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Vol. 69, No. 3 | Arnold AFB, Tenn. | February 7, 2022

Virtual reality capability used during sensor validation in AEDC test cell

By Deidre Moon
AEDC Public Affairs

When performing sensor validation tests in the Arnold Engineering Development Complex Sea Level Test Cell 1, or SL-1, last summer, AEDC engineers at Arnold Air Force Base had the opportunity to view in nearly real-time a three-dimensional representation of the test hardware and support systems using virtual reality.

The VR capability was provided by Augmntr, Inc., a Colorado-based company that specializes in augmented reality and virtual reality display technologies, through a Small Business Innovation Research project.

"In early 2018, we submitted an SBIR proposal for the development of the Virtual Test Cell Presence System (VTCPS), and we were fortunate enough to be one of the selected companies," said Lafe Redd, a cofounder of the company. "To date, we have supported five Phase I and two Phase II SBIRs serving the U.S. Air Force, U.S. Special Operations Command, the Defense Health Agency and the

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Lafe Redd, co-founder and CEO of Augmntr, wears a headset to view the Sea Level Test Cell using the virtual reality (VR) capability of the Virtual Test Cell Presence System (VTCPS), as preparations are made for a run of a General Electric F404 engine for sensor testing June 15, 2021, at Arnold Air Force Base. The VTCPS is a Small Business Innovation Research project with a goal of providing a VR capability to view test hardware and support systems in 3D in nearly real time. *(U.S. Air Force photo by Jill Pickett)*

AEDC engineers assist with SBIR effort researching noise reduction of aircraft engines

Dr. Tom Jenkins, left, president of MetroLaser, Inc., explains to Dr. David Mayo, with the Naval Air Warfare Center Aircraft Division, how the cameras are adjusted to best capture the particulates of exhaust from an aircraft engine as they are influenced by a laser field in order to create a 3D model of the velocity of the exhaust during a break in testing of the measurement system Nov. 18, 2021, at the Propulsion Research Facility. *(U.S. Air Force photo by Jill Pickett)*

By Deidre Moon
AEDC Public Affairs

Through a Small Business Innovative Research contract awarded to MetroLaser, Inc., by the U.S. Navy, a system is being developed to measure the gas velocity of engine exhaust to help find ways to reduce noise from aircraft.

Bernie Williamson, Air Force project manager, explained that in November the MetroLaser team used the J85 engine testbed maintained by Arnold Engineering Development Complex at the University of Tennessee Space Institute's Propulsion Research Facility near Arnold Air Force Base, Tenn., to study its three-component planar Doppler velocimetry, or PDV, measurement system for optical, non-intrusive measurements of gas velocity in the exhaust of an engine.

Members of MetroLaser and the Navy have collaborated on several other programs with AEDC, which helped them in deciding to use the PRF for this particular research.

"The engine testbed facilities at the Propulsion Research Facility have been vital to the success of the MetroLaser SBIR program," said Dr. David Mayo,

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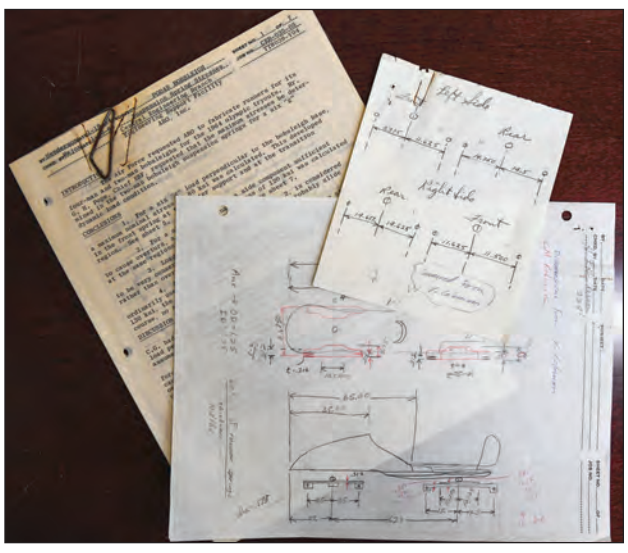

Documents from the early 1960s show Arnold Engineering Development Complex, then Center, provided engineering analysis and materials testing to support the U.S. Air Force bobsled team as they vied for a spot in the 1964 Winter Olympics. AEDC was asked to fabricate runners, the skate-like blades on which bobsleds slide, for the Air Force's two-man and four-man bobsleds, prompting the AEDC examination of the equipment. *(U.S. Air Force photo by Jill Pickett)*

AEDC once supported Air Force Olympic hopefuls in quest for winter games glory

By Bradley Hicks
AEDC Public Affairs

The 2022 Winter Olympics are underway in Beijing. Athletes from around the globe are competing in a myriad of events that showcase their years of training and dedication.

Many spectators in the stands and viewers at home are likely awed by the lightning-quick maneuvers of the Alpine skiers, the grace and precision of figure skating, the board-shaking hits and powerful slap shots of ice hockey, and the "how-is-this-an-Olympic-event" intensity of curling.

Perhaps as equally jaw-dropping are the blazing speeds reached in the sliding sports of luge, skeleton and bobsledding. Competitors in each of these events traverse icy downhill tracks on specially-designed sleds with the goal of completing the route with the fastest time. Their respective vehicles take

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The *High Mach* office is located at 100 Kindel Drive, Suite A236, Arnold AFB, Tenn. 37389-1236. Editorial content is edited and prepared by NAS. Deadline for copy is Wednesday at close of business one week before publication.

This commercial enterprise newspaper is an allowable NAS contractor publication for personnel at Arnold AFB.

