhahran, Saudi Arabia as a Weather Observer. During my shift a terrorist bombing occurred at the Khobar Towers barracks. I volunteered to go down to a local hospital to take accountability (name, rank, social security number, etc.) of all the injured U.S. personnel that were taken there. I was glad to be able to assist my fellow military members through this difficult time.

Salutes

Retirements

Col. Nathan Feldman, HQ AFWA, Offutt AFB, Neb.
Lt. Col. Robert Allen, HQ AFWA, Offutt AFB, Neb.
Lt. Col. Susan Robbins, HQ AFWA, Offutt AFB, Neb.
Maj. Thomas Coe, HQ AFWA, Offutt AFB, Neb.
Capt. Wayne Boline, HQ AFWA, Offutt AFB, Neb.
Master Sgt. Karl Lumbra, HQ AFWA, Offutt AFB, Neb.
Master Sgt. Sherry Ogren, HQ AFWA, Offutt AFB, Neb.
Master Sgt. Larry Pitsenbarger, HQ AFWA, Offutt AFB, Neb.
Master Sgt. Timothy Wert, HQ AFWA, Offutt AFB, Neb.
Tech. Sgt. Shawn Baker, HQ AFWA, Offutt AFB, Neb.
Tech. Sgt. Dana Becker, HQ AFWA, Offutt AFB, Neb.
Tech. Sgt. James Conry, HQ AFWA, Offutt AFB, Neb.
Tech. Sgt. David Dawson, 57th OSS/OSW, Nellis AFB, Nev.
Tech. Sgt. Richard Edwards, HQ AFWA, Offutt AFB, Neb.
Tech. Sgt. Christopher Lane, HQ AFWA, Offutt AFB, Neb.
Tech. Sgt. Loren Rudd, 88th WS, Wright-Patterson AFB, Ohio
Master Sgt. Cary Fitzsimmons, AFCWC, AFWA, Hurlburt Field, Fla.
Master Sgt. Karl Lumbra, HQ AFWA, Offutt AFB, Neb. (1 OLC)
Master Sgt. Andrea Preston, 204th WF, McGuire AFB, N.J. (ANG)
Master Sgt. Todd Stephenson, HQ AFWA, Offutt AFB, Neb.
Master Sgt. Bradley Wasson, 80th OSS/DOW, Sheppard AFB, Texas (1 OLC)
Tech. Sgt. Franklyn Grosso, 204th WF, McGuire AFB, N.J. (ANG)

Awards and Decorations

BRONZE STAR

Maj. Michael Van Sickle, 107th WF, Selfridge ANGB, Mich. (ANG)
Staff Sgt. Roy Lofts, 107th WF, Selfridge ANGB, Mich. (ANG)
Staff Sgt. Donald Wilhelms, 107th WF, Selfridge ANGB, Mich. (ANG)

MERITORIOUS SERVICE MEDAL

Lt.Col. Susan Robbins, HQ AFWA, Offutt AFB, Neb. (5 OLC)
Maj. Elizabeth Coates, 121st WF, Andrews AFB, Md.
Maj. Thomas Coe, HQ AFWA, Offutt AFB, Neb. (2 OLC)
Maj. Steve Gruber, 17th OWS, Hickam AFB, Hawaii
Maj. Paul Roelle, AFCCC, AFWA, Asheville, N.C.
Maj. William Tasso, HQ AMC, Scott AFB, Ill.
Capt. Darryl Leon, HQ AFWA, Offutt AFB, Neb.
Capt. Dawn Loisel, HQ AFWA, Offutt AFB, Neb.
Senior Master Sgt. Larry Williams, 110th WF, Bridgetown, Mo.
Master Sgt. Alan Doty, HQ AFWA, Offutt AFB, Neb. (1 OLC)

JOINT SERVICE COMMENDATION MEDAL

Maj. John Hogan, 107th WF, Selfridge ANGB, Mich. (ANG)
Master Sgt. Henry Christie, 107th WF, Selfridge ANGB, Mich. (ANG)

