

ARMOR & MOBILITY

July/August 2019
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BALANCING MODERN FLEET SUSTAINMENT

COMMANDER'S CORNER



Gen. Arnold W. Bunch Jr.
Commander
Air Force Materiel Command



Gen. Maryanne Miller
Commander
Air Mobility
Command
Scott AFB, IL



Lt. Gen. Gene Kirkland
Commander
Air Force
Sustainment Center
Tinker AFB, OK

- Air Drop and Engine Handling Upgrades
- Advanced Tech and Training Center
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REVITALIZING LEGACY

The U.S. Air Force's Air Mobility Command, led by Commanding General Maryanne Miller, is working to modernize airdrop and engine ground handling capabilities for its C-17 and C-130 fleets.

By Christian Sheehy

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Commander
U.S. Air Force Materiel Command



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By Jerry Zamora and Mike Graham



Tapping Mission Energy Potential

The U.S. Air Force Petroleum Office (AFPET) is collaborating with DLA Energy to bring advances in fuel alternatives and energy maximization to the field.

By Col. Phillip Noltemeyer

Cover: Capt. Christian Picotte (left) and Maj. Lamb, C-17 Globemaster III pilots assigned to the 816th Expeditionary Airlift Squadron, transport troops and equipment between forward operating locations in USCENTCOM area of responsibility. The C-17 is not only proficient in transport of troops and cargo but can perform tactical airlifts, airdrops, and medical evacuations. (U.S. Air National Guard photo by Staff Sgt. Patrick Evenson)

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INSIGHTS

With the truly global nature of the U.S. Defense Department's mission, the United States Air Force (USAF) exemplifies the objectives of worldwide service. As a purveyor of materiel from combat equipment to medical supplies to food, USAF sustains the fight from start to finish. From wartime to humanitarian crisis, the Air Force is called upon to respond with urgency.

The July/Aug issue of *Armor & Mobility* pays special attention to the unique challenges that our Airmen face. In an exclusive interview with Gen. Arnold Bunch, Commander, Air Force Materiel Command (AFMC), we get some keen insight into the myriad responsibilities AFMC has from next-generation capabilities to sustaining legacy systems. Much of what DoD relies on today can be called "legacy", or tried and true. Though long proven reliable, legacy equipment, in many cases, is not keeping pace with the evolution of technology, and in some cases, is no longer even compatible with newer capabilities. Centers of development such as USAF's newest Advanced Technology and Training Center (ATTC), recently stood up in Pittsburgh, PA, are pushing cutting-edge capabilities development, putting pressure on legacy to adapt or retire. The Air Force and Joint Services face diminishing manufacturing sources and material shortages (DMSMS) resulting in issues of added cost and extended lead times in achieving readiness.

Sustainment is perhaps the word that best describes DoD's current critical mission. As USAF challenges in maintaining dominance of the skies continue to present, the Air Force Sustainment Center (AFSC), led by Lt. Gen. Gene Kirkland, is simply asked to sustain weapon system readiness to generate continued airpower for the protection of U.S. global interests. From components to fuel to logistics, AFSC is at the tip of the airborne spear when it comes to sustaining the world's premier fleet of military aircraft and related systems. Without sustainment there is no readiness just as without mobility there is no power projection. In an interview with Gen. Maryanne Miller, Commander, Air Mobility Command (AMC), we learn about the growing demand for rapid global mobility as pertains to assets, capabilities, and most importantly people, whether in combat or humanitarian situations. Enabling this mobility is USAF's aerial transport fleet including its C-17 Globemaster and C-130 Hercules airframes. With both at critical junctures in service life, decisions regarding investment in needed upgrades are likely to come soon.

Of course, without the fuel to power the mission, there is no mission. The Air Force Petroleum Office, led by Col. Phillip Noltemeyer, is at the forefront of fuels development and energy alternatives for an evolving future fleet. Coupled with the asset movement solutions that U.S. Transportation Command provides and the power solutions of DLA Energy, all of the above is more achievable.

We welcome your comments and thank you for the continued readership!

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C-17: REVITALIZING LEGACY

The U.S. Air Force is at a crossroads in deciding to reinvest in its long-proven air transport workhorse, the C-17 Globemaster.

By Christian Sheehy, A&M Editor



A C-17 Globemaster III sits on the flight line at Dover Air Force Base, DE. The 436th Airlift Wing at Dover houses, maintains and operates the C-5M Super Galaxy and C-17 Globemaster III. (U.S. Air Force photo by Senior Airman Christopher Quail)

The Boeing C-17 Globemaster III military airlift aircraft is a high-wing, four-engine, T-tailed military transport vehicle capable of carrying payloads up to 169,000lb (76,657kg). It has an international range and the ability to land on small airfields. A fully integrated electronic cockpit and advanced cargo system allows a crew of three (the pilot, co-pilot and loadmaster) to operate all systems on any type of mission.

The C-17 has proven to be a reliable flyer, with a mission capable rate of around 83%. Gen. Maryanne Miller, Commander, Air Mobility Command, Scott AFB, noted that with the Air Force plans to boost its total aircraft inventory, it is possible that there may be a need for additional C-17s. USAF is working to determine what mix of aircraft is needed to get to the 386-squadron goal.



Gen. Maryanne Miller

With the anticipated addition of three new C-17 Globemaster III squadrons and the cutting of two C-130 Hercules squadrons, Miller projects that the total number of airlift squadrons in airlift inventory would be up to 54.

SOFTWARE UPGRADE

U.S. Air Force Air Mobility Command (AMC) is currently modernizing the Consolidated Airdrop Tool (CAT) for its C-17 and C-130 fleets. CAT development efforts are designed to improve the accuracy, speed and safety of AMC's high-altitude precision airdrops tailored to the specific requirements of the C-17 and C-130 aircraft. CAT will support military airdrop missions of all types around the globe. The Air Force

chose the Tapestry/Boeing team to lead the CAT development effort under a Mission Planning Enterprise Contract II (MPEC II) delivery order valued at \$26 million. The contract calls for the enhancement of CAT versions over a four-year period utilizing the agile development methodology. The final delivery of primary capabilities is projected for September 2020.

CAT software enables mobility airmen to calculate and plot both conventional and precision airdrop solutions to accurately deliver supplies in remote, austere environments. The software is the mission planning and execution component of the Joint Precision Airdrop System (JPADS) – a key aerial delivery capability for the U.S. military. JPADS uses GPS-guidance systems, steerable parachutes and an onboard computer to steer the loads to a single designated drop zone. It enables the cargo to be released from multiple points to reduce the risk of enemy fire, taking into account factors such as weather, terrain, aircraft capabilities and threats. JPADS includes a dropsonde, a type of probe that's dropped prior to the cargo to measure wind conditions. CAT receives this data inflight on a laptop, and runs aircraft performance and weather algorithms to determine the best point of release.

Whether their dropping beans or bullets, mobility airmen have always faced uncertainty with precision airdrops. Oftentimes, aircrews only get one pass to make a drop, and there's a lot that can go wrong. They must consider wind velocity, air pressure, payload mass and parachute drag, all of which can make or break an airdrop mission. Thus, CAT development efforts will reduce



Airmen from the 62nd Airlift Wing successfully completed the first continental C-17 Globemaster III Joint Precision Airdrop System, or JPADS, airdrop during routine training by dropping two bundles equaling 2,900 pounds at Yakima Training Center, WA. (U.S. Air Force photo)

uncertainty through advanced data and analytics. In addition to improving accuracy, the development efforts will provide greater automation inflight and workflow enhancements, including touch-screen capability utilizing Windows 10. This will minimize distractions

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Airmen from the 62nd Airlift Wing successfully completed the first continental C-17 Globemaster III Joint Precision Airdrop System, or JPADS, airdrop during routine training by dropping two bundles equaling 2,900 pounds at Yakima Training Center, WA. Traditional airdrops by Air Force airlifters are at altitudes of anywhere between 400 and 1,000 feet. With JPADS, aircraft have the potential to guide air drop bundles from as high as 25,000 feet. (U.S. Air Force photo/Airman 1st Class Leah Young)

caused by flight tasks in the cockpit, so aircrews can concentrate on the mission at hand.

Other improvements on the horizon include advanced algorithms for hazard/obstruction avoidance, weather assimilation capabilities and airdrop damage estimation. Support for newer parachute systems and configurations is in the works, along with software upgrades that would allow aircrews to drop heavier loads in higher altitudes to avoid threats on the ground.

CAT v6.1 is scheduled for delivery in August 2019 with fielding in December 2019. Future iterations will be delivered leveraging a full agile approach, allowing for continuous advancement of capabilities and immediate feedback from stakeholders each step of the way.

ENGINE GROUND HANDLING

This past June, the Air Force awarded D&D Machinery a \$8.9 million contract for the C-17 Globemaster program. The deal is for the Aircraft Engine Ground Handling Trailer, which is required to incorporate I-beam rails to interface with the rollers on the engine cradle. The C-17 is a high-wing, four-engine, T-tailed transport aircraft, that can carry large equipment, supplies and troops directly to small airfields in harsh terrain. The estimated total cost over the lifetime of the aircraft's program is \$328 million to \$368 million.