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- Excellence. We thrive on challenge, accomplishment, and mission success.
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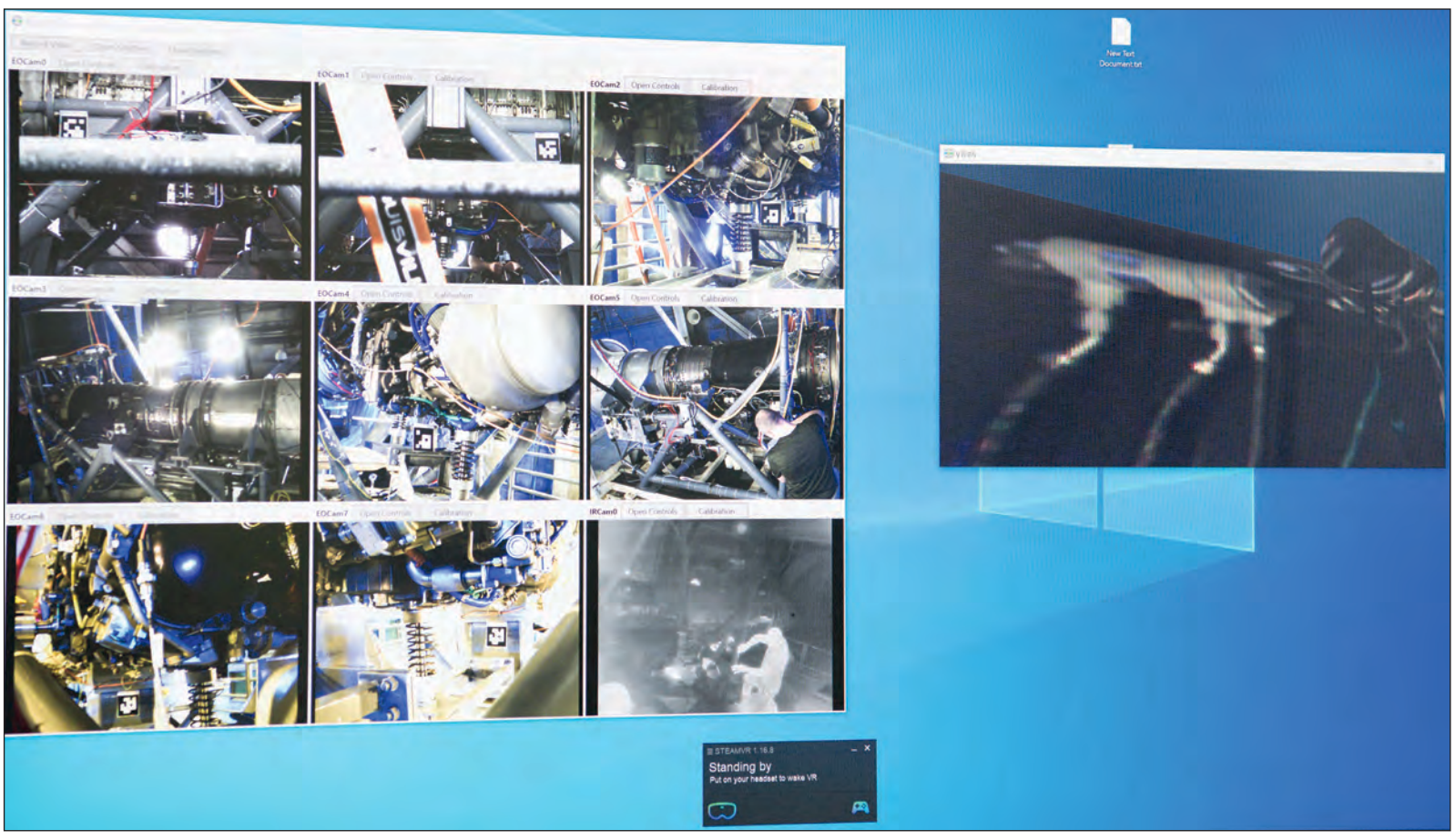


The interface of the Virtual Test Cell Presence System (VTCPS) is displayed on a monitor during a trial of the system during sensor testing in the Engine Test Facility Sea Level Test Cell 1, June 15, 2021, at Arnold Air Force Base. The VTCPS is a Small Business Innovation Research project with a goal of providing a VR capability to view test hardware and support systems in 3D in nearly real time. *(U.S. Air Force photo by Jill Pickett)*

U.S. Marine Corps."

The goal of the VTCPS is to provide a cost-effective, intuitive, and natural method to view and interact with hazardous environments that would otherwise be inaccessible, such as aerospace and automotive test facilities or other industries requiring remote monitoring of areas where humans cannot safely be present or where they would introduce unnecessary contamination factors.

"The VTCPS project was our first Phase II, which is the prototype system that was installed in SL-1 at Arnold Air Force Base," Redd said.

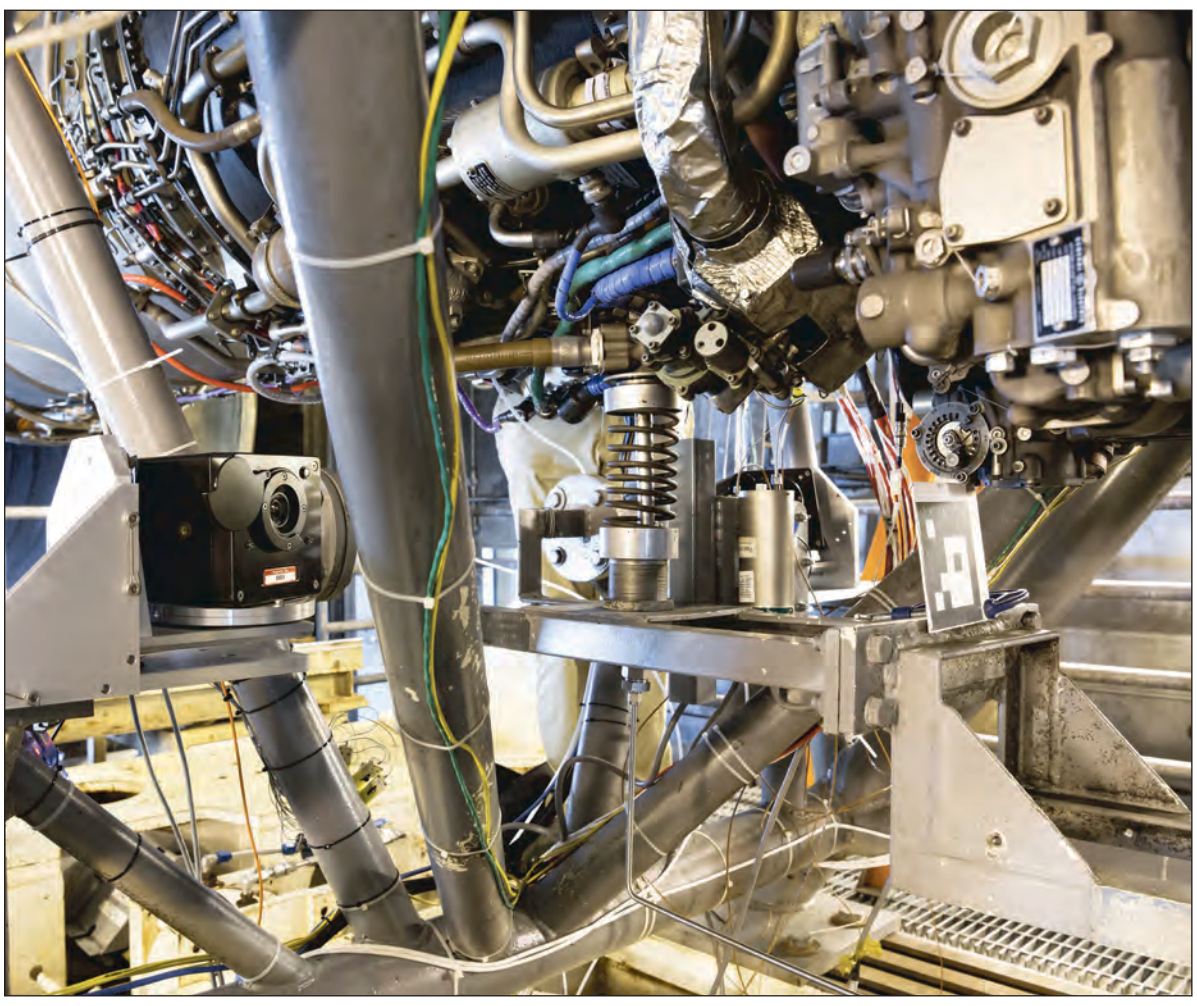
The virtual system is based on a distributed camera design, so that there are multiple viewpoints of the test cell simultaneously. The prototype system installed in SL-1 utilizes eight visible band cameras and one thermal longwave infrared camera. The architecture can accommodate almost any type of sensor and can support highly specialized devices, such as cameras that detect petrochemical vapors in the atmosphere.

The hardware architecture was selected to minimize data transmission delays through the system. This allows a near real-time delivery of the various video feeds.