AIR FORCE COMMENDATION MEDAL

Lt. Col. David Knapp, HQ AFWA, Offutt AFB, Neb. (2 OLC)
Capt. Edward Goetz, HQ AFWA, Offutt AFB, Neb. (3 OLC)
1st Lt. Christopher Lovett, 80th OSS/DOW, Sheppard AFB, Texas
Master Sgt. Darryl Guilford, 121st WF, Andrews AFB, Md. (ANG)
Master Sgt. Timothy Wert, HQ AFWA, Offutt AFB, Neb. (5 OLC)
Tech. Sgt. Dana Becker, HQ AFWA, Offutt AFB, Neb. (4 OLC)
Tech. Sgt. James Conry, HQ AFWA, Offutt AFB, Neb. (1 OLC)
Tech. Sgt. David Dawson, 57th OSS/OSW, Nellis AFB Nev.
Tech. Sgt. Richard Edwards, HQ AFWA, Offutt AFB, Neb. (2 OLC)
Tech. Sgt. Ronald Gacke, HQ AFWA, Offutt AFB, Neb. (3 OLC)
Tech. Sgt. James Memullen, HQ AFWA, Offutt AFB, Neb. (3 OLC)
Tech. Sgt. Scott Nych, HQ AFWA, Offutt AFB, Neb. (1 OLC)
Tech. Sgt. Joseph Plante, 203rd WF, Ft. Indiantown Gap, Pa. (ANG)
Tech.Sgt. Terence Tunnes, 203rd WF, Ft. Indiantown Gap, Pa. (ANG)
Staff Sgt. Brian Aragon, 17th OWS, Hickam AFB, Hawaii
Staff Sgt. Brian Campbell, HQ AFWA, Offutt AFB, Neb.
Staff Sgt. Noel Cumberland, HQ AFWA, Offutt AFB, Neb. (1 OLC)
Staff Sgt. Timothy Dunman, HQ AFWA, Offutt AFB, Neb. (1 OLC)
Staff Sgt. Huan Duong, 57th OSS/OSW, Nellis AFB Nev.
Staff Sgt. Megan Egnew, 17th OWS, Hickam AFB, Hawaii
Staff Sgt. Steven Fisher Jr., HQ AFWA, Offutt AFB, Neb.
Staff Sgt. Roy Karkosh, 121st WF, Andrews AFB, Md. (ANG)
Staff Sgt. Shane Siebert, HQ AFWA, Offutt AFB, Neb.
Staff Sgt. Tracy Pate, HQ AFWA, Offutt AFB, Neb. (2 OLC)
Senior Airman Lalaine Flores, HQ AFWA, Offutt AFB, Neb.

ARMY COMMENDATION MEDAL

Maj. Stephen Trauth, 122nd WF, Hammond, La. (ANG)
Senior Master Sgt. Robert Gilmore, 156th WF, Charlotte, N.C. (ANG)
Master Sgt. Craig Cross, 107th WF, Selfridge ANGB, Mich. (ANG)
Master Sgt. Paul Lobre, 122nd WF, Hammond, La. (ANG)
Master Sgt. Richard Webb, 126th WF, Milwaukee, Wis. (ANG)
Tech. Sgt. Todd Fitch, 107th WF, Selfridge ANGB, Mich. (ANG)
Tech. Sgt. Dwayne Klinzman, 17th OWS, Hickam AFB, Hawaii
Tech. Sgt. Bertrand Sausse, 122nd WF, Hammond, La. (ANG)
Staff Sgt. Todd Carballo, 122nd WF, Hammond, La. (ANG)
Staff Sgt. Tijuan Smith, 107th WF, Selfridge ANGB, Mich. (ANG)
Staff Sgt. Joseph Sonier, 122nd WF, Hammond, La. (ANG)
Senior Airman Michael Desselle, 122nd WF, Hammond, La. (ANG)
Airman 1st Class Shawn Peno, 202nd WF, Otis ANGB, Mass. (ANG)

JOINT SERVICE ACHIEVEMENT MEDAL

Maj. Michael Van Sickle, 107th WF, Selfridge ANGB, Mich. (ANG)
Tech. Sgt. Greg Schmidt, 107th WF, Selfridge ANGB, Mich. (ANG)
Staff Sgt. Christina Roberts, 116th WF, Camp Murray, Wash. (ANG)