Work under the contract will take place in San Antonio, TX, and has a scheduled completion date of September 18, 2023.

LOOKING OUT

The Air Force is presently looking to increase its aircraft squadrons by 14 by the year 2030. The Service is in initial discussion with Congress regarding concept and funding needs. It's unclear what other options would exist to increase the number of C-17 squadrons aside from restarting the production line. The Air Force currently operates 222 C-17s, but began retiring some of the oldest Globemaster IIIs in 2012. It may be possible that those C-17s could be taken out of storage and revitalized.

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A robotic laser coating removal system at Hill Air Force Base. (AFLCMC)

ENABLING NEXT-GENERATION AEROSPACE DEVELOPMENT

The U.S. Air Force has stood up a third Advanced Technology and Training Center (ATTC) to promote artificial intelligence and autonomous capabilities evolution.

By Ms. Debora Naguy, ATTC Director

This past April, the U.S. Air Force officially opened the third Advanced Technology and Training Center (ATTC). The focus of the new ATTC is on advancements in robotics and artificial intelligence (AI) for the United States Air Force. The ribbon-cutting ceremony opened with remarks from Dr. William Roper, Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics and Lieutenant General Robert McMurtry, Commander, Air Force Life Cycle Management Center (AFLCMC) followed by a facility open house and reception.



Ms. Debora Naguy

The Advanced Technology and Training Center, located in Pittsburgh, PA, (ATTC-PITT) was selected as the location for the third ATTC stand-up because Pittsburgh is a recognized city for robotics and AI advancements. By locating the ATTC-PITT in the center of it all, the USAF can effectively leverage and expedite adoption of information age solutions. ATTC-PITT operates out of a 12,500 square-foot contracted facility space, enabling the right opportunities for collaboration between academia, industry, research, and the Air Force maintenance community.

GROWING INDUSTRIAL BASE

Pittsburgh is advancing in the industry of robotics, AI, and machine learning. Major companies such as, Google, Apple, Amazon, Disney, Bosch, Ford, Uber, GE, and Facebook are all present in Pittsburgh to leverage the robotic and AI research and development.

There are 33 regional colleges and universities, including Carnegie Mellon University, University of Pittsburgh, Penn State, and Robert Morris providing a very high concentration of quality talent.

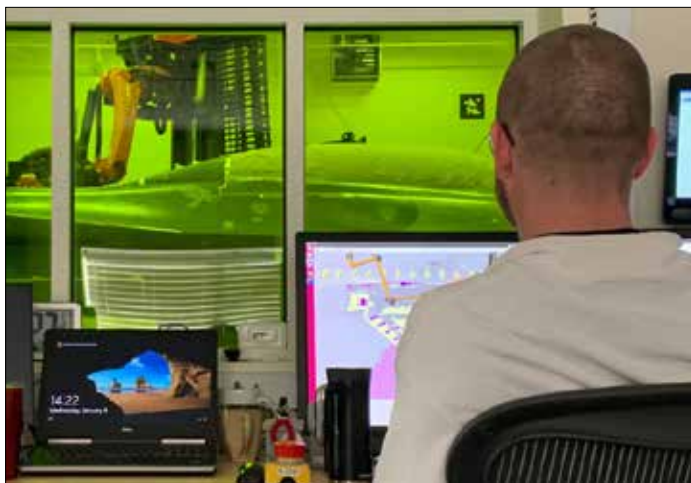
Carnegie Mellon University is a powerhouse in the fields of Robotics and AI, offering the first Ph.D. in Robotics and undergraduate degree in AI, and consistently ranks as a top school for computer science and engineering.

Beyond Pittsburgh's higher education organizations, the region has a motivated support network to fuel the growth of its high-tech startup community, with organizations like Innovation Works and the Richard King Mellon Foundation. Pittsburgh also has an active Technology Council, fostering a successful "incubator" environment.

Two Pittsburgh-based small businesses operate the ATTC-PITT under the guidance of Air Force Life Cycle Management Center, Product Support Engineering Division (AFLCMC/EZP). Titan Robotics, Inc. is closely tied to Carnegie Mellon University and has received an Edison Award and Department of Defense Great Idea Award for innovative automation with aircraft coating removal. PavCon, LLC is a key player in laying the foundation for the Air Force Condition Based Maintenance Plus (CBM+) program using machine learning and AI to predict component failure before affecting the mission. ATTC-PITT is equipped to deliver next-generation maintenance and sustainment solutions to the USAF. The ATTC team is dedicated to developing these technologies and deploying the solutions across the enterprise.

BUILDING ON PROVEN CAPABILITY

The first ATTC was established in 2017 in Dayton, OH with a focus on collaboration, innovation, and hands-on training. Due to the success of this ATTC, a second ATTC was established in Middle Georgia near



A robotic technician monitoring laser de-painting work at an Air Force facility. (AFLCMC)

Robins Air Force Base in October 2018. These ATTCs are focused on additive manufacturing, cold spray, corrosion prevention and control and laser de-paint and are strategically located near centers of engineering excellence. Both facilities perform testing, validation/verification and qualification while working in coordination with Air Force end users. The team is preparing for the stand-up of a fourth ATTC near Hill AFB, Utah that is focused on agile manufacturing and composite repair. This ATTC will be a joint effort between AFLCMC/EZP and the Air Force Sustainment Center's RAPTOR.

The Air Force came of age in the mid-1900s as the United States transformed from the industrial age. Today, the information age is revolutionizing every facet of business and military operations. With this metamorphosis, the Air Force has become "data-rich." The value of this data is limited without Subject Matter Expert (SME) insight. Once aggregated, the data can be transformed into information for use in Air Force decisions, ranging from senior leader dashboards, Major Command (MAJCOM) reviews, engineering review and assessment, supply forecasts, and maintainer guidance and feedback. Today, the Air Force Life Cycle Management Center, Product Support Engineering Division (AFLCMC/EZP) is executing this transformation with the implementation of Condition Based Maintenance Plus (CBM+). It is the automation of this data analysis that is supported through machine learning and Artificial Intelligence (AI).

As noted in the 2018 Department of Defense Artificial Intelligence Strategy, AI is the ability of machines to perform tasks that normally require human intelligence, such as recognizing patterns, learning from experience, drawing conclusions, making predictions, or taking action. In the age of machine learning, AI is ubiquitously reinventing the business model, and the AF is adopting AI to create a smarter, more lethal force.

CONDITION-BASED MAINTENANCE PLUS

The U.S. Air Force is using the latest in condition-based maintenance (CBM+), a holistic methodology that utilizes data to help maintainers, logisticians, and engineers making proactive, knowledge-based decisions. Successfully implemented, CBM+ will greatly reduce and eventually eliminate unscheduled maintenance, facilitate digital flight line requirements, streamline maintenance operations into efficient human-centered processes, enhance engineering effectiveness, optimize supply chain support, and improve asset generation and fleet awareness. The overarching goal is to ensure

agility and flexibility for the Warfighter. The CBM+ program is creating a cloud-based data ecosystem to provide the Air Force access to its own data.

CBM+ is not just one tool or process; it is an integration of procedural and technical tools and processes that work together to provide a unique and optimized solution for each weapon system platform. This suite of solutions includes hardware, software, and communications tools that offer big data analytics and AI in a cloud-based environment, and predictive maintenance monitoring (diagnostics and prognostics) with an interactive maintenance interface to harness the power of data.

CBM+, at its core, revolves around data, and the types of data available, dictate the CBM+ pathway(s) that can be executed. CBM+ has two distinct pathways, including predictive algorithms and enhanced Reliability Centered Maintenance (eRCM), respectively. Predictive algorithms are derived from on-board diagnostic data and/or flight data recorder files to make health-based, on-condition maintenance recommendations

Within the CBM+ cloud, data is enriched into a usable format and analyzed through cluster computing resources to identify statistically significant events. The development of these events establishes thresholds by which an "algorithm" can be formed and applied to future data sets to identify anomalies, or potential, impending failures of components. To develop a predictive algorithm for a component or sub-system, there must be accessible, on-board flight data through a network of sensors or data recorders. In-flight data may include component position, temperature, and pressure that can be analyzed for behavior trends to identify failures.

Maintenance narratives are key to understanding when and if failures occurred. Maintenance data is then cross-checked against the on-board data. A review of new flight data can reveal the need for component removal or repair, thereby preventing the potential for mission aborts or delays. eRCM utilizes maintenance and aircraft usage data to forecast remaining component life. It merges maintenance data with flight hour data to produce a failure distribution and recommended maintenance window before a part will fail. These eRCM forecasts support the schedule and performance of maintenance at the time and place when it is most advantageous to the Air Force mission. The tools used for these CBM+ pathways are part of the CBM+ Toolbox that support standardization and automation of forecast processes and predictive maintenance alert reviews.

Machine learning and AI have become key players with the automation of new data ingestion and predictive algorithms updates and eRCM forecasts. As an AI-enabled capability, CBM+ is predicting failures of critical components before they occur and suggesting maintenance before failure and feeding this information to Air Force Supply for spare part forecasting. This increases the bandwidth of the CBM+ team to on-board new algorithms and weapon systems. As the models evolve, the Air Force will realize benefits through increased mission effectiveness, increased aircraft availability, and reduced life cycle costs. CBM+ and AI will continue to expand and automate as the pathway for this foundational process is laid for the Air Force enterprise, led by AFLCMC/EZP.