Redd described how the set up works in the engine test cell and what the team is able to see.

"The system operator wears a VR headset and can see the views from the different cameras," he said. "The direct view of each camera is provided as a dashboard, and the user can focus on any scene desired. These are 2D views, but the software then combines the 'best view' from each of the cameras and combines them to create the 3D reconstruction of the test cell.

"The operator uses a gamepad to move around within the reconstructed virtual space. He or she can 'fly around' the test cell to any vantage point desired. If a detailed view of a particular engine feature is desired, the user can look at the 2D camera feed and inspect to the limiting resolution of that feed."



Cameras and registration symbols were placed around a General Electric F404 engine installation in Sea Level Test Cell 1 during sensor testing for a trial of the Virtual Test Cell Presence System, June 15, 2021, at Arnold Air Force Base. The cameras provide test personnel high-resolution views of test hardware and are compiled by the system for viewing with a virtual reality headset. The registration symbols enable the system to piece together the various angles. *(U.S. Air Force photo by Jill Pickett)*

The SL-1 cameras allow viewers to closely inspect an object in the test cell with the capability to zoom in to see features as small as 0.050 inches.

According to Redd, future versions of the software will interface with the existing AEDC data feeds and display those data results in the VR environment.

"For example, in SL-1 the operator will be able to see the various temperature and pressure values overlaid on the 3D view in VR. This would provide a fully comprehensive live view of the test event in VR, as though the operator were actually inside the test cell. Longer term, we envision that the system could blend in computational fluid dynamics prediction models, such that the user could see the 'as predicted' versus the 'as testing' results."

According to Bernie Williamson, test project manager at Arnold, the VTCPS offers AEDC test facilities advancements to the methods currently in place.

"Using the system in SL-1, we had a stable, more usable image, even with the heavy vibration caused by the General Electric F404 engine," Williamson said. "Another advantage is the test team is able to easily navigate between a full cell 3D view and individual cameras."

Redd added that future development and improvements to the system will include growth potential to add artificial intelligence and machine learning features and provide automated alerts and insights; inclusion of additional sensors into the existing housing, such as thermal infrared for remote temperature monitoring; and user-interface improvements that integrate the video recording system with existing AEDC systems and processes.

"Augmntr is fully committed, and highly excited, to work so closely with AEDC on this system," Redd said. "We hope to mature the system so that it can be used on a daily basis in multiple test cells, meeting all IT, security and operational requirements. The system should also be able to integrate with needed legacy and all future planned sensors to maximize AEDC's investment in any sensors. Additionally, the specific camera and lens modules used by VTCPS could be used for other systems as needed to provide an increase in image quality and stability."

Smoking Policy

1. The following revised Arnold AFB smoking policy is effective immediately and applies to all individuals on Arnold AFB.
2. Traditional Tobacco products (e.g. cigars and cigarettes):
   a. Smoking is permitted solely in Designated Tobacco Areas (DTAs) identified by designated signage. If no signage exists, smoking is not permitted in that area. It is the responsibility of all smokers to keep DTAs clean of cigarette butts.
   b. Tobacco use on the Arnold AFB Golf Course is permitted, but discouraged based on the health hazards of tobacco use and secondhand smoke. No smoking is permitted within 50 feet of golf course buildings except in the approved DTA.
   c. Smoking in government-owned/leased vehicles is strictly prohibited. Personnel are allowed to smoke in their personal vehicles at any time; however, at no time will personnel discard cigarette butts outside their vehicle.
   d. For government employees, the fact that a person smokes has no bearing on the number of breaks they may take. Breaks should be taken in accordance with the current supervisory and personnel policies that afford all employees the same break opportunities consistent with good work practices and accomplishment of the mission.
3. Smokeless Tobacco products (e.g. snuff and dip):
   Smokeless tobacco products are not to be restricted to DTAs. Smokeless tobacco use will be permitted in all workplace areas (inside and out) subject to reasonable safety and sanitary conditions. Specifically, containers of tobacco waste product, including sealed containers, must not be left unattended or disposed of in trash receptacles. Users of smokeless tobacco must flush tobacco waste down the toilet.
4. Electronic Cigarettes (also known as "e-cigs"):
   Pursuant to Air Force Instruction (AFI) 40-102, Tobacco Free Living, e-cigs are considered to be equivalent to tobacco products; however, e-cigs are not restricted to DTAs and are allowed to be used outdoors at a minimum distance of 25 feet from building entry/egress points. (This policy is dated July 27, 2016)

Action Line

Team AEDC,

I believe in free and open communications with our Team AEDC employees, and that's why we have the Action Line available. People can use the Action Line to clear up rumors, ask questions, suggest ideas on improvements, enter complaints or get other issues off their chests.

The Action Line has been expanded to include an option for your ideas, comments, or suggestions on the AcqDemo personnel system. Simply call the normal x6000 commander's action line. You will then be prompted to select option 1 for the Commander's Action Line or Option 2 for the AcqDemo line. They can access the Action Line via the AEDC intranet home page and by calling 931-454-6000.

Although the Action Line is always available, the best and fastest way to get things resolved is by using your chain of command or by contacting the organization directly involved. I encourage everyone to go that route first, then if the situation isn't made right, give us a chance.

Col. Jeffrey Geraghty
AEDC Commander

ENGINEERS *from page 1*

a mechanical engineer with the U.S. Navy and technical point of contact for MetroLaser. "The engineers and staff at the PRF have provided crucial support for the validation testing of MetroLaser's PDV technology."

Dr. Robert Howard, instrumentation and diagnostics subject matter expert, noted that MetroLaser and the Navy knew the PRF would be "an excellent, low-cost opportunity to demonstrate this measurement technique on a full-scale turbine engine."

He added that the Navy's interest in PDV stems from the need to understand the distribution of velocity in jet engine exhausts as a key to developing strategies for reducing noise from aircraft.

"Measurements are needed for comparison with engine exhaust flow-field models," Howard said. "Current measurement methods involve intrusive probes or optical methods that require seeding the flow with particles. The optical method developed by MetroLaser relies on the soot particles already existing in the exhaust and, thus, makes this measurement technique more versatile for performing velocity measurements on engine stands and winged aircraft."

With an expanded laser beam illuminating a swath of the exhaust's flow field, the MetroLaser approach relies on measuring the scattered laser light with three strategically placed camera systems mounted outside the exhaust.

"Specialized iodine filters are then utilized to help discern the Doppler frequency shift of the scattered laser light illuminating the camera systems," Howard said. "The shift in laser frequency results from the laser light being scattered from high velocity soot particles in the exhaust."

From left, Dr. Tom Jenkins, president of MetroLaser, Inc., and Regis Morgan, senior engineer with MetroLaser, observe the visual display of data during a test of the company's setup to non-invasively measure the unsteady, 3D velocity field of a jet plume from a stationary aircraft engine, Nov. 18, 2021, at the Propulsion Research Facility operated by Arnold Engineering Development Complex on the campus of the University of Tennessee Space Institute in Tullahoma, Tenn. The technology was being tested on a General Electric J85. *(U.S. Air Force photo by Jill Pickett)*

Brad Besheres, AEDC J85 test operations engineer, mentioned the test conducted in November 2021 was actually the second of a two-phase effort in the process.