AIR FORCE ACHIEVEMENT MEDAL

Master Sgt. Robert Buhrts, 164th WF, Columbus, Ohio (ANG)
Tech. Sgt. Kayne Smith, HQ AFWA, Offutt AFB, Neb.
Tech. Sgt. Robert Sugden, HQ AFWA, Offutt AFB, Neb. (2OLC)
Tech. Sgt. Teddy Wykle Jr., HQ AFWA, Offutt AFB, Neb. (2OLC)
Staff Sgt. Steven Baldinger, HQ AFWA, Offutt AFB, Neb. (1OLC)
Staff Sgt. Huan Duong, 57th OSS/OSW, Nellis AFB Nev.
Senior Airman John Holmes, 121st WF, Andrews AFB, Md. (ANG)
Staff Sgt. Earl Stoll, HQ AFWA, Offutt AFB, Neb. (1OLC)
Staff Sgt. Brian Tulaba, HQ AFWA, Offutt AFB, Neb. (1OLC)
Staff Sgt. Christopher Watkins, HQ AFWA, Offutt AFB, Neb. (1OLC)
Senior Airman Jameel Beasley, 17th OWS, Hickam AFB, Hawaii
Senior Airman Lucas Menebroker, 17th OWS, Hickam AFB, Hawaii
Senior Airman Brooke Saltsman, 17th OWS, Hickam AFB, Hawaii
Senior Airman Ryan Trickey, 17th OWS, Hickam AFB, Hawaii
Airman 1st Class Aaron Hedstrom, 26th OWS, Barksdale AFB, La.
Airman 1st Class Joshua Newport, HQ AFWA, Offutt AFB, Neb.

COMBAT READINESS MEDAL

Lt. Col. Christopher Strager, 146th WF, Coraopolis, Pa. (1OLC) (ANG)
Capt. Michael Graf, 146th WF, Coraopolis, Pa. (1OLC) (ANG)
1st Lt. Balentina McNamara, 146th WF, Coraopolis, Pa. (1OLC) (ANG)
Chief Master Sgt. Forrest Hendricks, 146th WF, Coraopolis, Pa. (1OLC) (ANG)
Master Sgt. Michael Gardner, 146th WF, Coraopolis, Pa. (1OCL) (ANG)
Master Sgt. James Malia, 146th WF, Coraopolis, Pa. (1OLC) (ANG)
Master Sgt. David Tucker, 146th WF, Coraopolis, Pa. (1OLC) (ANG)
Tech. Sgt. Clayton Eyler, 146th WF, Coraopolis, Pa. (1OLC) (ANG)
Tech. Sgt. John Tunney, 146th WF, Coraopolis, Pa. (1OLC) (ANG)
Staff Sgt. Robert Beveridge, 146th WF, Coraopolis, Pa. (1OLC) (ANG)
Staff Sgt. Michael Gaither, 146th WF, Coraopolis, Pa. (ANG)

HQ USAF/DP PERSONNEL SPECIALIST OF THE YEAR

Senior Airman LaLaine Flores, HQ AFWA, Offutt AFB, Neb.

STATE OF MARYLAND DISTINGUISHED SERVICE CROSS

Lt. Col. Blaine Tsugawa, 104th WF, Camp Fretterd, Md. (ANG)

PENSYLVANIA COMMENDATION MEDAL

Tech. Sgt. Clayton Eyler, 146th WF, Coraopolis, Pa. (ANG)

NORTH CAROLINA COMMENDATION MEDAL

Tech. Sgt. Michael Laney, 156th WF, Charlotte, N.C. (ANG)

INDIANA COMMENDATION MEDAL

Staff Sgt. John Rutledge Jr., 207th WF, Indianapolis, Ind. (ANG)

Education

WEATHER OFFICER'S COURSE

2nd Lt. Kimberly Marwick, 80th OSS/DOW, Sheppard AFB, Texas
2nd Lt. Annette Parsons, 26th OWS, Barksdale AFB, La.

WEATHER CRAFTMAN'S COURSE

Tech. Sgt. John Battig Jr., 72nd OSS/OSW, Tinker AFB,Okla.