AUTOMATION AND ROBOTICS

The new era of advanced computing, robotic capabilities, laser optics and sensors has allowed for a revolution in the aircraft

maintenance world. The Air Force has been investigating alternate methods of coating removal for the outer mold line of aircraft for decades. The original process utilizes harsh chemical solvents and produces millions of gallons of contaminated waste water. An alternative, media blasting, has been implemented for some aircraft but still produces large amounts of hazardous waste. The robotic laser method uses a thermal degradation process to remove coating minimizing waste while also removing the technician from the hazardous environment.

For several years, Air Force Life Cycle Management Center's Product Support Engineering Division (AFLCMC/EZP) has led the charge on reducing flow days and minimizing human exposure to hazardous waste by utilizing the latest technology in robotics and lasers. The team is working to find solutions and effective recipes to remove coatings in a clean environment.

In 2017, AFLCMC/EZP obtained airworthiness certification of the Robotic Laser Coating Removal System (RLCRS) for use on common aerospace materials. This mobile robotic system is currently in use at Hill AFB Utah where it uses a 6 kilowatt continuous wave fiber laser to de-paint F-16 aircraft. This robotic laser system automatically scans the aircraft and de-paints with little user interaction required. Two technicians are in a control booth out of harm's way from hazardous material byproducts as those are vacuumed up by the system. The waste generated is roughly equivalent to a bag of sugar as opposed to the large fifty-five gallon drums that hold the media blast waste by-product. Flow days for the maintenance cycle of the aircraft have also been reduced as compared to our full media blast process. Through the RLCRS, the depot has been able to return aircraft back to mission-ready status for the warfighter at an increased rate. Efforts to scale-up and improve the laser to a more powerful 12 kilowatt continuous wave system are currently underway for the RLCRS. The target is being able to remove all Air Force coatings used on aircraft across all substrates.

Another area of focus for the Air Force is implementing a robotic paint solution. The advantages of implementing a robotic paint solution are very similar to the benefits of the RLCRS including reducing flow days and minimizing human exposure to hazardous

waste. A robotic solution would reduce human variation in the paint process to ensure the proper amount of paint is applied. Implementing a robotic paint solution will save costs by streamlining the number of laborers required, reduce the time necessary to paint, and provide efficiencies in the paint process.

The team is working on developing a robotic laser de-paint system to remove belly tape and paint from the underbelly of the C-130. The current process of removing the protective belly tape under the C-130 weapon system is time-consuming, labor intensive, and requires the use of hazardous chemicals. By addressing a difficult area of coating removal for the depot, the system will reduce the total downtime and allow for parallel sustainment activity. Follow-on efforts will include a full C-130 robotic de-paint system.

There are many positive attributes regarding automation capabilities: improved environmental impact, increased workplace safety, and saving millions of taxpayer dollars for sustainment of our aircraft. However, the most important attribute is our ability to provide increased mission readiness. Returning our aircraft into service more quickly increases our strategic capabilities and better equips our Airmen. ■

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LEVERAGING PROCESS TO AVOID OBSOLESCENCE

The U.S. Air Force continues to grapple with the reality that airframe sustainment is multi-layered and equipment aging waits for no mission.

By Jerry Zamora and Mike Graham, DMSMS Policy & Training Program



Staff Sgt. Daniel Gallentine, 20th Component Maintenance Squadron jet engine craftsman, inspects a jet engine at the engine test facility, Shaw Air Force Base, SC. While the engine was at 29,000 pounds thrust capacity, Gallentine checked for oil and air leaks as well as any vibrating parts to ensure all components were working properly. (U.S. Air Force photo by Airman 1st Class Jensen Stidham/Released)

Like all Department of Defense services, the United States Air Force (USAF) has been facing Diminishing Manufacturing Sources and Material Shortages (DMSMS) issues for some time now. From a Sustainment point of view, aging aircraft have exposed numerous problems with first time failures, loss of suppliers, no-bid solicitations, cold-start issues increasing cost and extended lead-times. In addition, multiple system configurations further complicate DMSMS monitoring. The C-130s for example, has 17 different versions, with slight variations in avionics systems, parts, and configurations. This leads to problems when trying to plan for Form, Fit, Function & Interface (F3&I) replacements as well as for new modification programs. Other drivers affecting DMSMS management are the lack of adequate technical documentation, reverse engineering/emulation projects that induce long lead-times into the maintenance processes,

obsolete manufacturing techniques and rapidly changing technology in the electronics and microcircuit industry. Non-stocklisted items are the most recent issue from a supportability and funding stand point. These type of items were never meant to be replaced, but due to the extended service of many weapons systems the USAF is seeing a growing number of new failures. Original Equipment Manufacturers (OEM) within the aerospace industry no longer support, stock, repair or produce these items. Recently the USAF DMSMS team was made aware of a woman that was set to retire after forty years of service with a DLA supplier. This individual was the only known person possessing the skills and knowledge to produce ICBM reed relays. With a requirement for new reed relays this became a significant issue potentially affecting supportability of the entire program. This is an ever-present problem that in many cases is caused

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by the USAF not buying sufficient quantities or in strategic intervals to keep suppliers willing and able to dedicate space and keep qualified manufacturing facilities, or like in this case make it worthwhile to train new employees to make outdated parts.

NEW USAF DMSMS INSTRUCTION

To combat the aforementioned DMSMS issues and other supply chain challenges, the USAF is fostering senior leader engagement through various forums; expanding collaborative forecasting efforts through enhanced Deep Look or Deep Dive efforts, expanding market research

placed on current and proposed future technology trends and continuous monitoring for obsolescence/end of life alerts and strategically placed obsolescence mitigation opportunities during production and initial fielding. These are the areas that have the capability to extend system service life prior to the inevitable increase in obsolescence in the later sustainment stages of the system life cycle. Furthermore, the USAF is proactively/strategically working to regain control of DMSMS issues through the successful implementation of AFMCI20-105, Diminishing Manufacturing Sources and Material Shortages. This HQ AFMC driven instruction provides detailed expectations on USAF organizations to develop a robust DMSMS program within every program office. While

"A DMSMS Program requires AFMC stakeholder Integrated Product Teams (IPTs) comprised of people from Air Force Life Cycle Management Center (AFLCMC), or Air Force Nuclear Weapon Center (AFNWC) and Air Force Sustainment Center (AFSC) organizations. These stakeholder teams shall aggressively work across AFMC Center organizational lines as well as internal Center organizations to lead and pursue proactive, timely, and effective actions when a commodity, sub-system, and/or system (i.e., "item") is identified to have a DMSMS problem, particularly when those items threaten to degrade weapon system readiness."

—HQ AFMC/A4/A10

and source development capabilities, continually engaging with Defense Logistics Agency (DLA) and Air Force Contracting to streamline the purchase instrument process, and participating in DMSMS working groups charged with identifying critical obsolescence issues. Greater focus is now

acquisition documents have always stressed the need for obsolescence management, AFMCI 20-105 clearly reinforces it with specific roles and responsibilities. In fact, the initial focus of the DMSMS Management Team (DMT) is the creation or enhancement of a robust DMSMS Management Plan (DMP) that oversees obsolescence management throughout the life of the weapon system or program.

STRATEGIC ALTERNATE SOURCING PROGRAM OFFICE (SASPO)

AFMCI20-105 assigned SASPO to serve as the DMSMS Center of Excellence for the USAF. This combined government and contract support team provides DMSMS training for all USAF programs, integrates USAF program offices' best practices, reviews contract documents containing DMSMS language, i.e. Charter, Statement Of Work, Performance Work Statement, and serves as a working member for all program office DMSMS Management Teams (DMT).

Along with program membership, SASPO also provides a DMSMS Predictive Tool (AVCOM) and in-depth Analysis and Resolution (A&R) support to all USAF programs. AVCOM users can generate forecasting reports such as Component Health Status, create current System/Assembly Health Analysis or project the Health Analysis 20 years out to evaluate future obsolescence. AVCOM also provides F3&I equivalent parts for electronics. The Impact Analysis and Part Commonality Analysis allows users to view common parts not only across their own platform but also across the entire Air Force. Automated Product Change Notice / Product Discontinuation Notice alert and counterfeit notifications received directly from the manufacturers and Government Industry Data Exchange Program (GIDEP) are processed nightly to keep users informed of upcoming obsolescence issues. The SASPO A&R team researches Defense Logistics Agency and other USAF technical and logistics data and provides detailed analysis to include reliability, availability and maintainability (RAM) data, impact assessments and an evaluation of alternatives as required. The team takes a proactive approach to DMSMS management and maintains a reactive process when unforeseen issues arise. If there is no logistical solution available the issue is turned over to the Alternate Sourcing team that specializes



in working with the commercial market and other government agencies for possible alternate sourcing methods to include reverse engineering, repair development and additive manufacturing.