"In the fall of 2020, AEDC helped MetroLaser install and evaluate the performance of a basic laser and camera system comprising the components of the PDV system in the vicinity of the relatively harsh vibrating acoustic environment of the jet engine operated over its power range, from idle to afterburner operations," Besheres said. "The information and lessons learned from that test were used to design a mounting structure for the final demonstration, which led to a very successful test campaign that provided MetroLaser with ample data to declare a successful demonstration of the PDV system to their Navy sponsor."

Dr. Tom Jenkins, president of MetroLaser, said the PDV technique was also previously used at the AEDC National Full-Scale Aerodynamics Complex in the NASA Ames Research Center in Mountain View, California. In the 80-by-120 foot wind tunnel, the technique has been shown to be capable of resolving velocities as low as 2 meters per second from a single laser pulse and to be applicable at observation ranges exceeding 40 meters. These capabilities, in addition to the minimal requirements of PDV on the optical features of the aerosols in the flow, make it a way to measure three-component velocity vector fields in time-dependent flows in large-scale wind tunnel facilities. A high-quality, three-camera PDV system was assembled and installed in the wind tunnel to allow flow field measurements between the moving rotor blades of a full-scale rotor.

PDV can also be applied to measurements of the motion of solid objects whenever there are unique advantages to the use of localized laser targeting and the spatial discrimination that is provided by velocity field images. Examples include the individual flight paths and spin or tumbling velocities of multiple targets, the local velocities of moving machinery parts, and the motion of biological targets. In the case of measurements on solid objects where the path of the motion is known, only a single camera system is necessary to obtain the complete velocity along the trajectory and the laser illumination can be volumetric, rather than a light sheet.

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participants of each event down the frozen courses at speeds of 80 to 90 miles per hour.

To ensure optimal results and athlete safety, having the right equipment in the high-speed sliding sports may be just as important as the countless practice runs made to gear up for Olympic competition.

When U.S. Air Force officials decided the military branch should take a shot at Olympic glory in the 1964 games, they called on Arnold Engineering Development Complex to help give them an edge in the pursuit of the gold.

The Air Force requested that Arnold Research Organization, the contractor which managed what was at the time known as Arnold Engineering Development Center, fabricate runners for its bobsleds for the 1964 Olympic tryouts.

It is not clear from available records whether AEDC completed fabrication of the runners and if the runners were used on the USAF sleds, but it is apparent that AEDC personnel completed materials testing and engineering analysis for the runners.

Similar to skates, bobsleds ride on metal blades called runners. There are four runners on each sled, all located on the bottom of the bobsled hull. The movable front pair can be steered by the sled driver to control the direction of the bobsled, while the two runners located at the rear of the sled are fixed.

With the primary objective in bobsledding to, of course, actually finish the race, the goal was to make runners that would hold up throughout the duration of a run while simultaneously limiting friction.

Each bobsled run starts with a push-off to get the sled going on the track. After that, gravity propels the sled down the track toward the finish line. Gravity is a constant and affects all sleds equally, so the effectiveness of the push to start a bobsled run, as well as the aerodynamics of the sled and ability of the runners to maintain their glide, are key in determining the winner of a bobsled race.

A bobsled track is not a straight shot downhill. Courses are fraught with twists and turns. Riders are subjected to significant "g," also known as the gravitational force equivalent or g-force, when navigating these turns. G-force is the force on the body from acceleration or gravity.

Bobsledders may endure up to 5 g, or forces equivalent to five times their own weight, when rounding a sharp curve in the track. The force bearing down on them is great. For the sake of comparison, according to PBS, citing an article from the journal Spine, walking imposes 1 g on the human body. A slap on the back is equivalent to a little more than 4 g, the average sneeze is almost 3 g and plopping down in a chair is a little more than 10 g. Other g-force examples, according to the website ehub.ardusat.com, include the up to 6.3 g generated by rollercoasters and the more than 7 g the crew of the Apollo 16 was subjected to upon reentry. People suffer no ill-effects from such events because of their brevity, however, instantaneous high-g-force impacts can have adverse effects. Death or serious injury is likely to occur at 50 g and concussions will occur at around 100 g. Lingering g-forces at lower levels can also be harmful or deadly.

Considering the high rate of speed at which they are traveling and the forces imposed upon them, a crash could have disastrous results for a bobsled crew. To assess the possibility of sled overturn, AEDC personnel studied the impact of load conditions on the runners.

AEDC was tasked with fabricating runners for the USAF for both its two-man and four-man bobsleds, the two sizes recognized for competition in the Olympics. This prompted further study of typical bobsled runners by AEDC team members. By early 1963, Maj. Gen. Perry Hoisington, then-director of legislative liaison with the secretary of the Air Force, had made contact with G.H. Pope, then-AEDC Engineering Support Facility chief, to provide specifications on the sleds and the runners for each type.

Hoisington had also provided AEDC personnel with allowable measurements and weights for the bobsleds and drawings of the runners for the four-man sled.

According to a report written by Pope dated Jan. 6, 1963, Hoisington had advised a sled would be flown to AEDC by Jan. 9 of that year to aid the work.

"This sled can be retained for study until sometime in February," Pope wrote. "Accompanying this will be an Air Force officer who is an expert in bobsledding."

After asking Hoisington a question related to the bobsled lugs, Pope was referred to Dr. Arthur Tyler, who won a bronze medal as part of the four-man U.S. bobsled team in the 1956 Winter Olympics. According to his biographical information posted on the website olympedia.org, Tyler earned a Ph.D. in physics from the University of Michigan and was perhaps known as the "most scientific of all American sledders." He designed changes in his sleds, tested them in wind tunnels and applied his background in physics to arrive at the best combinations of aerodynamic factors.

Pope learned more from Tyler about the runners themselves, including how they are manufactured, how they are cared for and their expected sturdiness.

"Runners are trued with a file and polished with emery cloth and crocus cloth after each run by the crew," Pope wrote. "They are trued by eye without use of template. Further, the cross-section radii are accomplished in a like manner.

"Dr. Tyler has always finish-machined the runners prior to heat treatment and merely hand-polished them following tempering. Further, no attempt was made to prevent warpage other than to hang the runners vertically during heat treatment."

Tyler also stated the runners were tempered to C-44 to C-47 on the Rockwell scale, a scale used to measure the hardness of a material. This rating would put the runners above the middle of the Rockwell C scale range. While blades on the upper end of the scale may indicate they are made of harder steel and hold their edges better, they may also be more brittle than those found further down the scale, so a rating near the top of the Rockwell C scale range would not be preferable for bobsled runners. Neither would a rating near the bottom of the scale, as the steel would be too soft.

In a Jan. 8, 1964, addendum to his previous memo, Pope detailed work conducted on material provided by the Air Force.

"A sample removed from one of the pieces of material was heat treated by heating to 1600˚F and quenching in oil," he wrote. "The hardness was determined to be (Rockwell C scale) 44-45. After tempering at 325-350˚F, the hardness was determined to be (Rockwell C scale) 42-43. Microscopic examination of the material indicates that good impact properties will probably be obtained. A further sample will be removed and heat treated for Charpy specimen preparation."

The "Charpy" referred to is the Charpy impact test. According to the website sciencedirect.com, it is used to evaluate the relative toughness of a material as it measures the energy absorbed by a specimen while breaking under an impact load.

