Air Force
Civil Engineer
By Engineers. For Engineers.
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Engineers key to changing
Overseas Posture

Engineers key to changing overseas posture

As we wrap up the fiscal year, things continue to change not only throughout the Air Force and CE enterprise, but throughout the world. The Air Force continues to adjust to financial constraints, force structure limitations, an uncertain geopolitical environment and challenges to national security. Our installations serve as platforms from which we launch Air Force operations, and our installations abroad are especially important in this time of global instability.

Gen. David L. Goldfein, our new Chief of Staff, described our environment this way: "Today's global landscape offers equal amount challenge and opportunity."

This is exactly what CE is focusing on — new opportunities.

In this issue you will read about the Air Force engineer pivot to the Pacific and the challenges and changes it brings to the CE community. We must increase our base recovery capabilities, use more dynamic basing strategies, create more resilient warfighting platforms and invest in robust and capable partnerships. It is exciting to watch you take to these requirements and create solutions!

You will also learn about the Air Force's infrastructure landscape in Europe and the significant changes it will undergo over the next seven years, reducing how much the Air Force will need to spend sustaining and maintaining infrastructure and allow the Air Force to use its budget to recapitalize and sustain weapons systems, on readiness training and on investing in Airmen's quality-of-life programs.

Over the last 50 years, engineers have been an essential part of Air Force warfighting and have led the way during all of our major conflicts and humanitarian crises. From Vietnam, to Iraqi Freedom, to Inherent Resolve, CE has been there every step of the way, and we will be tomorrow as well. A primary change in the future will be our ability to project more combat power and effects directly from CONUS installations, but that is a topic for another day.

Thank you for all you do every day to ensure the U.S. Air Force is able to project global vigilance, global reach, and global power for America!

Timothy S. Green
Major General, USAF
Director of Civil Engineers

Features

Vol. 24 No. 1 Summer 2016

Sections

From the schoolhouse

I'm an Airman engineer

On the Cover

U.S. Airmen assigned to the Kadena, Yokota and Misawa civil engineer squadrons practice concrete screeding skills using the materials, equipment and methods to repair craters during airfield damage repair training exercise at Kadena Air Base, Japan, Sept. 15, 2016. This process can be done quickly in combat situations so airfield operations can resume. *(U.S. Air Force photo/Senior Airman Stephen G. Eigel)*

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OVERSEAS POSTURE

European infrastructure consolidation

The goal is to reduce expenses without harming the mission

By Ed McCarthy
SAF/IEI Installations Planning Division

The Air Force has an infrastructure problem. "Our installations are too big, too old and too expensive to maintain," Miranda Ballentine, assistant secretary of the Air Force for Installations, Environment & Energy, or SAF/IE, told several congressional committees during the Fiscal 17 budget rollout. For the fifth year in a row, the president's budget has requested authority to execute a new round of domestic Base Realignment and Closure, or BRAC, to allow the Department of Defense to properly align its infrastructure with its force structure requirements and control wasteful spending.

Congress denied the previous four BRAC requests, suggesting that DOD first perform a comprehensive review of its facilities in Europe.

Consolidation's origins

In January 2013, the secretary of defense directed a two-year initiative to assess excess infrastructure capacity in Europe, evaluate military value and political-military value criteria of each installation and develop force consolidation recommendations for approval. The purpose was clear: reduce long-term expenses through consolidation and ensure remaining infrastructure properly supports operational requirements and strategic commitments. In effect, the goals of European infrastructure consolidation, or EIC, were to achieve significant savings by eliminating excess infrastructure capacity, but "do no harm" to Air Force or other services' operations in the process.

While achieving savings and maintaining our commitments to European posture strategy were the touchstones of success for EIC, the wherewithal itself to carry out such a comprehensive consolidation in Europe held significant importance. Some of the major EIC drivers were to demonstrate to Congress that infrastructure reductions result in real savings and that DOD had the capability and processes in place to efficiently consolidate infrastructure.

The first step was to establish service-focused and cross-functional working groups to review and capture consolidation opportunities. The Air Force Working Group included staff from the offices of the SAF/IE assistant secretary; U.S. Air Forces in Europe, or USAFE; the deputy chief of staff for Logistics, Engineering and Force Protection, or AF/A4; and subject-matter experts from several offices throughout the air staff; and potentially affected major commands. From the outset, U.S. European Command, or EUCOM, strategic posture drove decision making.

Selection process

Paramount in EIC analysis and planning were development and use of repeatable, defendable processes that leveraged fact-based requirements and measurable installation attributes to ensure base closure recommendations were logic-driven and supportable. So how did the working group know whether there were opportunities to consolidate without adversely affecting European posture objectives?

Timing is everything

In the midst of the EIC analysis and selection process, Russian forces seized the Crimean peninsula. Did these aggression tactics impact EIC? "When events occurred in the Ukraine, we asked ourselves, 'Should we pause this?'" explained then acting Assistant Secretary of Defense for Energy, Installations and the Environment John Conger. "We weren't talking about reducing our ability to conduct a mission, we were talking about ability to do that same mission for less money. That was an effort worth continuing."

First, the team analyzed infrastructure capacity. Using an enterprise of six main operating bases and six forward operating sites in Europe, the group quantified the requirements of eight operations attributes and six base operating support attributes. By comparing infrastructure requirements to the inventory of infrastructure at both the individual installations and at the enterprise level, the AFWG definitively demonstrated that infrastructure exceeded requirements to the point that consolidations were possible.

To determine which installations should be consolidated, the team assessed comparative military value: measuring the mobility access, communications and intelligence; command and control; contingency response; responsive forces; and logistics support attributes for each installation.

From there, more than 50 consolidation scenarios were developed and reviewed for impacts to operations, bilateral relations and European posture strategy. Finally, as EIC is primarily a cost-saving initiative, a business case for each proposed action assessed the payback that a one-time investment would yield in enduring annual savings. Scenarios that did not generate savings were eliminated from consideration.

Results

Ultimately, the secretary of defense signed off on three Air Force-recommended actions:

- the divestiture of RAF Mildenhall, England, which included relocation of the 352nd Special Operations Wing to Spangdahlem Air Base, Germany; the 100th Air Refueling Wing to Ramstein Air Base, Germany; and the RC/OC/WC-135 Forward Operating Location to RAF Lakenheath, England;
- the divestiture of RAF Alconbury and RAF Molesworth and consolidation of intelligence missions into the Joint Intelligence Analysis Center at RAF Croughton, all in England; and
- a streamlining action at Morón Air Base, Spain, that revised base maintenance contract support and reduced airfield operations from 24 hours daily to eight hours daily, five days a week

These EIC decisions will reduce the Air Force's infrastructure footprint in Europe without reducing mission personnel or number of aircraft.