Tech. Sgt. Monica Kannady, 120th WF, Buckley AFB, Colo. (ANG)
Staff Sgt. Estelpaw Allen, 436th OSS/OSW, Dover AFB, Del.
Staff Sgt. Rex Ames Jr., 92nd OSS/OSW, Fairchild AFB, Wash.
Staff Sgt. Eric Andrews, 20th OWS, Yokota AB, Japan
Staff Sgt. Shaun Autry, 20th OWS, Yokota AB, Japan
Staff Sgt. William Bagley, 111th WF, Ellington Field, Texas (ANG)
Staff Sgt. Stoney Bair, 7th OSS/OSW, Dyess AFB, Texas
Staff Sgt. Lisa Blackwell, 18th WS/BWS, Ft. Bragg, N.C.
Staff Sgt. Deidra Brown, 78th OSS/OSW, Robins AFB, Ga.
Staff Sgt. James Brown, 75th OSS/OSW, Hill AFB, Utah
Staff Sgt. Jana Brown, 89th OSS/OSW, Andrews AFB, Md.
Staff Sgt. Juan Burciaga, HQ AFWA, Offutt AFB, Neb.
Staff Sgt. Barney Burr, 21st ASOS, Ft. Polk, La.
Staff Sgt. Jamie Ceier, 20th OSS, Shaw AFB, S.C.
Staff Sgt. Burton Conner II, 6th WF, Ft. Rucker, Ala.
Staff Sgt. Carlos Coronado, 210th WF, March ARB, Calif. (ANG)
Staff Sgt. William Everett, 11th OWS, Elmendorf AFB, Alaska
Staff Sgt. James Funkhouser, 366th OSS/OSW, Mountain Home AFB, Idaho
Staff Sgt. Christopher Gilbert, 15th ASOS, Ft. Stewart, Ga.
Staff Sgt. Felicia Godley, 60th OSS/OSW, Travis AFB, Calif.
Staff Sgt. Derek Gosney, 57th OSS/OSW, Nellis AFB Nev.
Staff Sgt. Christina Guides, 204th WF, McGuire AFB, N.J. (ANG)
Staff Sgt. Rodney Hattery, HQ AFWA, Offutt AFB, Neb.
Staff Sgt. James Hicks, 89th OSS/OSW, Andrews AFB, Md.
Staff Sgt. Margit Howard, 6th OSS/OSW, MacDill AFB, Fla.
Staff Sgt. Andrew Kowal, 436th OSS/OSW, Dover AFB, Del.
Staff Sgt. Mitchell Lorentz, 6th WF, Ft. Rucker, Ala.
Staff Sgt. Cade Mayer, 72nd OSS/OSW, Tinker AFB, Okla.
Staff Sgt. Donald Odom, 28th OWS, Shaw AFB, S.C.
Staff Sgt. Kenneth Roberts Jr., 6th OSS, MacDill AFB, Fla.
Staff Sgt. Anthony Roles, 314th OSS/OSW, Little Rock AFB, Ark.
Staff Sgt. Tina Rose, 3rd OSS, Elmendorf AFB, Alaska
Staff Sgt. Emili Sadler, 49th OSS/OSW, Holloman AFB, N.M.
Staff Sgt. Jill Schweigert, 57th OSS/OSW, Nellis AFB, Nev.
Staff Sgt. Lakesha Sewell, 78th OSS/OSW, Robins AFB, Ga.
Staff Sgt. Mark Smith, 18th WS/BWS, Ft. Bragg, N.C.
Staff Sgt. Tori Temple, 354th OSS/OSW, Eielson AFB, Alaska
Staff Sgt. Benjamin Tusha, 31st OSS/OSW, Aviano AB, Italy
Staff Sgt. Daravanh Vongsouvanh-Myers, 90th OSS/OSW, F.E. Warren AFB, Wyo.

FORECASTER COURSE

Master Sgt. Daniel Gaona, Seattle, Wash.
Staff Sgt. Yong Kim, 375th OSS/OSW, Scott AFB, Ill.
Staff Sgt. Fernando Ortega, HQ AFWA, Offutt AFB, Neb.
Staff Sgt. John Rivera, 47th OSS/OSW, Laughlin AFB, Texas
Staff Sgt. Amber Ruiz, 20th ASOS, Ft. Drum AIN, N.Y.
Staff Sgt. Tonya Trythall, 97th OSS/OSW, Altus AFB, Okla.
Senior Airman Tamara Aldrich, 21st OSS/OSW, Peterson AFB, Colo.
Senior Airman Bobby Baum, 46th WS, Eglin AFB, Fla.
Senior Airman Douglas Bunn Jr., 18th WS/BWS, Ft. Bragg, N.C.
Senior Airman Charles Doss, 56th OSS/OSW, Luke AFB, Ariz.
Senior Airman Catherine Lee, 305th OSS/OSW, McGuire AFB, N.J.
Senior Airman Gerber Lopez, 16th OSS/DOW, Hurlbert Field, Fla.
Senior Airman Matthew Mitchell, 45th WS, Patrick AFB, Fla.
Senior Airman Michelle Robertson, HQ AFWA, Offutt AFB, Neb.
Senior Airman Yaphet Rodriguez, Det. 1, 18th WS, Ft. Eustis, Va.
Senior Airman Randolph Rundio Jr., HQ AFWA, Offutt AFB, Neb.
Senior Airman Mitchell Westlund, 46th WS, Eglin AFB, Fla.
Senior Airman Corey Worster, 81st OSF/OSW, Keesler AFB, Miss.