AEDC personnel also examined the runners originally affixed to Podar sleds, Italian-designed racings sleds built with aerodynamics in mind. These runners were quite soft, around 22 on the Rockwell C scale, appearing to have been fabricated by bending bar stock and welding the lugs onto it.

"Dr. Tyler was advised of this condition during the previously mentioned conversation," Pope wrote. "He stated that this didn't surprise him since he had seen Podar sled runners break when a sled was dropped accidentally. At the time, he had thought that the material had not been properly tempered; but considering that the break that he had witnessed was in the immediate location of the welded-on lug, it was undoubtedly caused by improper treatment after welding.

"We compared the contour of the Podar runners with the four-man ordinates and found that they are identical over the major portion of the runner length. Further discussion with Dr. Tyler resulted in a recommendation to copy the Podar runners; however, he wishes to have them hardened and tempered to automotive spring condition."

AEDC worked to determine the maximum stresses in the two-man bobsled suspension springs for a 6 g dynamic load condition. Since assessment found that the sled would likely slide rather than overturn, calculated stress levels were deemed acceptable.

It does not appear that the U.S. Air Force team qualified to represent the nation in the 1964 Winter Olympics. Neither the U.S. two-man bobsled team nor four-man team was able to capture medals during those games.

Groups work to eliminate, diminish barriers to women's military service

By Jim Garamone
DOD News

WASHINGTON – Women are an integral part of the American military, and DOD officials are working to ensure their concerns are addressed.

Women make up roughly 20% of the Air Force, 19% of the Navy, 15% of the Army and 9% of the Marine Corps. Tens of thousands of women contribute every day to defending the nation. Their differences and needs must be considered for the United States military to function.

This is especially true since 2013, when then-Defense Secretary Leon Panetta and Army Gen. Martin Dempsey, then-chairman of the Joint Chiefs of Staff, repealed the combat exclusion policy. From privates to four-star generals, women serve in every rank and can serve in any specialty in the military.

"I think we're doing a great job in terms of recruiting the right kinds of people, providing access to people from every corner, every walk of life in this country," Secretary of Defense Lloyd J. Austin III said on CNN last year. "As long as you're fit and you can qualify, there's a place for you on this team."

But simply changing the policy is not the end of the process, and that is where programs like the Air Mobility Command's Reach Athena and the Department of the Air Force Women's Initiative Team come in. These groups look at the totality of women's service to find and eliminate barriers to ensure all can serve to their full potential.

An all-women F-15E Strike Eagle aircrew steps to the flightline in observation of Women's History Month at Royal Air Force Lakenheath, England, March 22, 2021. *(U.S. Air Force photo by Senior Airman Madeline Herzog)*

Air Force Maj. Jennifer N. Walters, who co-founded Reach Athena when she was stationed at Travis Air Force Base along with Major Kelsey Payton, said the program does build diversity in the military, but that is not the primary aim. "What it's for, is to identify policies that – intentional or not – are driving our talent away, or repelling them from the Air Force," she said in an interview. Reach Athena – named after the Greek goddess of wisdom and warfare – began in 2020 and is headquartered at Scott Air Force Base. The Air Combat Command has Sword Athena looking at barriers in that Air Force major command. The Women's Initiative Team is at the Department of the Air Force level and began in 2008. All work together.

The WIT is part of a seven-team barrier-analysis working group. It "specifically looks at women's initiatives to decrease or remove barriers impacting women's service in the Department of the Air Force in order to increase force-wide effectiveness," Air Force Maj. Megan Biles said. "We look at existing policy which impacts women's propensity to serve and elevate solutions to senior leaders."

The idea is to identify anything that is antiquated or impedes mission success. "Our capabilities, technology and missions have evolved, as has the population which currently serves today," Biles said. "Future conflicts do not have the same requirements that past conflicts had. How we train and our requirements need to be evaluated and must evolve to ensure we are recruiting and training the most effective force. That means enacting policies and best practices designed to intentionally develop those serving today, not keeping outdated standards only for the sake of tradition or because that is how we've always done it."

Leaders realized some of these outdated policies disproportionately affect one gender. And have empowered the WIT to help eliminate them.

It is not just policies that these groups study, but equipment, uniforms, gear, grooming and other processes. "A lot of times folks will identify an issue at the tactical level and pass it up the line," Walters said.

The groups also work with other service counterparts to share experiences, solutions and best practices.

One example was that body armor – designed for men – is not a good fit for women. Another was the requirement for women to wear their hair in a bun. Pilots found that having a bun made the helmets fit poorly, impacting safety, Walters said. These grooming changes made their way up the food chain, and Air Force leaders approved them last year.

The height/weight requirements are another area under scrutiny. The groups are looking at the reasons behind some of these requirements. Women are generally shorter than men. "If there is a mission requirement driving the height restrictions, that's fine," Biles said. "Our analysis provides recommendations to evolve requirements that were developed 50-60 years ago, which were based on anthropometric averages from a different demographic than currently serves today. The result of not updating these policies is an artificial limitation regarding recruitment potential into key military positions."

Pregnancy is another area of discussion. At one time, if a woman became pregnant, she was involuntarily discharged from service. Now, of course, women can continue to serve while pregnant. But there are still limitations pertaining to pregnant aviators that the barrier analysis groups are examining. Previously, if a woman became pregnant, she was automatically taken off flight status. "Now we've opened the aperture so that you can fly during the second trimester," Walters said. "But we're looking at [Federal Aviation Administration] practices and what commercial airlines do. They allow women to fly through the majority of the pregnancy without placing the mothers or the missions at risk."

The Air Force is now investigating the possibility of allowing aviators with doctor confirmed "uncomplicated pregnancies" to continue flying longer, which would increase readiness and positively impact culture.

Tied to this is the issue of breastfeeding. Most obstetricians and pediatricians recommend mothers breastfeed their babies. If they are home stationed, women can use a breast pump to feed their children while at work. The problem comes when mission requirements drive temporary dislocation. The groups are looking for ways to ship the breast milk home.

There are undoubtedly other areas where there may be barriers to women's service. These barrier analysis groups will continue to work to enable women to contribute to national defense.

Around Arnold

February is American Heart Month

By Rick Fleming
AEDC Safety

The American Heart Association published the article "Is 10,000 steps really a magic number for health?" by Michael Precker, American Heart Association News, on their website ***heart.org***. The italicized text below is the article, edited for length.

It's a worthy, healthy goal to take 10,000 steps each day, but that magic number didn't come from doctors or physical trainers.

In the mid-1960s, Japanese marketers trying to sell a pedometer named it manpo-kei, which generally translates to "10,000 step meter" in English. The Japanese character for "10,000" roughly resembles a person walking.

"It's a nice clean number and it makes a good marketing message," said Amanda Paluch, assistant professor in the School of Public Health and Health Sciences at the University of Massachusetts in Amherst. "You can see why it stuck. But there was not a lot of science behind it."

Paluch is the lead researcher of a new meta-analysis looking at the link between how many steps people take and cardiovascular disease. It reinforces the premise that while there's no magic number when it comes to steps, any number is healthier than the one below it. …

Her team analyzed seven previous studies whose participants wore step counters and tracked their cardiovascular health. The research encompassed 16,906 adults whose incidence of heart disease, heart failure or stroke was monitored for a median period of just over six years.

"We brought all these studies together for a large diverse sample," Paluch said. "What we're seeing is that the more steps you do, the more benefit you get."