Operations Attributes	Base Operating Support Attributes
Ramp area and serviceability	Headquarters and contracting (administration space)
Squadron operations	
Hangar capacity	Civil engineering
In-ground fuel hydrant system	Communications
Supply storage	Force support
Aircraft maintenance	Logistics readiness
Hot cargo pad	Security forces
Munitions storage	

1. RAF Mildenhall, RAF Lakenheath, England
2. Spangdahlem Air Base, Germany
3. Ramstein Air Base, Germany
4. RAF Alconbury, England
5. RAF Molesworth, England
6. RAF Croughton, England
7. Morón Air Base, Spain

In total, the Air Force EIC actions are expected to cost nearly $1.1 billion, but are projected to save approximately $280 million per year once implemented. The major driver of upfront costs are for military construction and associated furnishings and equipment for new facilities. EIC actions use existing excess infrastructure, such as vacated facilities, at gaining installations to the extent possible, but still require some mission-specific construction. Even with significant military construction, the savings generated from whole base closures are immense and will support payback of investment costs within a few years.

Challenges and lessons learned

Like any major relocation or bed-down effort, pre-decisional analysis without benefit of installation site surveys and detailed area development plans could only inform so much. The challenge in documenting requirements for EIC in advance of public announcement was further compounded by host nation and geopolitical sensitivities, which limited on-the-ground reviews of existing infrastructure and available construction space.

Because of these planning limitations, pre-decisional analysis provided a consistent, traceable and auditable method of building, evaluating and comparing various scenarios, but it did not contain the analytical fidelity to define EIC budgets. In order to mitigate the financial risk to EIC from these planning pitfalls, the AFWG included cross-functional subject matter expertise and reviewed lessons-learned from BRAC and other bed downs in an attempt to identify and quantify unknown requirements. Despite these efforts, there were still requirements not captured in advance. Subsequently, several funding gaps developed during the first year of implementation.

An EIC colonel's action group and a USAFE-led EIC Program Management Office were established as part of a larger EIC governance structure to validate requirements against budget limitations, review opportunities to use existing infrastructure and help guide relocation of existing infrastructure capacity. EIC governance bodies rejected hundreds of millions of dollars' worth of proposed projects as not absolutely necessary and not within the EIC budget. Civil engineers and project managers from the Air Force Installation and Mission Support Center, the Air Force Civil Engineer Center, USAFE, AFSOC, AF/A4 and SAF/IE worked together to bring operationally viable, within-budget options to the Air Force Civil Engineer Board for final decision-making.

Looking ahead

Congressional interest in focusing on overseas infrastructure reductions before domestic infrastructure reductions might have been the driver for EIC, but the benefits have gone beyond just checking a box for BRAC. Lessons learned in the analyses of capacity, military value and cost/savings will improve future BRAC and strategic basing processes. The Air Force's infrastructure landscape in Europe will undergo significant changes during the next seven years. EIC will reduce how much the Air Force will need to spend sustaining and maintaining infrastructure and allow the Air Force to use its budget to recapitalize and sustain weapons systems, on readiness training and on investing in Airmen's quality-of-life programs.

Editor's note: *Ed McCarthy is an SAIC contractor supporting SAF/IEI Installations Planning Division.*

New SharePoint site helps demystify FE acquisition coding efforts

By Robert Rushing
Air Force Civil Engineer Center

A little over a year ago, the civil engineer community embarked on an effort to bring Air Force civil engineers into compliance with the Defense Acquisition Workforce Improvement Act.

The act required the Department of Defense to establish a process through which the acquisition workforce would be recognized as having achieved professional status through certification. Certification is a process that determines if military or DOD civilians meet educational, training and experience requirements to work in an acquisition field or position.

The acquisition community defines facilities engineering, or FE, as the design, construction and life-cycle maintenance of military installations, facilities, civil works projects, airfields, roadways and ocean facilities. It involves all facets of life-cycle management, from planning through disposal. Their definition aligns with the day-to-day duties of a variety of CE personnel, including those working in design and construction, environmental protection, base operations and support, and housing/real property. As defined above, work carried out each day by civil engineers easily falls within the scope of facilities engineering.

FE acquisition coding certification will put Air Force civil engineers on par with their peers in the U.S. Army and Navy. Acquisition coding and certification is also a requirement laid out in Federal Acquisition Regulations, and the Air Force simply has not been in compliance. Our goal is to ensure all civil engineering interactions with contractors, including acquisitions/contracts are properly executed. In order to accomplish this, we must demonstrate professional acquisition competencies in both the civilian and military engineering workforce.

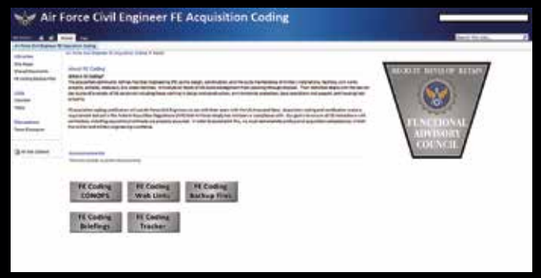
Early in the acquisition coding effort, the Human Capital Panel of the Civil Engineer Functional Advisory Council led a data call to civil engineer organizations to nominate positions for acquisition coding. A small volunteer team led by Zak Payne is working on facilities engineering codes.

During the initial call, more than 1,600 positions were nominated for acquisition coding. These positions went through a rigorous review process to ensure they met the established criteria. All 1,600 positions have finally been reviewed: 408 positions have been coded, 821 positions were disapproved and the remaining 371 positions are awaiting resolution prior to being coded (some positions are military, some positions are bargaining unit/union positions and others are not visible in the Acquisition Career Management System).

To help individuals and organizations keep track of their submittals, the Human Capital Panel Acquisition Coding Working Group has developed a user-friendly SharePoint site (https://afcec-portal.lackland.af.mil/cp/fe/SitePages/Home.aspx) that provides references, a tracker, the FE Coding CONOPs and web links for the acquisition coding program. Most users will find the FE Coding CONOPs to be a one-stop source for information about the acquisition coding effort. The CONOPS was written using information from across DAU, APDP and other sources and arranged to allow individuals and managers to quickly find specific information related to the acquisition program.

The page is set up with five easy-to-read and easy-to-use buttons that allow users to sort through several documents, briefings and web resource links related to the acquisition coding effort. Information is continuously being added to the site. Interested users should subscribe to the site so they can receive email alerts when information is added. The SharePoint site is intended to be the single, authoritative source for acquisition coding efforts and a one-stop shop for individuals and mangers seeking information about the program.

Editor's note: *Robert Rushing is AFCEC's Asset Integration Branch chief. He is a member of the American Institute of Certified Planners and is a Leadership in Energy and Environmental Design Accredited Professional.*



The Air Force Civil Engineer FE Acquisition Coding SharePoint site has five buttons on its homepage, which organize key content and allow users to easily access the information they need for acquisition coding efforts.

OVERSEAS POSTURE

Engineers pivot to the Pacific

By Col. Allen L. Thibeaux
Pacific Air Forces

The Air Force civil engineer pivot to the Pacific means change. Change to recovery capabilities, to more dynamic basing strategies, to more resilient warfighting platforms, to more robust and capable partnerships.

Each of these changes is an exciting challenge to the CE community. There are many drivers behind the U.S. rebalance, including rapid economic change, continued North Korean provocation, competing maritime territorial claims and near-peer military competitors that hold installations at risk.

China, North Korea and Russia are attempting to revitalize aspects of the international order in a manner contrary to international rules and norms. The U.S. seeks to preserve this order, which has been the bedrock for 70 years of peace and prosperity in a region with a long history of unprecedented violence and destruction. Much can be said about the need for change to CE business in the Pacific .