SASPO has had great success in providing timely feedback for organizations thus far; for example, a health assessment was completed, in less than 30 days, on over 6,600 TF33 engine parts. The final report was instrumental in supporting the B-52 Program decision to re-engine the aircraft.

The identification of the assigned DMSMS Subject Matter Experts (SME) is an important step in improving USAF DMSMS management. There is often a misconception within the logistician community that do not understand that managing DMSMS begins at the piece part level not at the LRU or SRU level. Once the root cause is identified, the issue can be resolved. As part of an OSD task on commonality, an analysis of all parts loaded in AVCOM revealed that there is a 33-35% commonality rate. By identifying the common parts and DMSMS SME's of every program office, the USAF will be able to avoid expending time and resources to solve the same issues that are common to multiple programs.

BALANCING LEGACY PROCESSES WITH NEWER SYSTEMS

More emphasis needs to be given during the acquisition phase on the need to obtain technical data that will enable sustainment efficiencies throughout the life of the program. The USAF must

strongly consider buying tech data at the time it is available and resolve to catalog and maintain configuration changes so that it will be available for future procurements and re-development efforts. Generally the Program Offices have used tech data as trade space - both for speed and more commonly for cost. If the plan is to sustain by F3&I for decades, we absolutely need data rights. If the logistics plan for sustainment is to do COTS and/or new modification efforts every decade or so...then data rights are less pressing to have but it would be critical to adequately fund the proposed upgrades.

In closing, an effective DMSMS program works to both proactively identify potential DMSMS risks and effectively resolve identified and unanticipated challenges. A Robust DMSMS program will mitigate DMSMS impacts throughout the system or equipment life cycle. All USAF DMSMS regulations, initiatives and program management efforts are ultimately aimed at reducing sustainment costs and increasing readiness of our legacy weapons systems and proactively influencing the future sustaining requirements of our new weapon systems with the goal of reduced obsolescence and data constraints. ■

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FROM BOMBERS TO SOFTWARE, KEEPING THE AIR FORCE THREAT READY

Gen. Arnold W. Bunch Jr. is Commander, Air Force Materiel Command, headquartered at Wright-Patterson Air Force Base, Ohio. He is responsible for installation and mission support, discovery and development, test and evaluation, life cycle management services and sustainment of virtually every major Air Force weapon system. The command employs approximately 80,000 people and manages \$60 billion of budget authority annually.

Gen. Bunch was commissioned in 1984 as a graduate of the U.S. Air Force Academy. He completed undergraduate pilot training in 1985. He completed operational assignments as an instructor, evaluator and aircraft commander for the B-52 Stratofortress. Following graduation from the Air Force Test Pilot School, Gen. Bunch conducted developmental testing in the B-2 Spirit and B-52, and served as an instructor in each. Additionally, he has commanded at the squadron, group, wing, and center levels. Prior to his current assignment, he was the Military Deputy to the Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics, at the Pentagon, Arlington, Virginia.



Gen. Arnold W. Bunch, Jr.

Commander

U.S. Air Force Materiel Command

A&M had the chance to speak with Gen. Arnie Bunch, Commander, Air Force Materiel Command, regarding AFMC efforts to support legacy systems sustainment and next-generation capabilities integration to keep the U.S. Air Force globally dominant.

A&M: Please provide some context as to AFMC's primary focus and present mission sets.

Gen. Bunch: Air Force Materiel Command's mission and focus are very broad. This command has built the most powerful Air Force in the world. To remain so, the nation is relying on us to develop, field and sustain the Air Force we need for the future. We have skin in the game throughout the life cycle of Air Force systems, from fundamental laboratory research, to technology development, inception of new operating concepts, prototyping and experimentation, developmental testing and fielding advanced systems, to include the nuclear deterrent operations, supporting the supply chain and depot sustainment for both new and aging aircraft and systems and modernizing the force to meet future challenges. So, whether you are talking about 60-year-old B-52 bombers, software, hypersonic weapons or Air Force uniforms, AFMC is where our Air Force comes for solutions.

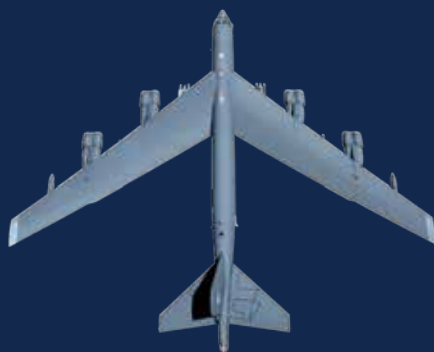
What many folks may not know, is AFMC plays a vital role in not only supporting the expeditionary readiness of Airmen but also supporting our bases, our power projection platforms, around the world. Our Air Force Installation and Mission Support Center (AFIMSC) leads the way for 77 bases providing security forces, civil

engineering, contracting, logistics readiness, financial management, services, and many other areas of expertise.

Ultimately, whether we're talking about people, weapon systems, or installation support, our mission is to provide the materiel to enhance Air Force readiness and lethality.

A&M: With regard to current Air Force materiel sustainment goals, what are some of AFMC's target support efforts?

Gen. Bunch: AFMC has instituted weapon system specific Aircraft Availability Improvement Plans (AAIP). These plans are foundational to our readiness and lethality efforts and achieving the Secretary of Defense mandated 80% Mission Capability on the F-16, F-22 and F-35 weapon systems. To improve the mission-capable rates on a number of weapon systems, Air Force Sustainment Center has devised a 20-year organic depot infrastructure plan designed to ensure continued cost-effective sustainment for the warfighter. The Air Force Nuclear Weapons Center (AFNWC) is working with the Air Force Global Strike Command (AFGSC) and has made great strides on the first-ever Programmed Depot Maintenance for Minuteman III launch facilities and launch control centers. Like the KC-135, we've identified Tinker Air Force Base, Oklahoma as the KC-46 depot and



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The KC-46 Pegasus and F-35A Lightning II are among the U.S. military's top weapon system acquisition programs. The aircraft will be major contributors to joint warfighting readiness for decades to come. The Air Logistics Complexes located at Tinker AFB, OK and Hill AFB, UT will perform programmed depot maintenance for the KC-46 and F-35A respectively. (U.S. Air Force photo by Ethan Wagner)

have started construction on new hangar facilities and are acquiring the equipment we'll need to sustain this fleet throughout its life cycle.

A&M: In terms of some challenges in transitioning from legacy systems, do you see the Air Force "building onto old" or "building up new"?

Gen. Bunch: You asked an 'or' question but the answer is yes, as we will build onto old 'and' build up new. Given the fiscal environment, this a delicate balance. We always have to make trades to deliver readiness with the mix of systems we have while fielding the Air Force we need. We know there are challenges associated with supporting an aging aircraft fleet. Old airplanes come up with new ways to break, they become increasingly expensive and difficult to maintain, and eventually are surpassed by new advanced systems fielded by our peer competitors. Just as we can't afford to field a force today comprised exclusively of F-22s, F-35s, and B-21s, we will need to carry a mix of proven, modernized and new equipment, along with more efficient and integrated systems for command and control of supporting logistics. With the National Defense Strategy as our guide, and continued support from Congress, I am confident we will strike the right balance.

Underpinning our nation's defense is our nuclear triad, including our Minuteman III Intercontinental Ballistic Missiles (ICBM), complemented by the B-52 carried Air Launched Cruise Missile (ALCM) and the B-2 delivered B61 family of gravity weapons. We've embarked on a major first-time field depot maintenance effort for the silos, but the entire ICBM infrastructure, including nuclear command, control and communications (NC3), is old and must be replaced. The ALCM was designed in the 80s with a 10-year service life and its survivability will be challenged by new Anti-Access/Area Denial threats. Minuteman III is in a position similar to ALCM and must be replaced. We must field the Ground-Based Strategic Deterrent system, Long-Range Stand Off weapon, NC3 and upgraded B61-12. There is an added challenge with transition from the Minuteman III to GBSD in that there will be a period of several years where we will have both systems on alert until recapitalization is complete. This is not something we have previously faced with this leg of the triad.

We've also initiated re-engining of the B-52 fleet so that workhorse can continue to support our Nation's defense for many years to come.

Adding and replacing Information Technology is particularly challenging when you have many legacy systems developed long before we were focused on cyber and today's cyber threat. You can't simply plug and glob on security patches when vulnerabilities are identified on old systems which don't talk to each other. We want to move toward an enterprise, cloud-based approach where security is baked in and the number of threat surfaces is reduced. Funding is finite, but this is an imperative for us. On software, we are moving swiftly with agile development approaches and seeing measurable results delivering incremental capabilities quickly, notably with apps supporting the F-35 and Air Operations Center weapon system. Virtually every weapon system runs on software, so we've charged the Program Executive Officer (PEO) for Digital with deploying AgileDevOps across its portfolio and assisting other PEOs, so we can achieve similar improvements across all programs.

A&M: From a logistics standpoint, talk about how AFMC is addressing USAF fleet maintenance in terms of predictive and proactive processes.