Paluch's team divided the participants into four groups based on their median number of daily steps: 1,951; 3,823; 5,685; and 9,487. Cardiovascular disease risk fell as the number of steps increased. The most active group had less than half the number of cardiovascular disease events than the least active, 243 versus 491.

"The message is to move more," she said. "Don't get caught up in 10,000 or any other number. It is not an all or nothing situation for cardiovascular health benefits. Just getting incremental increases in your steps could be meaningful in your cardiovascular health."

The next step regarding steps, Paluch said, is to look at how much the intensity of exercise matters and the health benefits beyond cardiovascular considerations.

"We want to look at other outcomes, like mental health and cancers," she said. "There are many ways physical activity works on the body, and that makes it a great tool for promoting our health and staying healthier for longer."

Federal physical activity guidelines urge adults to sit less, move more and accumulate at least 150 minutes of moderate-intensity aerobic activity each week.

"This research shows that the number of steps we should be striving for to generate benefits for cardiovascular disease is lower than 10,000, maybe between 5,000 and 6,000 steps per day, which is pretty much the equivalent of 150 minutes per week." …

For many people, Paluch said, that 10,000 figure can be intimidating, no matter how appropriate it may be for a marketing campaign.

"If you're not there, don't become overwhelmed and throw in the towel," she said. "Think about progressive improvements and working them into your lifestyle and your schedule. Park farther from the store. Take the stairs instead of the elevator. The great thing about steps is we can fit them into our daily lives."

Let me conclude with a true story.

Several years ago, I got a call informing me that I should come to the first aid room because one of my employees was not feeling well.

I went and saw her, a very tough 55-year-old woman who had a medium build and was fairly healthy, laying down holding her chest and crying. When I asked her what was up, she said her chest hurt and that her reoccurring heart burn was really bothering her. When I checked her out, her symptoms included chest pain, pulse racing, light headedness, shortness of breath, nausea and sweating.

I told her she needed to go to the doctor and I was calling an ambulance. She argued saying it was just heartburn. Long story short, when the ambulance got there they gave her a nitroglycerin pill and transported her.

When she returned to work weeks later, she shared that the doctor told her if she had not gotten treatment she would probably have died that afternoon. She has since started walking every day and is in good shape with no further heart trouble.

It is never too late to influence your future. Keep moving, listen to your body and do not ignore symptoms. Take care of yourself and as always…take care of each other.

Cop Corner: Visitor access

By Dan Hawkins
Arnold AFB Anti-Terrorism Program Manager

If you have ever wondered why there is sometimes a long wait for visitors when they arrive at the Visitor Control Center, or VCC, the information that follows may provide you with insight to help you navigate the system and minimize wait times for your visitors.

Visitor access is broken down into three separate functions: sponsorship verification, vetting and credentials issuance.

Sponsorship verification essentially makes sure an authorized person has submitted an appropriate request to validate the need for the visitor to be on base. This request can only be submitted via the Team AEDC portal or in person. To access the Visitor Request form on the AEDC Portal, go to the right side of the page and click on "Request Services," and locate the "Visitor Badge Request Form."

Once sponsorship has been confirmed, the visitor must be appropriately vetted. The vetting process includes querying both local and national databases to ensure the person is not wanted, on a terrorism watch list or has a significant criminal background.

After being thoroughly vetted, the visitor can receive appropriate credentials, good anywhere from one day to one year. The primary credential for all visitors is the Defense Biometric Identification System, or DBIDS, identification card or paper pass. This credential is machine-readable and allows the guard at the gate to scan the code and quickly verify its legitimacy. Most visitors will also be issued an AEDC circulation control badge. This badge is worn at all times within the mission area and is used to indicate authorization to be on base.

Visitor processing is a comprehensive process intended to ensure the safety of base personnel and the mission. Four separate information technology systems are used in the process, and latency or maintenance issues often interrupt the process or significantly increase wait times.

We have taken many measures to improve service, including remodeling the facility to provide adequate space and physical separation between work centers, increased the VCC staff and operating hours, and adopted the use of the DBIDS Virtual Enrollment System that allows sponsors to pre-enroll visitors so their wait time in the facility is reduced.

We will continue to review and refine our processes to maximize efficiency as we comply with all federal laws and orders to ensure only appropriately vetted personnel are allowed base entry.

The facility is now open from 6:30 a.m. to 5 p.m., Monday through Friday. Delays still occur at peak times. If possible, having your visitors show up during off-peak hours may be helpful in reducing their wait time. More information, to include frequently asked questions, is available at our Base Entry webpage: ***https://www.arnold.af.mil/Home/Base-Entry/***

Please direct any questions or suggestions for future articles to our distribution group: ***AEDC.Arnold.CopCorner@us.af.mil***.

Simplified human/machine interfaces top list of critical DOD technologies

By Todd Lopez
DOD News

WASHINGTON – A modern-day cell phone packs quite a wallop when it comes to computing technology and capability. But most cell phones barely come with a "quick start guide," let alone an instruction manual that spells out how to use all the features.

Cell phone companies have mastered the interface between humans and technology, making their use entirely intuitive and rendering thick instruction manuals a thing of the past.

The same thing should be happening for weapons systems used by servicemembers, Heidi Shyu, who serves as the undersecretary of defense for research and engineering, said. During a virtual discussion today with the Potomac Officers Club near Washington, D.C., she said intuitive, easy-to-use human/machine interfaces is something that's a priority for her and the Defense Department.

"When I [served as an executive for the] Army before, one of the experiences I learned is with a lot of our weapons system, you really have to have a manual and go through weeks of training, if not months and years to be proficient, which is ridiculous," she said. "[Weapons systems] ought to be designed with the appropriate ease-of-use human/machine interface, so it will become much more intuitive."

As the Defense Department's chief technology officer, Shyu said she's interested in developing better ways to simplify the way service members use the technology they are given in order to reduce the training burden and learning curve.

"I really would like to see how we can change our weapons systems' human/machine interface to be a lot more intuitive, to ease the amount of training that's required," she said.

For most service members, combat means use of a weapon such as a rifle, an aircraft that can drop a bomb or launch a missile, or a ship or tank that fires a large gun that requires a round to be loaded. All of these kinetic weapons systems fire solid projectiles which need to be carried along with warfighters, and which may eventually run out. But a new generation of weapons systems, which uses directed energy rather than expendable ammunition or ordnance, is on the horizon, Shyu said.

"In the area of directed energy, we're ... finally at the cusp of developing laser technology," she said. "After 30 years, we're finally getting to the point of fielding the prototypes. So I'm thrilled. Army and Navy are [both] fielding laser systems. I'm really happy to see that. We're also developing high-power microwave systems as well."

The Optical Dazzling Interdictor, Navy program, or ODIN for short, is a nonlethal weapons system used to confuse and perhaps render harmless an enemy drone – rather than shooting it down.

The ODIN system is already installed on multiple Arleigh Burke-class guided-missile destroyers within the Navy's fleet, and there are plans to install additional systems as well.

The Army is also developing several directed energy systems. One of those is the Directed Energy Maneuver-Short Range Air Defense, or DE M-SHORAD system, which involves a 50kW-class laser to protect divisions and brigade combat teams from unmanned aerial systems, rotary-wing aircraft, and threats from rockets, artillery and mortars.

The department is also interested in the development of advanced materials, Shyu said.