Engineers balance against these potential threats and other future capabilities by continuing to build, sustain and protect combat platforms as CE has for decades. In addition, Pacific engineers pivot to new capabilities and methods. CE is transforming in the Pacific in these key areas:

- **Base recovery**
- **Adaptive basing**
- **Passive defense**
- **Partner nation engagement**

Base recovery
The most significant change to this capability is the new Rapid Airfield Damage Repair system. In its proposed end state, a large RADR kit will allow a few hundred engineers to recover an airfield damaged with more than 100 craters and unexploded ordnance, or UXOs, within eight hours.

The Air Force Civil Engineer Center is fielding the crater repair component in the Pacific while developing technology for airfield damage assessment and UXO removal.

This system, a significant departure from the Rapid Runway Repair capability applied throughout the Cold War, is designed to counter a few large craters and provide for 100 passes over a fiberglass mat. RADR handles a larger volume of small craters and provides for 3,000 passes over a quick-set concrete or asphalt surface. Without this capability, recovery will be measured in days rather than hours if new weapon systems with submunitions are used against our airfields. Such delays will have a massive operational effect.

Adaptive basing
Adaptive basing is an approach to counter Anti-Access/Area Denial, or A2/AD, capabilities by maneuvering combat capabilities among permissive bases (sanctuaries), combat operations bases (limited A2/AD threat) and minimal operations bases (under significant A2/AD threat).

An installation could shift status among permissive, combat and minimal operations as conflict evolves during a campaign. This allows commanders to move combat iron in response to risk to installations and apply that power to effectively remove the threat to the installations offensively. CE will tailor an engineer force to match each installation posture. Planning for this concept is still in progress and presents a significant logistics challenge as PACAF sets the theater to support. The plan likely will require many additional locations that are today inaccessible and poorly provisioned.

Passive defense
There are two changing aspects to passive defense. First, there is greater appreciation for critical infrastructure resiliency. Installations are sensitive to single points of failure for critical assets such as airfield pavements, fuel storage and distribution, communications networks or power systems, to name a few. PACAF submitted 14 projects worth $480 million to improve resiliency for existing facilities and infrastructure to compete in the FY18 military construction program build.

Second, in addition to traditional hardening, the Air Force has been considering the benefit of expedient sheltering. In a draft RAND report, analysts suggest expedient aircraft shelters would complicate enemy targeting and improve survivability for aircraft. The erection and use of hundreds of these shelters present a challenge for engineers as tactics, techniques and procedures, training and plans for the massive labor effort remain unclear and undeveloped.

Partner nation engagement
There are two relationships to build with partner nation engagements that address change in this area of responsibility, both of which are served by the PACAF Pacific Unity engagement program. There is the relationship with the country and the relationship with that country's military.

First, the Air Force fosters goodwill through partnership activity that leads to access and communicates the value of U.S. partnership regionally. PACAF engineers strengthen these relationships through Engineer Civic Action Program activities, total force/joint/multinational construction projects typically providing schools, clinics or community centers.

Next, PACAF engineers engage with their military counterparts as the appetite for engineer capabilities has grown because of the changing security concerns that all of the U.S. allies share. For this, Pacific Unity provides subject matter expert exchanges, workshops, key leader engagements and bi-lateral/ multilateral exercises, demonstrations or training events.

PACAF guides these events toward a mutually agreed end state with capability and interoperability goals tailored to each country's interests. Most Pacific Unity events are executed and led by Air Force civil engineers from base-level units. Thus, military-to-military ties are established at all levels from squadrons to numbered Air Forces to the PACAF Component major command headquarters and above. Dozens of examples abound each year from school construction in Thailand led by the 35th Civil Engineer Squadron from Misawa Air Base, Japan, to the first multilateral Silver Flag class at the Pacific Regional Training Center at Andersen Air Force Base, Guam, with students from Japan, Australia, Republic of Korea and Singapore.

All of this comes at a significant cost. PACAF has requested more than $1 billion in construction to support Asia-Pacific resiliency before beginning to propose a funding strategy for adaptive basing. Preliminary concepts for this strategy will cost billions more and need hundreds (if not thousands) of engineers if RADR, sheltering, fire, explosive ordnance disposal, emergency management and bed down are required at all of the proposed locations.

Since capabilities such as RADR are not portable, a prepositioning strategy will likely be necessary, driving significant cost. There are those who suggest that Chinese Anti Access/Area Denial capability increasingly puts the U.S. on the wrong end of a cost-imposition calculus. The U.S. military should take a hard look at these costs in light of the costs imposed on potential adversaries as it adjusts to these changes.

American military engineers have been making history in the Pacific for decades. Perhaps the most compelling of the many examples is the nine-month SEABEE construction of the world's largest base at Tinian to launch the most devastating attacks of World War II: both nuclear strikes. Military engineers made the most powerful power projection in history possible. Air Force civil engineers will continue to employ these tools and take center stage in executing Pacific Command and PACAF strategies in this area of responsibility.

All of the ways and means in the new PACAF strategy are tied to one or more of the capabilities CE professionals provide. Ours is a growth industry in the Pacific.

Master Sgt. Jeffrey Randall, 8th Civil Engineer Squadron emergency management flight superintendent, removes a wingman's overboots as Republic of Korea Air Force members watch June 8, 2012, at Kunsan Air Base, Republic of Korea. The joint training provides familiarization for both sides on how each other operates in case of a chemical, biological, radiological or nuclear attack. (*U.S. Air Force photo/Senior Airman Brigitte N. Brantley*)

OVERSEAS POSTURE

Supporting the pivot

Engineering improvements tailored to strategic locations

By Maj. Natalie Chounet
Deputy Chief, Basing & Beddowns
AFIMSC Detachment 2

The pivot is an evolution of Pacific theater strategy that will affect airpower.

Pacific Air Forces mission owners have imagined and calculated preventive, offensive and defensive tactics for a variety of scenarios. Offense may be the essence of airpower, but the foundation of airpower is ground support, and engineers with the Air Force Installation and Mission Support Center's Det. 2 specialize in planning ground support. Constructing such foundations is an engineering challenge given the freckles of islands across the vast Pacific, but tenacity has paid off for one location.

Seated at the southern end of the Mariana Arc, Guam has been an ideal stopover since the European sea voyages of the 16th century. The tropical isle serves a similar role for the U.S. Air Force.

"The importance of Guam's mid-Pacific location has not diminished since World War II," said W. Mike Hancock, Det. 2 program manager for Guam development.

Andersen Air Force Base, Guam, has hosted a continuous bomber aircraft presence since 1944 and serves as an operational lynchpin to the western Pacific. The airfield supported flight legs during World War II and later supported the Vietnam War, illustrating the utility of its location. During the Korean War, Guam was used as a behind-the-line maintenance location for aircraft and was the first stop for many U.S. evacuees from the Philippines immediately after the eruption of Mount Pinatubo.

The strategic importance of Guam extends beyond the Pacific theater. During Operation Enduring Freedom, for example, the airfield served as a trans-Pacific air bridge to deliver aircraft to the Mideast. Fewer than 4,000 miles southwest of the Hawaiian Islands and 1,500 miles east of the Republic of the Philippines, the island has proven to be a strategic stronghold over the years.