WEATHER FORECASTER APPRENTICE COURSE

Tech. Sgt. Michael McGann, 107th WF, Selfridge ANGB, Mich. (ANG)
Tech. Sgt. Richard Rohde, 28th OWS, Shaw AFB, S.C.
Airman 1st Class Crystal Andito, 15th OWS, Scott AFB, Ill.
Airman 1st Class Antwione Canada, 28th OWS, Shaw AFB, S.C.
Airman 1st Class Donna Cannon, 28th OWS, Shaw AFB, S.C.
Airman 1st Class James Carpenter, 192nd FW, Richmond, Va. (ANG)
Airman 1st Class Robert Curry, USAFE OWS, Sembach AB, Germany
Airman 1st Class Jamie Dickinson, 25th OWS, Davis-Monthan AFB, Ariz.
Airman 1st Class Nathan Fried, 28th OWS, Shaw AFB, S.C.
Airman 1st Class Danielle Garcia, 25th OWS Davis-Monthan AFB, Ariz.
Airman 1st Class Scott Hamrick, 15th OWS, Scott AFB, Ill.
Airman 1st Class Glenn Harrison, 15th OWS, Scott AFB, Ill.
Airman 1st Class Brian Holland, 25th OWS Davis-Monthan AFB, Ariz.
Airman 1st Class Scott Horn, 15th OWS Davis-Monthan AFB, Ariz.
Airman 1st Class Eli Hoven, 15th OWS, Scott AFB, Ill.
Airman 1st Class Dominic Martin, 15th OWS, Scott AFB, Ill.
Airman 1st Class Matthew Mattern, 25th OWS, Davis-Monthan AFB, Ariz.
Airman 1st Class Kimberly Phillips, 28th OWS Shaw AFB, S.C.
Airman 1st Class Michelle Schluter, 20th OWS Yokota AB, Japan
Airman 1st Class Richard Skelly, 15th OWS, Scott AFB, Ill.
Airman 1st Class Jordan Slocum, 25th OWS Davis-Monthan AFB, Ariz.
Airman 1st Class Ryan Snider, USAFE OWS, Sembach AB, Germany
Airman 1st Class Bailey Teske, 127th WF Topeka, Kan. (ANG)
Airman 1st Class Dylan Tucker, 28th OWS, Shaw AFB, S.C.
Airman 1st Class Joshua Uhl, 20th OWS, Yakota AB, Japan
Airman 1st Class Christopher Walters, 25th OWS, Davis Monthan AFB, Ariz.
Airman Kevin Bell, 15th OWS, Scott AFB, Ill.
Airman Daniel Buckley, 25th OWS, Davis-Monthan AFB, Ariz.
Airman Matthew Currier, 15th OWS, Scott AFB, Ill.
Airman Steven Lowry, 26th Barksdale AFB, La.
Airman Amber Moosly, 28th OWS, Shaw AFB, S.C.
Airman William Montgomery, 25th OWS, Davis-Monthan AFB, Ariz.
Airman Travis Smiley, USAFE OWS, Sembach AB, Germany
Airman Jeremy Whitford, 28th OWS, Shaw AFB, S.C.
Airman John Zie, 25th OWS, Davis-Monthan AFB, Ariz.
Airman Basic Emily Kuss, 25th OWS, Davis-Monthan AFB, Ariz.
Airman Basic Danielle Laney, 28th OWS, Shaw AFB, S.C.