"I'm certainly interested in materials that can handle higher heat, higher temperature, next-generation hypersonic materials," she said. "I'm interested in material that's stronger, but lighter weight. It certainly can help us reduce the logistics burden; and also materials that can have higher efficiency – materials that can potentially change properties. [There are] a lot of different areas within advanced materials we need to continue to push the research in."

The department is also doing its part to bring the manufacture of microelectronics back to the U.S. to improve supply chain reliability, Shyu said.

"You guys have all heard about the situation that we're in with the supply chain, where 70% of our chips are coming from Asia," she said. "That poses a supply chain risk. You can see there's a lot of interest on the Hill in terms of helping out the microelectronics foundries to try to onshore some of the capabilities."

Shyu said the Defense Department is working closely with the Department of Commerce and with foundry companies to make that happen.

"We also work very closely with intelligence communities to make sure we understand all the needs and figure out how we can leverage commercial processes which can evolve at a much faster rate than just the defense-unique foundry," she said.

Finally, Shyu said, the department is interested in having the U.S. take the lead on the development of 5G technologies — and the advancement of the next-generation of radio communications as well.

"I call it the 'next G'," she said. "Namely, beyond 5G. What I don't want to happen is for us to take our eyes off the ball and play catch-up. I'm interested in making sure we're developing technologies on 6G and 7G, so we, the U.S., can shape the standards, as opposed to some other country shaping the standard and us playing catch-up."

DOD, nation celebrate Black History Month

By Dave Vergun
DOD News

WASHINGTON – Black History Month, also known as National African American History Month, is an annual celebration of achievements by Black Americans and a time to recognize the positive impact they've had on the history of the United States and the Defense Department.

Black people have fought in every United States war, from the Revolutionary War through the wars in Iraq and Afghanistan. Ninety African Americans have been awarded the Medal of Honor.

Yet, throughout most of American history, Black service members were placed in segregated units. Desegregation didn't occur until Jan. 26, 1948, when President Harry S. Truman issued Executive Order 9981 directing the armed services to integrate.

Active-duty service members number 1,319,283; of those, 227,974, or 17.3%, are African American, as of December 2021.

According to the U.S. Census Bureau, in 2020, the Black or African American population was 41.1 million, representing 12.4% of the U.S. population.

Tuskegee Airmen gather around a table and talk in Ramitelli, Italy, in March 1945. ***(Photo courtesy of Library of Congress)***

Notable Dates

- Black people, both slave and free, served on both sides during the Revolutionary War. African Americans also served on both sides in the War of 1812 (1812-1815). Many served with the British in order to gain their freedom and resettle in non-slave nations, particularly Canada, Bermuda and Sierra Leone.
- In the Civil War (1861-1865), over 186,000 African Americans fought for the Union Army and Navy. A lesser number of African Americans were used as laborers on the Confederate side.
- Six regiments of African Americans, known as buffalo soldiers, served in the Indian Wars from 1863 to the early 1900s and in the Spanish-American War in 1898.
- About 367,000 African Americans service members served in Europe during World War I (1917-1918).
- Around 1.3 million African American service members served during World War II (1941-1945).
- During the Korean War (1950-1953), about 600,000 Black service members served in the armed forces.
- About 300,000 African Americans served in the Vietnam War (1961-1975).
- The two top-level Black Americans in DOD have been Army Gen. Colin Powell, chairman of the joint chiefs of staff (1989-1993), and Secretary of Defense Lloyd J. Austin III (2021-present).

Black soldiers in an artillery unit move forward in Belgium, Nov. 9, 1944. ***(Photo courtesy of Library of Congress)***

History of the Celebration

The origin of Black History Month is associated with the noted African-American historian Carter G. Woodson. In 1926, he initiated the celebration of Negro History Week during the second week in February.

February was chosen because that is the birth month of Frederick Douglass, an abolitionist and social reformer, and President Abraham Lincoln, who abolished slavery.

The celebration was expanded to the entire month of February in 1976 by President Gerald Ford; since that time, every president has designated February as Black History Month.

During his 1976 Black History Month announcement, Ford linked the commemoration to the nation's 200th anniversary of the Declaration of Independence that year.

On Feb. 11, 1986, Congress passed Public Law 99-244, which designated each February as "National Black (Afro-American) History Month."

Canada, Ireland and the United Kingdom also celebrate a Black history month.

AFGSC applying the Art of the Possible

By William Tsao and
1st Lt. Kaylin Hankerson
Air Force Global Strike Command
Public Affairs

BARKSDALE AIR FORCE BASE, La. – The Air Force Global Strike Command Office of Logistics and Engineering (AFGSC/A4) has a reputation for rapidly testing new ideas and driving innovation that takes Air Force Global Strike Command to the next level. One of the latest ways AFGSC/A4 is innovating is by investing in the application of the Art of the Possible.

Based in a wealth of knowledge and experience from across the ranks of the Air Force, AoP is a concept that standardizes a process, identifies a system's constraints, and helps users manage their process optimally; the concept has quickly become something leaders see value in adopting.

To lead AFGSC's implementation of AoP, the A4 staff recruited expert, William Tsao from Robins Air Force Base to lead the way. "AoP is a game changer," Tsao said. "It's a constraint-based management system that I've seen lead to huge gains in productivity during my time at Robins and the best part [about AoP] is the standardization, ownership, that shops have over the system."

One AFGSC shop in particular that has seen success with AoP implementation was the Wheel and Tire shop, from the 2nd Maintenance Squadron, or 2MXS, at Barksdale Air Force Base.

When the Wheel and Tire shop began their AoP journey, there was a healthy level of skepticism, but innovation won in the end. "It [skepticism] was totally understandable; as humans, we tend to be naturally resistant to change," Tsao said. "The team at the 2 MXS was very accommodating and interested in doing things differently because through the training they too saw that AoP could be value added to the mission."

A white board, located in the 2MXS Wheel and Tire backshop, breaks down how the application of Art of the Possible concept has improved processes, decreased workflow time and saved man-hours. ***(Air Force Courtesy Photo)***

One of the key principles behind AoP is limiting work-in-progress (WIP) so it does not overwhelm processes. Through AoP, the Wheel and Tire shop was able to determine an appropriate WIP level as well as break up their process in to smaller, more manageable segments. The latter is better known as gating, and the grouping of similar work within a process machine's overall flow helps a shop manage the process via smaller buckets of work.

"There were some growing pains much like any new effort," Tsao said. "One of the technicians, Tech. Sgt. Keith Jackson, initially didn't "buy" the WIP the calculations came up with, he even tried to beat the calculations only to later find that it took about 20 minutes longer doing it his way. After that experiment, Tech. Sgt. Jackson was sold and became one of the biggest advocates for AoP."

The impact of AoP on the Wheel and Tire shop has allowed them to stabilize their work-flow, resulting in over 1,900 man-hours saved per year and a 23 percent reduction in overall flow-time. Another positive effect found was an increase in process consciousness for the shop, which led to the identification of several Continuous Process Improvement initiatives to be tackled.

With hard numbers and the successes from the 2 MXS, senior leadership was briefed and it was decided that the next stop for AoP implementation was north to Minot Air Force Base, North Dakota.

"It was a logical next step for us to spread the knowledge and to standardize shops within the command that supported the same mission," said Tsao.