Det. 2 program managers began evaluating the location's capabilities to support the next evolution of operational strategy nearly 15 years ago. The result is a meticulous composition of large-scale construction, repairs, improvements and additions to keep the airbase vital. Recent years have seen expanded aircraft parking areas, improved flying operations facilities, repaired aircraft and weapon maintenance facilities and new aircraft hangers with the latest technology in protection design.

Proposed improvements include new command facilities, maintenance storage facilities and infrastructure protection systems. Along with additional mission space, community support proposals include expanding lodging facilities and adding a dining facility to serve the growing number of Airmen on the island.

The Guam improvements are in support of evolving regional security strategies for the theater.

With escalating regional tensions in the Pacific and continued political strain between the Democratic People's Republic of North Korea and Republic of Korea, Guam serves as a bedrock of stability for the U.S. and its partner nations.

As Andersen AFB's 70 years of history illustrate, the utility Guam provides for Air Force global reach is undeniable. It will continue to be a bastion of Pacific airpower primed and prepared to prevail.

(*above*) A U.S. Air Force B-52 bomber is parked on Andersen AFB, Guam. (*U.S. Air Force photo/Senior Airman Alexander Riedel, 36th Air Wing Public Affairs Office*)
(*below*) Andersen Air Force Base, Guam, has hosted a continuous bomber aircraft presence since 1944 and serves as an operational lynchpin to the western Pacific today.

Arctic construction efforts heat up with plans to house F-35 squadrons

By Maj. Natalie Chounet
Deputy Chief, Basing & Beddowns
AFIMSC Detachment 2

Air Force Installation and Mission Support Center Det. 2 has a new office name, but carries the responsibility of supporting Pacific Air Forces' operational requirements by providing planning and programming support for new missions arriving at main operating bases as well as other locations throughout the theater. Far from the Pacific Headquarters building in Hawaii, and a world away in climate, the Air Force mission at Eielson Air Force Base, in the frozen north of interior Alaska, will be expanding at this decade's end.

In addition to its existing F-16 fighter aircraft, the base will be home to two F-35A Lightning II squadrons. The additional aircraft will double the number of fifth-generation fighters in the region, providing increased survivability and battlespace awareness, according to former Air Force Chief of Staff Gen. Mark A. Welsh III.

The expected arrival of the squadrons in 2020 and Alaska's short summer construction seasons combine to create a tight deadline to develop and execute planning requirements.

Despite the challenging timeline, Det. 2 basing and bed-down planners partnered with Eielson's 354th Civil Engineer Squadron to execute an aggressive approach to deliver much-needed airfield and operational expansions to the base.

"Alaska may be the largest state in the nation, but available space for the added flying mission and associated support 'tail' is limited," said Jim Farris, Det. 2 Site Activation Task Force member. "The existing airfield geometry and support requirements for fifth-generation fighters negate the possibility of 'double bunking' new aircraft within existing hangar space," driving the need for additional facilities.

(above) **Aircraft representing the U.S. Air Force, U.S. Marine Corps, the Republic of Singapore Air Force and the Japan Air Self-Defense Force sit on the tarmac June 7, 2016, during RED FLAG-Alaska 16-2, at Eielson Air Force Base, Alaska. RF-A enables joint and international units to sharpen their combat skills by flying simulated combat sorties in a realistic threat environment. (*U.S. Air Force photo/Tech. Sgt. Steven R. Doty*)**
(below) **U.S. Marine Corps F-18 Hornets assigned to the Fixed Marine All-Weather Fighter Attack Squadron 242, Marine Corps Air Station Iwakuni, Japan, are prepped before a flight on June 7, 2016, during Red Flag-Alaska 16-2 at Eielson Air Force Base, Alaska. This exercise provides unique opportunities to integrate various forces into joint, coalition and multilateral training from simulated forward operating bases. (*U.S. Air Force photo/Airman Isaac Johnson*)**
(facing page) **Borrow pit operations begin early in the construction season at Eielson Air Force Base, Alaska. (*U.S. Air Force photo/354th Public Affairs Office*)**

The short construction season will be busy: Crews will put hammers to nails to complete eight military construction projects and five major sustainment, repair and modernization facility projects in the first phase.

Providing heat in all the facilities also challenged the team. One proposal is to extend existing steam piping to the "South Loop" development area instead of constructing an additional steam plant. The 11,000-foot utility corridor extension is the most cost effective, utilizing existing manpower, causing marginal increases in maintenance and netting overall cost savings projected to be $150 million during the 30-year life of the system. Additional ideas under consideration include an alternate electrical distribution design to minimize specialized transformer and fixture costs.

The team also is brainstorming ideas for other functional areas, including munitions operation areas, flight simulator training requirements and increased community service requirements. Community support facilities anticipate an increased demand when the additional 2,000 active-duty members and their families arrive in the Last Frontier. An additional satellite dining facility was chosen as the best solution to provide Airmen easy access to hot meals in arctic conditions in the new mission areas. Available local community housing is expected to stand up to demand for additional units while on-base schools are expected to see large increases in enrollment. Newly constructed school-age and medical facilities will expand the existing support footprint to accommodate the new population.

Editor's note: *Chounet is the deputy chief of basing and bed downs for AFIMSC's Det.2.*

Out of sight, not out of mind:

Military design and construction overseas

By Benjamin Kindt
Air Force Civil Engineer Center

Living and working overseas is a dream to many — seeing ancient sites, meeting new people and being immersed in fascinating cultures are attractive to us. Beyond the limelight of living overseas, beyond the tourist sites and beautiful countryside, Air Force civil engineers work tirelessly at foreign locations day in and day out to maintain our infrastructure, assist our allies and adapt to the unique challenges that emerge from working overseas.

On the surface, many would think that operating an Air Force installation overseas would be similar to one in the United States. Host nations — foreign countries in which U.S. Air Force installations are located — and the U.S. have numerous, complicated agreements between them. These agreements dictate everything from legal rights of Airmen in the respective country to the proper design standards that must be incorporated in new facility construction.

Most commonly seen in Status of Forces Agreements and Defense and Economic Cooperation Agreements, these arrangements add an additional and complex layer to design compliance. The designer must not only design to Air Force standards, but also know and incorporate the host nation's laws, the rules dictated by agreements and, if necessary, add NATO standards.

"In Germany, the installation needs permission from the German federal group in charge of design and construction to execute any projects over a small threshold," said David Ferry, Europe design and construction branch chief for the Air Force Civil Engineer Center Facility Engineering Directorate. "Each local national employee also requires access to a window — a requirement unique to Germany. This is the kind of country-specific rule you have to remain aware of to ensure you are in compliance."

The complexity of working overseas is compounded by the limited international experience of U.S. personnel stationed there because of required rotations. Known as the "five-year rule," U.S. military personnel cannot spend more than five years overseas without returning and holding a position in the U.S. for one year.

Stateside, you will find staff on site with 10 or 20 years' experience; that is never the case at one of our foreign bases. Frequently rotating staff, constant ramp-up, loss of valuable coworkers and reinventing the wheel are tiring for the international staff and host nation partners. Even if the leadership team can identify a potential applicant already stationed in their respective country, filling that role is hampered by rules that cause that new applicant to lose his or her Living Quarters Allowance if he or she is not coming from the U.S.