COMBAT WEATHER TEAM OPERATIONS COURSE

2nd Lt. Bradley Harbaugh, 26th OWS, Barksdale AFB, La.
Staff Sgt. Warren Hines, 15th OWS, Scott AFB, Ill.
Staff Sgt. James Melton, 26th OWS, Barksdale AFB, La.
Staff Sgt. Chad Quin, 8th OSS/OSW, Kunsan AB, Korea
Staff Sgt. James Shryock, Det. 2, 607th WS, Camp Humphreys, Korea
Staff Sgt. Travis Wooten, 607th WS, Yongsan AIN, Korea
Senior Airman Amy Alcorn, 26th OWS, Barksdale AFB, La.
Senior Airman Brandon Bartley, 26th OWS, Barksdale AFB, La.
Senior Airman Amanda Burrows, HQ AFWA, Offutt AFB, Neb.
Senior Airman Shannon Byers, OL-C, Det. 1, 607th WS, Camp Stanton Korea
Senior Airman Christopher Morales, 26th OWS, Barksdale AFB, La.
Senior Airman Monica Reddin, 19th ASOS, Ft. Campbell, Ky.
Senior Airman Brian Smith, Det. 2, 607th WS, Camp Humphreys, Korea
Senior Airman Kimberly Whitt, 26th OWS, Barksdale AFB, La.
Airman 1st Class Matthew Stroud, 19th ASOS, Ft. Campbell, Ky.
Airman 1st Class Brandy Tamplain, 26th OWS, Barksdale AFB, La.

SENIOR NCO ACADEMY

Master Sergeant Stephen McElroy, HQ AFWA, Offutt AFB, Neb. (Distinguished Graduate)

NCO ACADEMY

Tech. Sgt. James Barton, 26th OWS, Barksdale AFB, La.
Tech. Sgt. Duke Fahey, 26th OWS, Barksdale AFB, La.
Tech. Sgt. Michael Gilbert, Det. 2, 10th CWS, Ft. Campbell Ky.

AIRMAN LEADERSHIP SCHOOL

Staff Sgt. Joseph Andava, 57th OSS/OSW, Nellis AFB Nev.
Staff Sgt. Johnny Flores, 80th OSS/DOW, Sheppard AFB, Texas
Staff Sgt. Ryan Glidden, 80th OSS/DOW, Sheppard AFB, Texas
Staff Sgt. Natalie Roberts, 57th OSS/OSW, Nellis AFB Nev.
Staff Sgt. Jonathan White, 26th OWS, Barksdale AFB, La.
Senior Airman Duane Holt, HQ AFWA, Offutt AFB, Neb. (Distinguished Graduate)
Senior Airman Brandi Lorenzen, Det. 2, AFWA, Sagamore Hill, Mass. (Levitow Award)
Senior Airman Phillip Mohr, 56th OSS/OSW Luke AFB, Ariz.
Senior Airman James Rafiner, 56th OSS/OSW Luke AFB, Ariz.

NTFS MANAGERS COURSE

James Buckles, 62nd OSS/OSW, McChord AFB, Wash.
1st Lt. Christopher Lovett, 80th OSS/DOW, Sheppard AFB, Texas
2nd Lt. Paul Koecher, 11th OWS, Elmendorf AFB, Alaska
2nd Lt. Kimberly Matwick, 80th OSS/DOW, Sheppard AFB, Texas
Master Sgt. Michael Chandler, 80th OSS/DOW, Sheppard AFB, Texas
Staff Sgt. Johnny Flores, 80th OSS/DOW, Sheppard AFB, Texas
Staff Sgt. Derek Gosney, 57th OSS/OSW, Nellis AFB, Nev.
Staff Sgt. Kenneth Lester Jr., OL-A, 374th OSS, Camp Zama, Japan
Staff Sgt. Michael Rosales, 75th OSS/OSW, Hill AFB, Utah
Senior Airman Erika Bentler, 11th OWS/DOO, Elmendorf AFB, Alaska
Senior Airman Joshua Rosenberg, 20th ASOS/E Flight, Fort Drum, N.Y.
Senior Airman Kari Shannonhouse, 347th OSS/OSW, Moody AFB, Ga.
Senior Airman Jillian Weinman, 80th OSS/DOW, Sheppard AFB, Texas

ANG Promotions

Promotion to Lieutenant Colonel

Thomas May, 199th WF, Wheeler AAF, Hawaii

Promotion to Major

Matthew Doggett, 123rd WF, Portland, Ore.

Promotion to Senior Master Sergeant

George Hathaway, 140th WF, Willow Grove ARS, Pa.
Vince Delaney, 207th WF, Indianapolis, Ind.

Promotion to Technical Sergeant

Carlos Coronado, 195th WF, Channel Islands ANGS, Calif.
Mark Herrett, 104th WF, Camp Fretterd, Md.
Johnny Hobbs, 164th WF, Columbus, Ohio
Michael Petticord, 123rd WF, Portland, Ore.
Donald Wilhelm, 107th WF, Selfridge ANGB, Mich.