Gen. Bunch: Understanding we have a fleet mix of some new and many aging platforms, we have made several important investments in transforming sustainment. We established the Rapid Sustainment Office (RSO) under Air Force Life Cycle Management Center. The RSO is focused on a number of technologies including Condition Based Maintenance (CBM+), additive manufacturing, cold spray, and robotics. For CBM+ and predictive analysis, we start by analyzing and understanding the data already captured by our aircraft to make better informed decisions. Currently, we have efforts underway with the C-5, B-1 and C-130. As we learn lessons, we will apply those lessons to other platforms. Clearly, we benefit in readiness and safety when the data shows we need to replace a part or system that is near the end of its useful life, or about to fail, and we replace it before it actually does fail.

The RSO is establishing a strong ecosystem by partnering with key innovation providers. Most recently, the RSO teamed with the Reverse Engineering and Critical Tooling (REACT) Lab at the Oklahoma City Air Logistic Complex. This lab provides engineering services that are positively impacting the AFLCMC Program Offices. In April alone, REACT provided the Air Force and DoD with cost avoidances through innovation and engineering support, totaling approximately \$3.4 million and avoided 1,521 depot flow days. The RSO plans to continue expanding their relationship with REACT and other Air Force Sustainment Center offices to quickly scale RSO technologies to the field and depots.

As we move forward, we continue to look for new focus areas for the RSO to address. Our latest focus areas are obsolescence, training, analytical and decision tools, low observable maintenance and other key areas across the sustainment enterprise that will reduce costs and improve readiness.

To develop new technologies faster, we stood up an Advanced Technology and Training Center at Wright-Patterson Air Force Base and Middle Georgia, near Robins Air Force Base. They are establishing and sharing best practices to address some of our aging aircraft maintenance issues and solving them by laser scanning parts, 3D printing new parts using various composite and metal materials,

using cold spray deposition to repair worn, but very expensive parts, like gear boxes, and more. In March, a new ATTC was established in Pittsburgh, PA, focusing on Robotics, Artificial Intelligence, and Automation. We're working with the Air Force Research Laboratory to qualify 3D printed parts for critical safety of flight applications. Our maintainers are already saving time and money using these approaches, in the nascent stage. In some cases, we can print parts on site, or benefit from data ensuring the right part, at the right place and time. The future in this field is boundless.

A&M: From a partnering aspect, how is AFMC working to reflect govt/industry teaming in advancing the USAF/Joint DoD mission?

Gen. Bunch: It's no secret American workers and industry built the world's most dominant Air Force. We have great defense industry partners who are delivering a bow-wave of modernized systems. The focus is speed of delivery and reducing life cycle cost. We've been open about our desire to do more prototyping and experimentation, and I think industry is fully on board with the approach. We need to mutually protect our data and intellectual property to prevent our most sensitive technology from being harvested by our adversaries for their advantage. We are increasing use of new contracting authorities and reducing the burden of navigating our contracting system to invite innovative, agile, non-traditional tech companies and small businesses to join our team. One way we do this is via a Pitch Day, an acquisition event where we present a problem, ask for

solutions and award a same day contract. This is a culture change. It may involve taking a little risk, and I think we need to do more of it.

In addition, AFIMSC is a driving force for innovation and industry partnership in the area of Agile Combat Support. AFIMSC stood up a fulltime innovation office in 2018 and held its first Innovation Rodeo in January. Eight teams from across the Air Force pitched their concepts to senior leaders in the Installation & Mission Support community. In partnership with AFWERX, the top three ideas are now being further vetted for implementation in the private sector innovation ecosystem with industry tech-accelerators.

A&M: Feel free to speak to other challenges and goals moving forward.

Gen. Bunch: We have to continue to train and educate our people. We must recruit, hire, award, reward and retain talent. Our people are our most valuable resource and the foundation of everything we do.

Finally, we have to ensure the American people understand the importance of air and space power's contributions to national defense. Armed with that understanding, and with Congress' support, we can keep the momentum moving forward to enhance joint readiness while modernizing our nuclear deterrent, and field vital systems such as F-35, KC-46, B-21, T-X, Combat Rescue Helicopter, among others.

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ENSURING RAPID GLOBAL MOBILITY FOR MISSION-CRITICAL SUPPLY

Gen. Maryanne Miller is the Commander, Air Mobility Command, Scott Air Force Base, Illinois. AMC's mission is to provide rapid, global mobility and sustainment for America's armed forces. The command also plays a crucial role in providing humanitarian support at home and around the world. The men and women of AMC, consisting of active duty, Air National Guard, Air Force Reserve and civilians, provide airlift, aerial refueling, special air mission, aeromedical evacuation and mobility support. As the Air Component Commander for U.S. Transportation Command, General Miller is responsible for directing global air mobility operations in support of national objectives.

General Miller was commissioned in 1981 as a distinguished graduate of the ROTC program at Ohio State University. She is a command pilot with more than 4,800 flying hours in numerous aircraft.

The general has commanded two wings and held numerous staff leadership positions on the Air Staff and the Joint Staff. Prior to her current assignment, she was the Chief of Air Force Reserve, Headquarters U.S. Air Force, Arlington, Virginia, and Commander, Air Force Reserve Command, Robins AFB, Georgia.



Gen. Maryanne Miller

Commander
Air Mobility Command

A&M had the opportunity to speak with Gen. Maryanne Miller, AMC Commander, regarding current and newer initiatives being driven by a global Air Force/DoD mission set.

A&M: Please provide some focus as to your role as AMC commander and present AMC mission.

Gen. Miller: I have the great honor and privilege of leading the incredible men and women of Air Mobility Command, the world leader in rapid, large-scale, global military operations. We have been trusted with ensuring national security objectives on a global scale, projecting agile power through airlift, air refueling, aeromedical evacuation and global air mobility support. Our Airmen pride themselves in their exceptional ability to deliver the right effects, to the right place, at the right time.

The demand for Rapid Global Mobility is steadily increasing, and our future requirements are rapidly expanding. While AMC has been primarily focused on delivering manpower and material assets, our mission is continuously expanding across multiple domains. We must develop unmatched capabilities that enable access and freedom of maneuver in some of the most contested global environments – in air, space and cyberspace. We must move at the speed of war.

A&M: With regard to current Air Force materiel support priorities, what are some of AMC's target efforts?

Gen. Miller: As Air Force Chief of Staff Gen. David Goldfein said, "we are a global power because of global reach." AMC is a big part of that global reach building American strength against our adversaries and American hope in support of our partners. Mobility Airmen deliver capabilities to those warfighters who depend on them, and they can do it at a moment's notice.

Approximately every three minutes, an AMC aircraft takes off somewhere around the world providing airlift, aerial refueling or aeromedical evacuation support to the Joint force. Since the beginning of 2019, we moved more than 97,000 passengers and nearly 124 million pounds of cargo in strategic and intra-theater missions supporting fellow warfighters in the U.S. Central Command area of responsibility.

Looking forward, AMC must be ready to operate in any contested environment. We are constantly developing our assets, capabilities and, most importantly, our people, to meet the challenges we face as a nation in an environment of great power competition.

A&M: Can you provide a KC-46A status update? How is AMC integrating the aircraft into the fleet?

Gen. Miller: Since integrating the first KC-46A Pegasus into our fleet this past January at McConnell AFB, KS, the Air Force has received



General Miller, right, discusses the state of the command's expeditionary and domestic mission sets with 182nd Airlift Wing and Illinois Air National Guard leadership during a visit to the Illinois Air National Guard's 182nd Airlift Wing, Peoria, IL. The General is responsible for leading total force Airmen in providing worldwide airlift, aerial refueling, special air mission, aeromedical evacuation and mobility support. (U.S. Air National Guard photo by Tech. Sgt. Lealan Buehrer)

10 more at both McConnell AFB and at Air Education and Training Command (AETC)'s Formal Training Unit Altus AFB, OK. The delivery of all 179 KC-46s to the Mobility Air Forces (MAFs) should be complete by 2029. Operational ground testing started in May at McConnell with flight testing beginning as of June 2019.

AMC will use a phased approach when integrating the Pegasus into our inventory. As we transition to operating the KC-46A, we will divest our legacy fleet, while maintaining maximum air refueling capacity and capability for the warfighter. In 2029, the Air Force's air refueling fleet will consist of the KC-46 and KC-135.

A&M: From a sustainment standpoint, talk about how AMC is addressing USAF fleet maintenance in terms of predictive and proactive processes.

Gen. Miller: We've recently adopted the Condition-Based Maintenance Plus (CBM+) approach to managing fleet readiness. This is a predictive approach that aims to convert unscheduled maintenance to scheduled maintenance. The approach leverages both sensors, providing information on parts stress and performance and historical maintenance data. This approach will be a culture change, but we believe it will enhance AMC's ability to keep promises to those warfighters who depend on us, while also saving time and money. We anticipate this approach will reduce unnecessary "churn" in the maintenance process by addressing repairs before an aircraft has to be halted for unscheduled maintenance. Our maintainers work hard to meet increasing demand for air mobility capabilities. We believe this Air Force-wide approach will yield the benefits needed to keep our aircraft moving without over-straining our world-class maintenance teams.

CBM+ has already proven successful through initial test phases at Travis AFB, California, and MacDill AFB, Florida. We have high expectations for enterprise-wide integration across the Mobility Air Forces.