In some locations, long-tenured and experienced host nation partners can help with the ramp-up and preservation of intellectual capital, but many times it is the burden of the new staff to learn on the job and ensure the mission isn't affected by the change.

Additionally, the geography and ways of doing business are different. In Korea, Japan and the Pacific islands, there are expansive former battle sites with the potential for unexploded ordnance, or UXO —a significant concern when developing a site or conducting exercises.

"In Guam, construction costs in 2015 have seen increases averaging 35 percent to satisfy the safety requirements that UXO poses. Clearing these massive sites are a large cost burden that must be incorporated into all estimates," explained Michael Nii, Pacific design and construction branch chief for AFCEC's Facility Engineering Directorate.

Equipment choices can also change dramatically based on location.

"Many Pacific islands have climates with lots of salty, humid air — perfect to corrode metal. While a standard issue air conditioner unit might be fine in Phoenix, using that same air conditioner in Okinawa could see its functional life cut in half due to accelerated wear and tear," said Col. Scott Warner, Pacific division chief for AFCEC's Facility Engineering Directorate.

Engineers designing facilities in these locations must use their knowledge of the local area to select equipment that can survive in dramatically different environments and conditions. Foreign currency rates also change, sometimes rapidly, but the funds appropriated to execute projects does not. When currency prices change, project teams have to adjust on the fly to ensure that the mission succeeds.

Another obvious burden is that everyone else is very far away. Referred to by Warner as "the tyranny of time and distance," the dramatic time zone differences makes coordinating events, attending meetings and conducting site visits a burden.

"Being in Hawaii, no one is close to us (in time zone) except Alaska. Everyone else is five or six hours earlier or later — even a full day ahead. Getting anything done in Japan or Korea on a Friday is problematical; our Friday is their Saturday."

Overseas staff routinely participate in meetings at odd hours — from early morning to late at night— because that is what it takes to be available to speak with on-site staff, leadership at AFCEC or to report to the Pentagon. Travel arrangements are much more challenging because of longer transit times, higher costs and sometimes intermittent availability. To go to Wake Island in northeastern Micronesia for a day requires a two-week stay because of infrequent flights to the western Pacific region.

These challenges do not stop our men and women abroad from getting the job done, and many appreciate the unique opportunities overseas duty brings.

"If you like easy, this is not the place to be," Warner said. "If you like challenging and interesting, there is no other place you'd rather be. The different environments, interesting people and dynamic problems all make for a great place to live and work."

Ferry shared similar sentiments.

"I've never felt more connected to the operational mission of the U.S. Air Force than when I have been stationed overseas. We have the privilege of being the face of the Air Force to the world while solving new and complex problems every day," Warner said. "I work with phenomenal people -- both Americans and our allies -- and learn about how they do business. I get to learn about this country and can see exactly how we're impacting the mission abroad. I can't ask for anything more."

Editor's Note: *Kindt is the chief of AFCEC's Facility Engineering Directorate Standards and Evaluations Branch.*

(*facing page*) A tactical missile maintenance facility is being constructed on Andersen Air Force Base, Guam, in support of Asia Pacific Resiliency. (*U.S. Air Force photo*)

PHANTOM LOADS

a monitor cost analysis

By Capt. Shane Veitenheimer
1st. Lt. Chad Martel
1st. Lt. Corey DeGroot
1st Lt. Chris Twigg
and Brian Allen
Air Force Institute of Technology

In today's fiscal environment, it is no surprise that Air Force units from headquarters to the flight level are talking about energy conservation.

As Secretary of the Air Force Deborah Lee James has said concerning responsible and productive use of resources, "A little bit from each of us can really become something very, very significant."

Former Chief of Staff of the Air Force Gen. Norton A. Schwartz, in delivering his 2010 speech "Energy as an Operations Enabler," urged our entire military force to "inculcate the notion of energy efficiency as a strategic imperative." Similar notions of energy efficiency permeate our doctrine, guidance and directives. Energy conservation efforts are here to stay, and an extremely avoidable cause of energy waste is the presence of phantom loads on our base power grids.

Phantom loads occur when unused appliances remain plugged into power outlets. Although appliances may appear to be idle or even off, they require power for minimal features such as digital clock displays, remote control infrared sensors or standby modes. The range of watts appliances consume while not in use vary from fractions of watts to tens of watts, which can lead to a large amount of energy consumption over time.

This unnecessary energy consumption has encouraged many electricity suppliers to initiate campaigns to encourage consumers to disconnect idle appliances. An estimated 10- to 33 percent of home energy bills can be attributed to phantom loads. Solutions include traditional or "smart" power strips, which can easily isolate several items simultaneously, as well as physically unplugging rarely used items.

Our study, initiated by the 88th Air Base Wing's energy office on Wright-Patterson Air Force Base, Ohio, aimed to estimate the potential monetary savings of a similar energy conservation initiative. The Un-Plug It campaign aims to increase the number individuals on base who turn off or unplug energy consuming devices over extended weekends, so long as the devices are not connected to the AFNET network. Due to their prevalence in Air Force buildings, and the fact that they are non-network devices, the scope of the research was limited to estimating the savings associated with computer monitors. Prior to long weekends, wing leadership promotes the Un-Plug It campaign. With regards to computer monitors, recipients are encouraged to physically turn off all monitors, not to unplug them, before leaving for the weekend.

To estimate the potential monetary savings of the Un-Plug It campaign, the research team chose to conduct a Monte Carlo simulation. This technique enables the input of point estimates and probability ranges into a mathematical equation. This equation is then calculated for a large number of iterations, each with a slightly different yet equally valid outcome. This variation of outcomes is due to the inclusion of probability distributions, and is one of the simulation's greatest strengths. When compiled together, these outcomes result in a probability distribution of potential outcomes, for example, we are 95 percent confident that you could save between $10 and $100. The simulation is an iterative process, being run for as many trials as necessary to achieve the desired level of fidelity in the output probability distribution.

For this research, a field study was conducted on an arbitrary weekend to determine the wing's baseline energy conservation habits, for example, the percentage of monitors that were turned off. This data was used as a benchmark, and enabled researchers to estimate additional money saved as a result of the Un-Plug It campaign. Utilizing the Rule of Five to capture the median with high confidence, five facilities owned and operated by the 88th Air Base Wing were randomly selected for inclusion in the study.

Un-Plug It campaign daily savings per 100 people

	Powered off	Unplugged
Normal weekend day (field study participation rates)	$0.009-$0.1252	$0.0614-$0.4528
Campaign weekend day (80 percent participation)	$0.017-$0.2106	$0.1172-$0.7564

The same field study, in conjunction with an estimate for the wing's population size provided by the 88th Force Support Squadron, also enabled researchers to estimate the total number of monitors utilized by the wing. A second field study was conducted in which five different models of computer monitor were connected to a data logger in order to measure each monitor's power usage while on, in sleep mode and off. These monitors were randomly selected from the monitors found on the AFIT campus.

The measurements from each study were used to create individual probability distributions for the variables to be included in the simulation. These distributions, in conjunction with the current energy rate ($0.067 per kilowatt-hour) provided by the energy office, were then used to create the Monte Carlo simulation to determine the range of Un-Plug It campaign savings.

The baseline field study showed between 32 and 54 percent of personnel participate and turn off their monitors on normal weekends. This established normal weekend savings ranges shown in Table 1. The results for a potentially more successful extended holiday weekend, using an estimated 80 percent campaign success rate, are also shown. The potential savings for a modified Un-Plug It campaign in which personnel are instructed to physically unplug the monitor also were calculated.

The saving ranges in Table 1 were calculated on a per-day rate (24 hours). As it stands now, the Un-Plug It campaign only shows marginal cost savings. Assuming a total of 36 long weekend days per year for the 10 federal holidays (Saturdays and Sundays associated with each federal holiday plus an estimated six family days), Wright-Patterson could expect long weekend phantom load monitor savings between $140 and $1,750 annually as the campaign currently stands (i.e. simply hitting power off). However, should the campaign guidelines be altered to have personnel physically unplug the monitors, the savings could climb to between $970 and $6,260 annually, not including standard weekend efforts.

These numbers may seem discouraging when compared to the average Air Force base's multi-million-dollar annual budget, but a few things should be kept in mind.

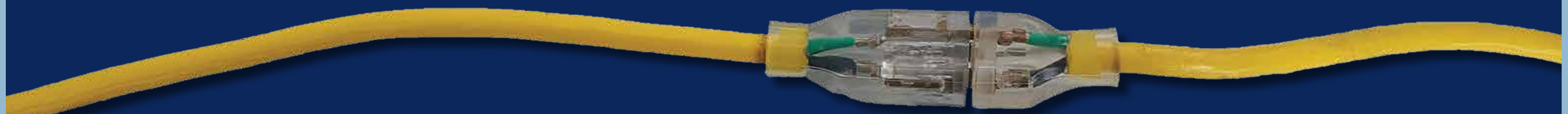
First, this study included only computer monitors, which are one small portion of the eligible electrical office equipment found in an average base facility (e.g. printers, display televisions, projectors, speakers, coffeepots and microwaves).

Second, the campaign was advertised only to Wright-Patterson AFB personnel. Should additional bases be included, one would likely see a significant increase in potential annual savings.

Third, it is this research group's opinion that the Un-Plug It campaign and similar initiatives have a greater effect on the Air Force enterprise than can be captured in a single research project.

While the monetary savings may be seen as negligible, the fact remains that our total force is being moved toward making energy efficiency and conservation an operational priority. Being environmentally and energy conscious is a mindset that must be adopted entirely, not a trend that can be applied when and if the monetary benefits deem it worthwhile.

The potential monetary savings of the Un-Plug It campaign and similar initiatives may seem insignificant when viewed individually, but if from an enterprise perspective, the monetary, social and cultural impact could very well have a significant impact.



from the SCHOOLHOUSE

Photovoltaic pavements

new technology may answer concerns about energy security

By Capt. John Nussbaum
Air Force Institute of Technology

Historically, only two things have been required to sustain an Air Force installation: a runway and water. However, the increasing dependence of every system operated by the Air Force has led to a third critical capability: power.

Civil engineers who've been in a weather-related or other disaster will say one of the most strenuous tasks is sustaining base power during outages. During emergencies, power goes to mission-critical facilities that are supported by costly and laborious standby generators. Although this has been the system for years, recent experiments by the Department of Homeland Security indicate generators can be knocked offline in a cyber-attack, representing an energy security concern beyond just the reliance on externally sourced power from the grid. The emerging market of photovoltaic pavement technologies may present a solution.

A controversial idea from inception, these systems have been in development for nearly a decade. Three major global manufacturers are testing and refining the technology: Solar Roadways Inc. of Sandpoint, Idaho; the SolaRoad Consortium of Amsterdam in the Netherlands; and Colas' WattWay system of France.

A horizontally placed photovoltaic cell with a thick plate of textured glass on which people, bikes, cars and potentially planes move will never be as efficient, per square foot, as a traditional field array of photovoltaic panels. This is the main argument against photovoltaic pavement, and it is accurate. However, those who look at per-square foot efficiencies are missing a few critical points in a potential application for DOD installations.

First, the systems are far more space efficient. A traditional photovoltaic array takes up acres of space only to have a few thousand square feet of photovoltaic cells. For example, the photovoltaic array built adjacent to the U.S. Air Force Academy in Colorado Springs, Colorado, is approximately 20 percent space efficient when we compare the actual square footage of photovoltaic cells to the acreage required for the array. The current SR3 product from Solar Roadways Inc. is 94 percent space efficient per unit, and the units are placed nearly adjacent to each other. Even with a 1-inch gap between them and allowing for potential expansion and contraction, the product is still estimated at over 80 percent space efficient, which is four times the space efficiency of a traditional array.

Second, few DOD installations have massive swaths of vacant, unprotected land to dedicate to a traditional, large photovoltaic array. Of those available, many are already being turned into traditional arrays through public-public/public-private partnerships. However, DOD mandates for renewable energy production are increasing, and traditional arrays are not an option at some locations. This means other technologies must be considered. Rooftop arrays often are viewed as the next best option. However, the average Air Force facility was not constructed with the intent of having thousands of pounds of dead load on its roof. The structural upgrades required not only are cost prohibitive but also could cause the facility to be closed while upgrades are installed. Not many wing commanders are keen on losing hangars for months to put up a rooftop system.

Pavements must be replaced at the end of their lifecycle. The cost for this is already accounted for in DOD budgets and schedules. The WattWay system can be laid directly on top of an existing pavement similar to a laminate with nearly no modification. Both the SolaRoad and Solar Roadways products require extensive modifications and custom foundations. Any of these systems can be incorporated into regularly scheduled road surface replacements so as to minimize mission effects, but there are associated costs.

However, cost and value are not necessarily synonymous. All of these products could provide something currently unavailable to the majority of installations: energy security. Current stand-by generators require fuel, high levels of maintenance and have other vulnerabilities. Replacing these with a system of photovoltaic pavements eliminates the fuel supply chain and associated costs, reduces the workload on an already extremely stressed workforce, and they're not easily hackable. Admittedly, they'll require energy storage systems such as facility-sized battery banks, but this technology is rapidly improving.

Data from Altus Air Force Base, Oklahoma, a small installation, details that the standby generators consume nearly 388 gallons of diesel fuel per hour to provide just over 6 megawatts of available power. The actual demand is lower than this capacity as none of the generators are used to peak-load capacity to avoid damaging them. At current fuel costs near this installation, that's over $830 per hour to provide power to mission-critical facilities, or more than $20,000 a day.

Real property data shows that Altus has over 3.4 million square yards of paved surfaces. However, for safety and convenience, we will just look at replacing the 89,383 square yards of sidewalks, which equates to a capacity of 8.97MW of potential, assuming 15 percent power efficiency and 80 percent space efficiency.

Using the solar insolation data available from the NREL TMY3 dataset and PV Watts Calculator and making a few educated assumptions (shading losses set to 20 percent and an inclination of zero degrees), we find that annual production of a sidewalk-only photovoltaic pavement array would produce over 9.97 gigawatt-hours of energy per year. Even if we increased the shading to 50 percent, this sidewalk array would produce over 6.17 GWh per year. This could provide the same power capacity as the generators for 42 days with no fuel or maintenance required if an appropriately sized battery bank were available. That's a savings of $840,000 in diesel fuel costs alone.