A&M: How does Air Mobility Command seek to manage the challenges of future warfighting?

Gen. Miller: Our mission has not changed: We deliver rapid global mobility in contested domains anywhere anytime. The ways and means of executing our mission must evolve in big and small ways based on the threats we face. We must become faster and smarter. For this, I am relying on our greatest advantage – our Airmen.

Innovation is foundational to solving the threats inherent within contested domains. The challenges of the fight are ever-changing and our Airmen have to be able to prevail by rapidly adjusting to address a variety of threat vectors impacting our mission accomplishment.

We have some of the most skilled and creative members in our force. I'm asking our Airmen to propose solutions to problems that frustrate them each day, the problems they know best how to solve. I continue to be amazed by their ability to solve problems, while taking calculated risks. They are taking matters into their own hands, writing code, creating prototypes and finding solutions that save our Air Force time, money and, sometimes, lives. It is these Airmen that I trust to usher Air Mobility Command into the future of warfighting. It is these Airmen that execute my vision of Air Mobility Warriors – projecting decisive strength across contested domains and delivering hope ... always!

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TAPPING MISSION ENERGY POTENTIAL

The U.S. Air Force Petroleum Office (AFPET) has a rich history of providing global petroleum and aerospace energy management expertise to the field.

By Col. Phillip Noltemeyer, U.S. Air Force Petroleum Office



An F-35A Lightning II receives fuel from a KC-135R Stratotanker from the 28th Expeditionary Air Refueling Squadron. The 28th EARS maintains a 24/7 presence in the U.S. Central Command area of responsibility, supporting U.S. and Coalition aircraft in various operations in countries such as Iraq, Syria and Afghanistan. (U.S. Air Force photo by Senior Airman Keifer Bowes)

While the U.S. Air Force Petroleum Office (AFPET) has transformed over time, its focus remained technical excellence in support of fuels operations, expert petroleum engineering and infrastructure advice, and precise product quality determinations. AFPET today is a proud member of the 635th Supply Chain Operations Wing (SCOW), where our fuels expertise is added to the wing's global supply, vehicle, and War Reserve Materiel management portfolio. Prior to becoming a part of the 635 SCOW, AFPET was assigned as a Field Operating Agency reporting to the Air Staff. Prior to that, AFPET spent nearly 40 years combined as a detachment under the former Warner Robins Air Logistics Center and San Antonio Air Logistics Center.

Regardless of AFPET's organizational alignment, its mission of providing timely, accurate fuels answers to the field has not changed. More recently, the Air Force reduced the size of Major Command staffs, and transitioned that particular role over to AFPET. Known as Installation Support Centralization, this transition allows AFPET experts to provide uniform, responsive support to customers around the globe, and provides a 'one-stop shop'

for Air Force Fuels Management flights to get the right answers to make their mission happen.

LEVERAGING SUPPLY TO MEET DEMAND

The Air Force is the DoD's largest fuel consumer, accounting for more than 50% of Defense Logistics Agency-Energy sales each year. The Air Force's high-volume, worldwide consumption of fuel means that there is always some operation requiring additional technical or operational support. AFPET personnel, working in conjunction with base- and theater-level experts, continually ensure fuels operations are conducted in the most effective and efficient way possible. Through our partnership with Defense Logistics Agency-Energy, AFPET ensures Air Force units have access to the right fuel, at the right time, wherever they may be called upon to operate.

One of the challenges we all face is high operations tempo ranging from home station training to theater exercises to combat operations. Whether supporting new missions, or sustaining operations at locations where

we've had a presence for years, planners at all levels work to balance operational and logistics requirements while seeking to constantly meet commanders' objectives. AFPET leverages the years of experience our workforce provides, ensuring tactical operations are shaped to ensure success, while working theater-level petroleum logistics solutions through DLA-Energy and the various major commands. AFPET's goal is to ensure taxpayers get their money's worth for the fuel we consume.

Ensuring each Air Force operation has the right fuel, at the right place, at the right time, is AFPET's focus. We work hand-in-hand with the bases who establish the requirements, as well as DLA-Energy, who contracts with commercial industry to acquire and deliver the product we need. In fact, AFPET's headquarters is collocated within the DLA facility, which facilitates constant communication and coordination. This close relationship is vital to overall mission success. In just one example of the positives of our partnership with DLA-Energy, we collectively worked to transition 131 locations in the continental United States to receive commercial grade Jet A fuel, which is then treated with the various military fuel additives at the Defense Fuels Support Points for each base. This change increased the pool of suppliers able to deliver to the Air Force, which drove competition and reduced cost, while still maintaining the same level of capability for the military. A true 'win-win' situation!

BUILDING ON OTHER CAPABILITIES

Our Service is embracing alternative fuels opportunities while maintaining current mission assurance. Over recent years, the Air Force has certified the fleet to fly on two alternative aviation fuel blends: a synthetic fuel produced using the Fischer-Tropsch process and a biofuel produced by hydro-processing esters and fatty acids. The Air Force also has incorporated alternative options for vehicle and facility fuels, from procurement and operation of electric vehicles, to those that run on ethanol blends, to solar, wind, and geothermal energy capabilities at various bases. As this journey proceeds, we are committed to maintaining access to the energy we need to operate.

Here at AFPET, our role in supporting these



1st Lt. William Gomez, Aerospace Fuels Laboratory deputy chief, checks for separation of fuel and water in a sample at the Quality Surveillance Fuels Lab, Wright-Patterson Air Force Base, OH. The additive being tested for prevents water in the fuel from freezing as it separates in flight. (U.S. Air Force photo by Michelle Gigante)

new options is to make sure that the products meet the right chemical properties to be used and stored in Air Force systems. With our contingent of chemists, petroleum engineers, and fuels operations experts, we make sure the products are compatible with Air Force vehicles, equipment, and aircraft. That information is shared with the various weapon system program offices, so that the data can be added to appropriate technical orders, enabling Airmen in the field to operate confidently that their new fuel is going to deliver the right results.

While the Air Force is not in the business of producing aviation fuel, we are excited about leveraging advances made by commercial industry, as we all seek economical and environmentally conscious alternatives to accomplish our missions.

PARTNERING FOR MAXIMIZED EFFICIENCY

One of the key ways the Air Force Petroleum Office partners with industry is through our innovation and research process. Leveraging various tools as available, AFPET technical experts evaluate what the field needs and look for options on how to get it. One recent example is the new Large Capacity Refueling Vehicle, set for initial delivery in 2019. This 18,000-gallon truck was designed as a significantly less expensive alternative to installing an additional hydrant system to support ramp and hot cargo loading areas; one that is more efficient than executing multiple runs with a standard R-11 refueling unit. Another example is our work to support fuel desulfurization technology research. If realized, this technology could deliver low sulfur fuel to locations around the globe where the refining infrastructure is not capable of producing fuel meeting the low sulfur requirements of new vehicles and equipment.

Additionally, AFPET championed an initiative to develop a new, standardized hydrant system design. This new system is based off of the Type II hydrant system, which originated in the 1950s and was known for its simplicity, ease of maintenance, and ruggedness. These characteristics, when coupled with the right amount of new technology, make the new system ideal for more austere basing environments, where they can meet a hydrant refueling demand while retaining maintenance and operations simplicity.

PARTNERING TO POWER THE MISSION

By Brig. Gen. Albert G. Miller, Commander, DLA Energy



Brig. Gen. Albert Miller

Defense Logistics Agency Energy and U.S. Air Force Petroleum Office have a superb history of teamwork and always putting the Warfighter first while holding ourselves accountable for the resources entrusted to us by the American people.

BOOSTING FUEL

Great progress has and is being made by the DLA Energy and the AFPET team in developing expeditionary fuel support concepts and capabilities to support dynamic operations strategies and ensuring we have the right product at the right place and time for the Warfighter.

From the expeditionary aviation fuel additive injection concept to the optimization of available global commercial aviation fuel sources, we strive to provide flexible and resilient solutions for contingency support. In the partnership area of additives, DLA has successfully forward-positioned critical fuel additives in a readily deployable kit at multiple locations in the Indo-Pacific Command theater, and are continuing to refine this effort to support the USAF's global mission.

IMPROVING INFRASTRUCTURE



We are also working together to pro-actively provide the right sized fuels facility infrastructure, in the best possible operating condition, and fully capable of delivering fuel to the Warfighter when needed. The maintenance, repair, and upgrade of infrastructure assets has been aggressively addressed with innovative procurement strategies.

We look forward to a mutual focus on refining contingency fuel requirements that will provide a solid footing for optimal global posturing of Department of Defense fuel resources and capabilities. The USAF is our largest customer with 138 Defense Fuel Support Points and sales valued over \$5 billion. We do not anticipate any unsurmountable challenges supporting the USAF, only continued opportunities for mission success as we partner together in the future.

LOOKING AHEAD

Finally, AFPET is excited about working with small businesses to leverage innovations in areas like rapid field testing capabilities. This technology has the potential to allow field users to detect particulate matter or water in fuel, potentially transmitting the results in real-time via an app on their phone to the AFPET Lab. This would enable rapid, informed decision making, potentially returning aircraft to service faster, while still providing confidence to the operator that their fuel is clean and dry.