This, however, doesn't count for second- or third-order effects that the capabilities of some of these systems offer. Integrated LEDs could eliminate the need for the $900,000 spent in fiscal 2015 replacing paint markings alone. The self-heating capability could eliminate the need for costly snow and ice removal operations, which regularly pull manpower out of other shops, causing base-wide impacts, not to mention the material and equipment costs.

The potential for energy security should be enough to pique interest in developing this emerging technology. Admittedly, it has many hurdles to surpass. However, the test roads implemented in the Netherlands and being rolled out in France are helping to explore the concept's potential.

The Solar Roadways product still has to jump a few Department of Transportation hurdles, but negotiations are nearly complete for a cooperative research and development agreement between the company and the Air Force Institute of Technology to help test the product and identify its potential.

Emerging technologies will draw naysayers, but for photovoltaic pavement systems, the potential is clear. Further investigation will prove if they're worth the cost.

Editor's note: *Nussbaum is an engineering management graduate student.*

(*From top*) Solar Roadways Inc.'s SR3 model product. The SolaRoad Netherland Demonstration Bike Path in Amsterdam. WattWay system from Colas. (*Courtesy photos*)

from the SCHOOLHOUSE

Stay safe when working in dusty areas

By Capt. Mark Johanning
and Capt. Craig Poulin
Air Force Institute of Technology

What is silica dust?

Silica is the common name for silicon dioxide, a chemical compound most often found in nature as quartz. Crystalline silica, the molecular structure of the most common forms of silicon dioxide, is of particular interest to civil engineers

In most regions of the world, silica is the primary constituent of sand. Additionally, many varieties of rock (such as granite, sandstone and shale) include silica, commonly in the form of quartz. In the construction industry, silica is a major component of Portland cement, the basic ingredient in concrete, stucco, mortar and grout.

Construction activities are a common way to release small particles of silica into the air. When these particles are small enough to be inhaled, the silica is said to be respirable.

A real danger

Exposure to silica is a serious hazard that affects more than 2 million workers in the U.S. Exposure can come from drilling, sawing, grinding or crushing materials. Risk areas for CE Airmen include cutting or drilling through concrete or masonry blocks, grinding materials with a grinding machine and demolition work.

Breathing in silica dust can lead to severe illnesses such as silicosis — in which silica particles scar the lungs, reducing their capacity to contain oxygen. Over time, this can lead to further issues such as lung cancer — somewhat similar to how breathing in asbestos fibers can lead to mesothelioma.

The dangers of asbestos are well known to our Airmen, but many are unfortunately unaware of the dangers posed by silica.

OSHA's new rule

In a final rule published March 25, OSHA amended its standards for occupational exposure to respirable crystalline silica. The rule took effect June 23 and includes two provisions, one for construction and one for general industry and maritime. Construction activities have one year to comply. General industry and maritime activities have two years.

Like other hazardous substances, OSHA limits workers' exposure to silica by specifying a permissible exposure limit. Employers must limit worker's exposure to this number, as averaged over an eight-hour workday. PELs are generally given in parts per million or micrograms per cubic meter. OSHA's new guidance sets the limit for respirable crystalline silica to 50 micrograms per cubic meter, averaged over an eight-hour shift.

Proper protection

There are a variety of ways to provide protection while working around crystalline silica dust.

Construct engineering controls: utilize water (i.e., wet saw) to help keep dust levels down while working or a vacuum, exhaust hood or equipment shroud to physically keep dust away from Airmen.

Implement administrative controls: Limit the time Airmen perform tasks exposing them to respirable silica to reduce their overall hazard exposure.

Wear personal protective equipment: Utilize National Institute of Occupational Safety and Health-approved respiratory protection with a minimum assigned protection factor of 10 or higher.

Calculating exposure levels - Unless denoted, each OSHA permissible exposure limit is based on an eight-hour workday. When exposure is less than or greater than eight hours, a time-weighted average must be calculated to assess the risk.

What should Airmen do?

Ideally, worksites and practices should be tested to ensure that the permissible exposure limit is not being exceeded. But for many construction sites, regular sampling and testing in a laboratory is not feasible.

To address this limitation, OSHA created a table listing 18 common construction work activities that expose workers to respirable silica dust. The table includes equipment and tasks such as stationary masonry saws, jackhammers, handheld powered chipping tools and heavy equipment vehicles used to fracture silica-containing materials.

For each activity, the table provides requirements for protecting workers through engineering controls, administrative controls and personal protective equipment. If an employer does not meet the requirements listed in the table, silica dust must be monitored to ensure exposure does not exceed the limit.

The full table can be found in OSHA regulation §1926.1153 Respirable crystalline silica.

The section of the table below applies to any Airman using a handheld power saw to perform construction activities on materials containing silica — for example, cutting CMU block. For this particular operation, the Airman must be protected with the following methods:

- An integrated water delivery system (i.e. wet saw) is always required to keep dust down
- If working outdoors, personal protective equipment is required only when working for more than four hours
- If working indoors or in an enclosed space, personal protective equipment is always required

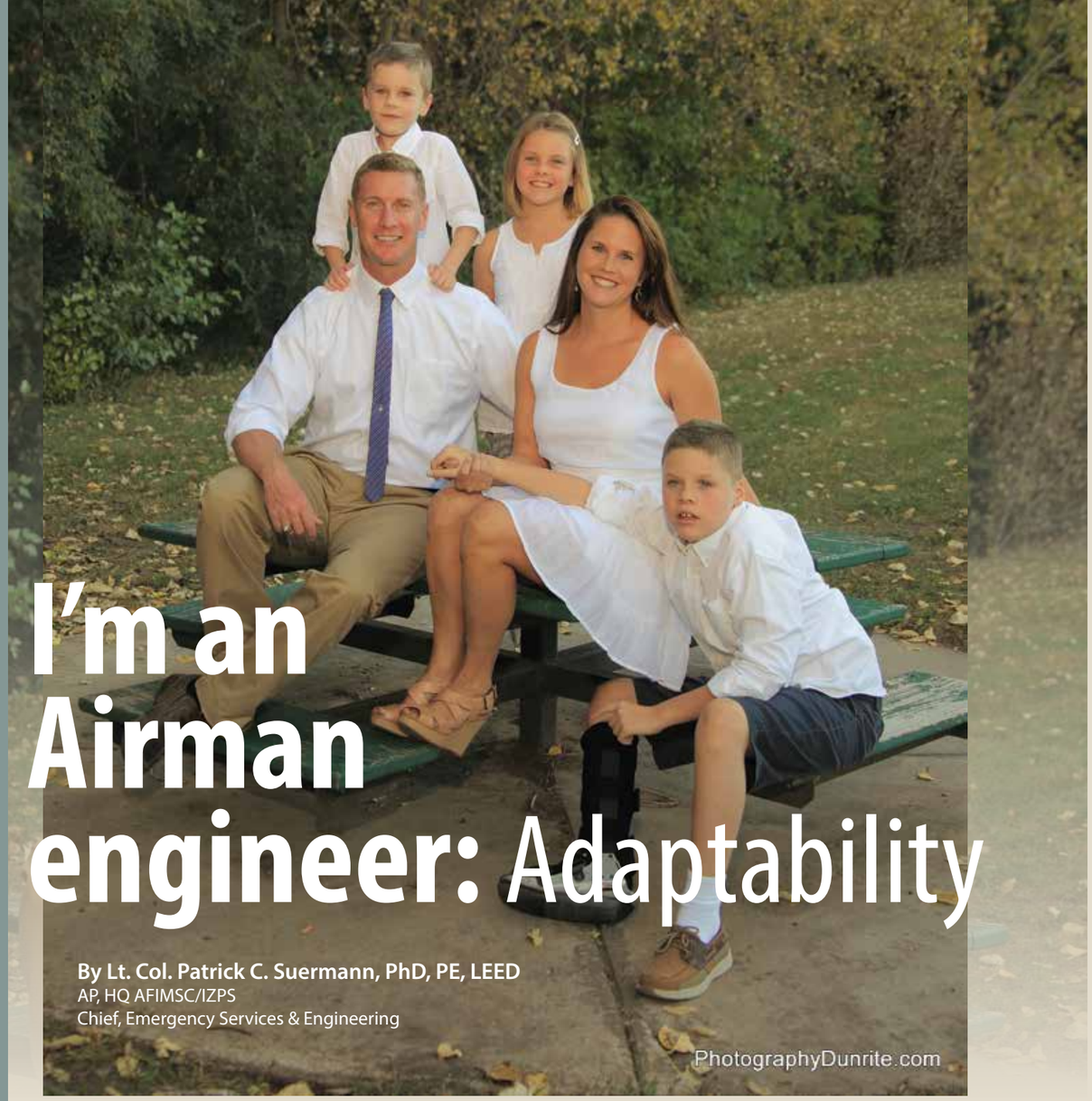
Employers must either provide these protection methods or ensure proper testing and monitoring of employees.