Overall, the Air Force Petroleum Office is proud of its role in making the Air Force mission happen. From our chemists at the various regional labs, to our equipment specialists at the depot, to our experts who shape fuels operations, to the mission support team that holds it all together, each and every one of us is dedicated to making sure that Air Force units and other customers worldwide have the precise information they need to smartly and effectively operate. ■

SUSTAINING AIR POWER LETHALITY FOR COMBAT OVERMATCH

Lt. Gen. Donald E. "Gene" Kirkland is the Commander, Air Force Sustainment Center, Air Force Materiel Command, headquartered at Tinker Air Force Base, Oklahoma. As the AFSC Commander, he leads more than 40,000 Total Force U.S. and U.K. Airmen across three air logistics complexes, three air base wings, and two supply chain wings, operating from a global network of 26 locations.

The AFSC is responsible for \$26 billion in assets generating \$16 billion in annual revenue. The command provides global logistics and sustainment planning, operations and command and control, including agile software development and sustainment, supply chain management and execution, weapons systems maintenance, modification, repair and overhaul, as well as critical sustainment for the Air Force and Navy nuclear enterprise. The AFSC also provides mission essential support to joint and interagency operations, allies, coalition partners, and foreign military sales partners.

General Kirkland entered the Air Force in 1988 through Officer Training School. He is a career aircraft and munitions maintenance officer and has served on the logistics staffs at U.S. Central Command and the Joint Staff. He also served as Executive Officer to the Chief of Staff of the Air Force and Commander of the Oklahoma City Air Logistics Complex. Prior to his current assignment, he was the Director of Logistics at Headquarters U.S. Air Force.



Lt. Gen. Gene Kirkland

Commander
Air Force Sustainment Center

A&M had the opportunity to speak with Lt. Gen. Gene Kirkland, Air Force Sustainment Center Commander, regarding some AFSC efforts for maintaining U.S. dominance in the skies of a global battlespace.

A&M: Please provide some context as to AFSC primary focus and mission sets at present.

Lt. Gen. Kirkland: Our sole mission and the primary focus that guides all of our activities within the Air Force Sustainment Center is to sustain weapon system readiness to generate airpower for America. We do that in myriad ways at multiple locations, but with the single, driving focus of keeping warfighters in the air.

Our three complexes - Ogden Air Logistics Complex at Hill Air Force Base, UT; Oklahoma City Air Logistics Complex at Tinker Air Force Base, OK.; and Warner Robins Air Logistics Complex at Robins Air Force Base, GA, provide logistics support and maintenance for aircraft, engines, avionics, missiles, accessory components, and software.

It takes all three Complexes to sustain a single weapons system and to sustain critical components of the nuclear enterprise.

In addition, our supply chain management and supply chain operations wings ensure parts availability for those processes.

The Sustainment Center impacts not just individual systems but every system in the Air Force fleet, whether by operating its supply chain, repairing the air vehicle and its components, overhauling its engines, managing its fuel or war reserve materiel, or maintaining its software.

With more than 40,000 personnel, at 26 geographic locations, this is just a brief overview of a very broad mission that holds significant strategic value to our nation.

A&M: With regard to current Air Force materiel sustainment goals, what are some of AFSC's target support efforts?

Lt. Gen. Kirkland: First and foremost, all of our support efforts focus on providing readiness for the National Defense Strategy (NDS). Our AFSC-specific goals are in precise alignment with both NDS and Air Force Materiel Command strategies.

First, we deliver cost-effective combat readiness. We are continually working to increase levels of readiness while keeping



Item manager Mia Maynard and Sean Davison, an aerospace engineer, both with the 424th Supply Chain Management Squadron, examine a transition trailing edge fan reverser part for a KC-135 Stratotanker aircraft. The 448th Supply Chain Management Wing is the single Air Force wholesale supply chain management wing. (AFSC)

costs reasonable, as it takes more money to keep older aircraft combat-ready. The average age of our aircraft is now 28 years old. By employing a constraints-based management philosophy known as “Art of the Possible,” we make our processes more efficient and, ultimately, provide more value for our weapons system customers.

Next, we aim to deliver supply chain readiness to enable combat power. One focus is improving supply support to meet the Secretary of Defense requirement to improve the F-16 Mission Capable rate to 80 percent by the end of fiscal 2019. Two ways we plan to do that is by surging depot and contract repair efforts and increasing the breadth and depth of items stocked at F-16 bases.

In working with the F-16 System Program Office and the Defense Logistics Agency – Aviation, the 448th Supply Chain Management Wing has reduced the Total Non-Mission Capable for Supply rate by 3.6 percent and is postured to continue that downward trend.

Also, we also want to develop mission assurance enablers. By that, I mean making sure our IT networks are resilient, our infrastructure is meeting our needs, and that we are being responsible stewards of energy, which again affects our cost savings.

Last and most importantly, we will develop and support Airmen, both military and civilian. Our people are the forces of readiness that drive this AFSC machine. We will make sure those people have the training and support they require.

A&M: As the Air Force prepares for delivery of the first KC-46 aircraft, how is AFSC preparing for the transition?

Lt. Gen. Kirkland: AFSC is poised and ready to take on the KC-46 depot maintenance workload. The Air Force took delivery of the first KC-46 in January at McConnell AFB, Kansas, and we currently expect our first aircraft to arrive at the Oklahoma City Air Logistics Complex at Tinker Air Force Base for maintenance in late 2020.

The first two hangars where we will house the KC-46 during depot maintenance are nearly complete. Construction of additional hangars

will follow. In all, there will be 14 hangars to support the total fleet of 179 aircraft.

The new KC-46 sustainment mission will eventually create about 1,355 new jobs for the Air Force Sustainment Center.

The OC-ALC business office has been working to make sure the aircraft maintenance process itself is fully supportable by going through developmental packages with the technical data to ensure we have all the parts, support equipment and a hiring plan needed to begin depot-level maintenance.

Also, the 448th Supply Chain Management Wing stood up a dedicated KC-46 Supply Chain Management Flight to plan and execute supply strategies that will ensure support for all KC-46 customers for Air Force-managed depot-level repairables.

Our AFSC supply chain and Defense Logistics Agency have developed joint contract strategies for post-interim contract support that leverage DLA's contracting expertise, as well as provide critical support through their OEM partnerships.

The anticipated benefits of this joint Air Force and Defense Logistics Agency supply venture include minimizing the number of contracts to manage, capitalizing on existing industry capabilities and available material for reduced repair times, minimizing initial inventory, and providing best value to the taxpayer.

A&M: From a partnering aspect, how is AFSC working to reflect govt/industry teaming in advancing the USAF/Joint DoD mission?

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A 309th Maintenance Group corrosion control technician sands down the inside of an F-16 engine nacelle during the repainting of the aircraft at the Ogden Air Logistics Complex at Hill Air Force Base, UT. (AFSC)



Emile Summer, 402nd Software Maintenance Squadron electronic engineer, runs the custom navigation section during a simulated mission in the Warner Robins Air Logistics Complex C-5 System Integration Lab. (AFSC)

Lt. Gen. Kirkland: To ensure our aging weapons systems stay in the fight for as long as the nation needs them, our workforce must find new and innovative ways to apply emerging technology to aircraft that are sometimes more than 50 years old. One way we do that is through partnering with our communities, academia and industry.

Public-Private Partnerships are a strategy that assists in maintaining industrial balance and enhancing warfighting capabilities. To sustain a more agile workforce and ensure future mission supportability, the AFSC partners with the aerospace industry to help achieve this goal.

Through our partnerships, the AFSC is able to reduce costs through improved joint efficiencies gained by leveraging combined strengths and competencies, reduce investments in what could otherwise be duplicative capabilities, increase speed of delivery, introduce new technologies, all while maintaining quality and safety focus.

The government/industry partnership consists of a high performing integrated team that continually monitors and identifies strengths, weaknesses, risks, and opportunities throughout the life of the partnership. These successful partnerships strengthen a reliable, agile and responsive organization, focused on achieving "Art of the Possible," and enables stronger collaboration and abilities to better identify and exploit mutual benefits to move forward and meet the challenges faced by our Air Force and the DoD.

The innovation centers mentioned previously join academia, government, and defense industry partners to apply today's technology to aging weapons systems.

The Ogden Air Logistics Complex at Hill Air Force Base entered into membership with Utah Science Technology and Research in 2018, which is a high-tech incubator and prototype lab to foster business development in the tech sector. USTAR offers access to additive manufacturing equipment, milling machines, metal-working equipment and software.

Also, Warner Robins Air Logistics Complex at Robins Air Force Base in middle Georgia signed an Education Partnership Agreement with Georgia Tech, which is committed to embracing agile software development methods. We are employing these methods now to speed up our software development and get solutions to our warfighters even faster.

Collaborating with industry and academia has no doubt moved our mission forward.

A&M: Feel free to speak to other challenges/goals moving forward.

Lt. Gen. Kirkland: As a career logistician, I am convinced there is no more important organization in the business of sustainment to the warfighter. Given the scale of operations and unique capabilities of this center, our combined workforce, facilities and knowledge base is nothing less than a national resource.

Because of that, we strive to recruit, hire and retain the right people to do our work. The AFSC requirement for scientists and engineers, including software engineers, continues to increase, and we compete with commercial industry for their talents. Our scientists and engineers have a wide variety of responsibilities including circuit card analysis, upgrading software for aircraft, designing modifications, chemical testing and more.

Our personnel experts are working right now to make the hiring process easier to bring these STEM professionals onto our team. Initiatives such as the congressionally-authorized Direct Hire Authority are crucial to expedite the process for these career fields. This authority expires in 2025; we hope Congress will make it permanent.

Eighty percent of the AFSC workforce is civilian. Finding skilled craftsmen and technologically minded professionals is crucial to sustaining Air Force fleets for the long-term. We're a great place to work, and we focus on being a competitive option for the next generation of job seekers.

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SUPPORTING JOINT DISTRIBUTION FOR MISSION ASSURANCE

General Stephen Lyons was confirmed in July 2018 as the 13th commander of U.S. Transportation Command (USTRANSCOM), one of ten Combatant Commands in the Department of Defense. Lyons' experience spans over 36 years of military service in positions of progressive leadership responsibility.

GEN Lyons began his career in Germany during the Cold War and subsequently held a wide range of assignments to include command of Soldiers at every level, multiple deployments, and more than six years of experience in joint assignments. As a battalion commander in 2003, he participated in 3rd Infantry Division's major combat operations to invade Iraq. Since 2003, he has spent over 40 months deployed to the U.S. Central Command area of responsibility in support of Operation Iraqi Freedom and Operation Enduring Freedom (Afghanistan). He also served as the 14th USTRANSCOM deputy commander from 2015-2017.



GEN Stephen Lyons

Commander
U.S. Transportation Command

A&M had the opportunity to speak with GEN Steve Lyons, Commander, U.S. Transportation Command (USTRANSCOM), regarding efforts the command is undertaking to advance Air Force and Joint DoD missions on a global scale.

A&M: What is USTRANSCOM's current role in support of global and domestic U.S. interests?

GEN Lyons: USTRANSCOM's mission is to project and sustain military power globally in order to assure our friends and allies, deter potential adversaries, and if necessary, respond to win decisively. We accomplish our mission by conducting globally integrated mobility operations, leading the broader Joint Deployment and Distribution Enterprise (JDDE) and providing joint enabling capabilities in order to project and sustain the Joint Force in support of national objectives.

The worldwide work of the command is carried out by a Total Force team of more than 122,000 Active Duty, National Guard, Reserve and civilian personnel. We also partner with industry under contract to the U.S. government to provide critical transportation capacity and leverage global trade networks. During wartime we gain access to additional commercial capacity through emergency preparedness programs like the Voluntary Intermodal Sealift Agreement (VISA) and Civil Reserve Air Fleet (CRAF). These programs provide access to approximately 70 vessels and 270 long-range international aircraft to accomplish our mission.

The Joint Force is in constant motion. Somewhere on the globe a USTRANSCOM aircraft is touching down every 3 minutes, USTRANSCOM ships are underway, trains are loading, aerial refueling missions are orbiting overhead, and planes converted to intensive care units are moving our ill and injured. In short, the sun never sets

on USTRANSCOM, and this activity would increase significantly in a wartime scenario with a fully-mobilized deployment enterprise.

The key to conducting globally-integrated mobility operations is the dynamic synchronization of transportation networks that allows us to allocate scarce mobility resources in support of SECDEF's highest priorities, whether foreign or domestic. These activities hinge on a resilient global posture that provides access, basing, and overflight; sufficient mobility forces and capacity; and enabled by global command and control.

A&M: With today's challenges associated with sustaining mobile asset visibility at all times, what are some areas of focus for TRANSCOM?

GEN Lyons: An immediate focus is challenging our own thinking about what 'In Transit Visibility' (ITV) means. Many of the current tools and processes designed to track cargo as it flows through the JDDE were designed to aid logistics organizations. While ITV is important for these organizations, it is equally important for supported Commanders across the Joint Force.

We need to challenge our thinking on 'who' this visibility is for, and we also need to re-think 'why' we need it. Simply answering

the question 'Where's my stuff?' is no longer sufficient. Instead, we must provide Combatant Commanders with the ability to monitor and influence the arrival of combat forces and critical sustainment materiel required to achieve their campaign objectives. Similarly, ITV must improve visibility of CL IX for major weapon systems to help materiel managers and commanders at echelon optimize lethal affects.

So what does this mean for USTRANSCOM? Ultimately, the ability to provide Combatant Commanders with accurate information—at speed and at scale—hinges on process and data discipline. So we are focused on identifying and eliminating the gaps and seams in the JDDE's digital architecture, and making the right investments in data management and analysis to provide those tools and insights.

A&M: As the U.S. continuously responds to emerging problems around the globe, how do you see TRANSCOM providing support for possible combat scenarios?

GEN Lyons: The National Defense Strategy (NDS) describes a security environment characterized by great power competition, one in which commanders will need to operate without continuous domain superiority and at the end of long and contested lines of communication. With 85% of the Joint Force originating in CONUS, it is imperative that USTRANSCOM retains the ability to project military power when our Nation calls.

In previous decades the Joint Force could generally deploy when we wanted, assemble where we wanted, and conduct operations how we wanted. In a future that is unknown and ever-changing, we acknowledge that the homeland is no longer a sanctuary, and it is likely all warfighting domains will be contested.

To assess the full range of combat scenarios USTRANSCOM works closely with Services and Combatant Commands to ensure globally-integrated war plans are transportation feasible on required timelines. In coordination with OSD, USTRANSCOM periodically conducts congressionally-mandated Mobility Capabilities Requirements Studies (MCRS) to assess the size and sufficiency of mobility forces, global mobility posture and global C2 capabilities. The MCRS examines USTRANSCOM's ability to satisfy the NDS and associated global war plans, providing insight into the command's capabilities, capacity, readiness, and strategic risk.

As a result of our assessments, USTRANSCOM has identified three top readiness concerns: (1) sealift; (2) aerial-refueling; and (3) cyber mission assurance. We are working actively with appropriate stakeholders to include Congress to improve warfighting readiness in these areas.

The enormous success of the Joint Force over the last 30 years does not guarantee success for the next 30 years. We should expect that capable adversaries will attempt to degrade or deny our ability to project power, and may do so without ever firing a shot. USTRANSCOM continues to evolve to ensure the U.S. Military retains power projection as a comparative advantage. Throughout all of our efforts, our number one priority is, and will remain, warfighting readiness.

A&M: How is TRANSCOM evolving for the future?

GEN Lyons: USTRANSCOM's enduring purpose is to project and sustain the Joint Force, but what is clear is that the security environment is rapidly changing. To maintain power projection as a strategic comparative advantage, we must continue to evolve and

inspire innovation and critical thinking at every level. As the Services modernize mobility platforms, USTRANSCOM is modernizing the digital architecture that enables global C2, setting conditions for us to get better and faster.

Our approach acknowledges that data can be as useful as a weapon system in war when enabling global C2. Computational processing continues to advance rapidly as we integrate game changing capabilities like Artificial Intelligence, which has enormous potential to improve USTRANSCOM mission outcomes through enhanced decision-making on a global scale.

We are working several initiatives in the areas of enterprise data management, cloud computing, and IT design to take advantage of today's technology, speed decision making, augment human capital, accelerate learning, reduce costs, and improve productivity. These efforts are essential to enable USTRANSCOM to retain our strategic comparative advantage to project and sustain the Joint Force globally.

A&M: Feel free to speak to other challenges/milestones for TRANSCOM moving forward.

GEN Lyons: I would highlight two points. First, as the character of war continues to change at an increasing rate, so does the demand for logistics. The challenges associated with near-peer adversaries, the complexity of advanced weapons technology, and long external lines of communication are just a few factors driving logistical demands upward. The question we must address is whether future logistical costs are sustainable in scenarios involving large-scale combined arms operations. It will be important that our future warfighting concepts address new ways to deliver lethal effects, but with lessened logistical demands.

The second point I would highlight is the level of competition below armed conflict that we see targeting the JDDE. Revisionist powers clearly recognize the United States' ability to project the Joint Force on a global scale as a distinct comparative advantage, and they are actively seeking to understand, infiltrate, and position themselves to degrade and deny our ability to respond to crisis with joint forces. An adversary's ultimate goal is to win without fighting. Nefarious activities in the cyber domain, infiltration of contract value chains, foreign investment in critical global choke points, attempted erosion of geopolitical access, and development of increasingly potent anti-access/area-denial weapons are clear indicators of adversary intent to impede the U.S. from getting to the battlefield in time or in sufficient numbers to prevail. Revisionist powers are employing a whole-of-government approach to compete, leveraging state-owned enterprises, and do not distinguish between operational systems and DoD logistics or business systems. We should expect potential adversaries to seek the point of least resistance. As a result, we must remain keenly alert to their activity today, and maintain a capable and resilient strategic mobility posture ready to deploy and sustain the Joint Force globally.

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