Bottom line

The dangers of working in dusty environments are well known. We must protect Airmen when they are exposed to crystalline silica. It does not matter how big you are, or how tough you are — repeatedly working around silica dust, while unprotected, could have serious repercussions later in life.

Editor's Note: *Johanning and Poulin are instructors at the Civil Engineer School of the Air Force Institute of Technology, Wright-Patterson AFB, Ohio. Both are OSHA outreach trainers, authorized to offer OSHA 30-hour courses in Construction Safety. Units interested in offering the WMSS 632 course at their installations should contact the AFIT Civil Engineer School through the course website at http://www.afit.edu/CE. For more information on the dangers of silica, go to https://www.osha.gov/silica*

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 HOURS/SHIFT	> 4 HOURS/SHIFT
(ii) Handheld power saws (any blade diameter)	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions,		
	- When used outdoors	None	APF 10
	- When used indoors or in enclosed area	APF 10	APF 10



I'm an Airman engineer: Adaptability

By Lt. Col. Patrick C. Suermann, PhD, PE, LEED
AP, HQ AFIMSC/IZPS
Chief, Emergency Services & Engineering

PhotographyDunrite.com

Adaptability. If you applied to the Air Force Academy in the 1990s, they asked you to write an essay about one word that described yourself, and that is the word I chose. I had already lived in about 11 places in my 17 years of growing up as an Army brat, and it seemed like the right word to describe both me, as well as the Air Force, which was undergoing its largest transformation since World War II. Gone were SAC and MAC, and the newly formed ACC and AMC Headquarters were finding their way (among others). Not dissimilarly, the Air Force is undergoing another major transformation now as it is decreasing installation and mission support functions at major commands and centralizing them at the Air Force Installation and Mission Support Headquarters. It seems like a fitting time to go back to that word: *adaptability*.

Growing up in a military family requires adaptability. In today's climate, people more aptly call this "resiliency." You get accustomed to new schools, new teachers and new ways to spell your name on moving boxes every year to three years. And so, like my mother and brother before me, I moved in the summer before my senior year of high school from Wilmington, North Carolina (where my dad was the Wilmington district engineer), to Carlisle, Pennsylvania (where my dad was going to attend the Army War College). I adapted by joining the football, swimming and tennis teams to meet new friends. I was excited that my essay about adaptability must have worked: I was accepted to the Air Force Academy in December of my senior year … and my spring semester calculus grade probably reflected that!

Growing up in a military family requires adaptability. In today's climate, people more aptly call this "resiliency."

Fast forwarding four arduous years, I made it through. I went from failing the physical fitness test to getting a perfect 500. I went from bombing "Thermo" quizzes to the superintendent's list. I was most proud that I was the highest-ranked cadet going into the Air Force as a civil engineer officer. That was until I got to my first base and realized that I had very little idea of what a CE officer actually did. Adaptability to the rescue, once again.

While then-Maj. Patrick Suermann was stationed at Thule Air Base, Greenland, on an unaccompanied tour as the 821st Support Squadron Commander, his wife, Megan, was in San Antonio, Texas, finishing her master's degree in special education. (*photo provided by author*)

Fast forwarding to 2005, my wife, Megan, and I were back at the Air Force Academy, this time I was an assistant professor. I had high hopes of going to a RED HORSE unit or a chief of ops position oversees in Europe. However, around the same time, we finally got an answer for why our son Drew, who had been developing well until he was 1 year old, had actually regressed in the last 18 months – he was diagnosed with autism. As Drew lost more speech than he gained until he actually ceased talking altogether, I had a hard time employing my favorite word that had gotten me through so many other challenges in life. Adapting to this "new normal" was the hardest thing I ever endured.

Luckily for me, I have a great wife. Megan threw herself into learning everything she could about autism. In order to stay in the States, I applied for and was accepted for the Academy faculty preparation PhD program and was attending graduate school again. For as hard as I was working at my PhD, I think Megan and Drew were working harder to learn what worked for him and how to best help him become the best version of himself; all while trapped inside the cognitive disability that was rendering him unable to communicate with the outside world. The real turning point was when my wife went back to school while I was in Afghanistan and then Greenland and she finished her master's degree in special education. Later, she would go on to earn her Board Certified Behavior Analyst certification. For as little as known about autism, Megan accomplished every degree and certification you could master on the subject. Megan did not only "adapt" — she overcame.

Drew is a happy 13-year old now. He cannot do all the things his peers can, but he's forging new paths every day and doing typical things that 13-year-old boys do. He loves the Texas outdoors and eats like a horse. We are constantly on him about cleaning his room or deleting things off our phones and iPads. But, I cannot imagine life without him, his sister, Isabelle, or our other son (who also has autism), Jack.

And so it goes too, for those afraid of the change that comes with "the largest change in the Air Force in 20 years," HQ AFIMSC. You learn, you work hard, you adapt – you overcome. Drew and Megan taught me that.

U.S. Airmen assigned to the Kadena, Yokota and Misawa civil engineer squadrons practice concrete screeding skills using the materials, equipment and methods to repair craters during airfield damage repair training exercise at Kadena Air Base, Japan, Sept, 15, 2016. This process can be done quickly in combat situations so airfield operations can resume.
(*U.S. Air Force photo/Senior Airman Stephen G. Eigel*)

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