The Wheel and Tire shop within the 5th Aircraft Maintenance Squadron at Minot was able to replicate the successes seen at Barksdale; Tiffany Steele, Staff Sgt. Jacob Hatch and Tech Sgt. Jeston Jump were a few of the individuals who helped lead Minot's AoP implementation. Within a few weeks, the 5 MXS saw a 50% reduction in their flow-time.

The AFGSC 2022 Strategic Plan was recently released, and one of the lines of effort is modernization; AFGSC senior leadership is calling for creative, forward-thinking and outside-the-box ideas to improve the force. The implementation of AoP and the improvements it brings the mission is exactly the type of innovation leaders envision will modernize the command for the battles of today and tomorrow.

"Innovation is a crucial part of our Modernize line of effort," said Lt. Gen. Mark Weatherington, Air Force Global Strike Command deputy commander. "The command is committed to investing in Strikers' innovative ideas and applying new concepts so that we can maintain our competitive edge."

In the near future, an AoP handbook will be released to all AFGSC units to educate and inspire others to implement the concept within their own shops and work areas.

"My goal is to guide and help all of our leaders be able to implement AoP in their operations because the best part of my job is seeing the lightbulb come on after they see the concept, the training and the scenarios in action," Tsao said.

For more information or assistance with AoP, feel free to contact Tsao at ***william.tsao@us.af.mil***.

AFWERX Agility Prime completes first USAF-piloted flight of an eVTOL vehicle with partner Kitty Hawk

By Katie Milligan
AFWERX

WRIGHT-PATTERSON AIR FORCE BASE, Ohio (AFRL) – The AFWERX Agility Prime program took another step forward in December with the first government remotely piloted flight of an electric Vertical Takeoff and Landing (eVTOL) aircraft.

Capt. Terrence McKenna, an Air Force Reserve pilot with the 370th Flight Test Squadron and the Test and Experimentation Lead for AFWERX Agility Prime, participated in remote pilot in control (rPIC) training on the Heaviside aircraft at the Kitty Hawk Corporation's facility in Palo Alto, California from Dec. 13-17, 2021.

The training culminated in the first government remote piloted flight of an electric Vertical Takeoff and Landing (eVTOL) aircraft when he successfully flew the Heaviside via the Buddy Box System. This first Airman flight demonstrated another key milestone in the collaboration.

Kitty Hawk, in partnership with Agility Prime, is evaluating a training syllabus for their unmanned eVTOL aircraft, the Heaviside. McKenna's over 15 years of expertise piloting manned aircraft such as the C-5 and the T-38, as well as designing, developing, and testing manned and small unmanned aircraft systems (sUAS) as a civilian engineer, assisted Kitty Hawk's team of engineers in refining both their product and their training procedures.

From left, Parker Downey, with Kitty Hawk, and Air Force Reserve Capt. Terrence McKenna manually operate the Heaviside as external pilots through all phases of vertical lift and fixed-wing flight. *(Courtesy photo)*

Kitty Hawk: Building on the Wright Brothers' Legacy

Kitty Hawk Corporation was founded in 2010 by Sebastian Thrun and is backed by Google co-founder Larry Page. Their series of Heaviside aircraft are just several in a line of over 20 various eVTOL prototypes. Kitty Hawk is headquartered in Palo Alto, California and conducts much of its testing there. In July 2021, the USAF granted Kitty Hawk airworthiness approval, enabling the company to take advantage of additional testing opportunities through a partnership with Agility Prime.

Josh Lane, a Flight Test Engineer (FTE) for Agility Prime, began working with Kitty Hawk in March 2021 and has collaborated with Kitty Hawk to develop test plans supporting their prototype testing and goals to commercialization.

Focusing on Federal Aviation Administration (FAA) revised Part 23, the safety standards and type certification requirements for small aircraft, and other potentially relevant parts of the Code of Federal Regulations, eVTOL companies like Kitty Hawk gained a greater understanding of the requirements they would have to comply with in order to gain type certification. However, Lane explained that the road to certification for eVTOLs is an ongoing, collaborative process.

"These are new designs that don't fit the FAA mold, and there's not a 100 percent fit in some of these companies' cases, so there's a lot of engagement going on getting this path to a certified FAA aircraft," Lane said. "They're using baseline Parts and working with the FAA to determine what that certification basis is and what areas to be adjusted and addressed."

McKenna concurred, saying, "Agility Prime is figuring out how we approach training for these types of aircraft. This is a whole new ballpark."

The Heaviside aircraft

Named for the English engineer, physicist, and mathematician Oliver Heaviside, the Heaviside is Kitty Hawk's current flying model. The company has worked through several iterations of this vehicle and are in the planning stages for the next.

The Heaviside was first deployed in 2019 after nearly a decade of development. This aircraft's maximum takeoff weight is approximately 880 pounds, allowing for a passenger up to about 176 pounds. Heaviside can travel at speeds of roughly 180 miles per hour, but most significantly, it remains quiet: only about 35 decibels at 1,500 feet above ground level, which is slightly louder than a whisper and about 100 times quieter than a helicopter. Additionally, Heaviside has demonstrated 237 transitions between hover and forward flight, as well as a range of 100 miles on a single charge.

Heaviside takes advantage of several advanced technologies, such as Distributed Electric Propulsion (DEP), as this aircraft has eight fully electric propellers. Additionally, Lane explains that Kitty Hawk has refined its use of automated flight capabilities through its Ground Control Station (GCS); engineers can upload a flight plan, telling the vehicle to fly to certain locations, and the Heaviside can perform the entire flight profile without human intervention.

However, a training feature of the Heaviside is the Buddy Box setup, which is a secondary remote controller wired to a primary controller. This system is intended for the use of an instructor and a student performing the duties of an external pilot in manual flight mode; the trainee handles and operates the aircraft while the instructor provides supervision and support.

The Buddy Box system works much like a driver's education car: the driving instructor is in the passenger seat and allows the student to manually operate the vehicle, but is ultimately in full control and able to brake if necessary. Likewise, for a Buddy Box setup, the instructor can override any direction that the remote pilot in command (rPIC) gives the aircraft from the primary controller.

The Heaviside and future models will not rely on an external pilot for flight operations, but utilizing this training method now affords the opportunity for more immediate and qualitative feedback on the aircraft, while also building out a training syllabus for the GCS operator.

Training with Capt. Terrence McKenna

Though the current training plan for the Heaviside includes a five-day familiarization course and a 12-day rPIC qualification course, McKenna participated in elements of only the familiarization course.

Kitty Hawk utilizes techniques such as Scenario-Based Training (SBT), which is derived from the FAA's Airmen Certification Standards (ACS) and places the student in lifelike situations in order to complete each lesson objective. Additionally, Kitty Hawk employs Learner-Centered Grading, allowing students to assess their own performance in open conversation with their instructor.

Agility Prime chose McKenna to participate in this training because he fulfilled Kitty Hawk's trainee prerequisites, which include possessing either a military pilot rating or an FAA Part 107 and 61 certificate. Through a building-block approach, students must also demonstrate proficiency in flying smaller remote control (RC) aircraft, such as fixed-wing aircraft and quadcopter, before graduating to the Heaviside.

During the week in California, McKenna primarily concentrated on the duties of the external pilot, flying in manual mode, rather than automated flight and operating the GCS. Days 1 and 2 focused on ground academics, including simulation training, preflight checklists, and exposure to the Heaviside's GCS. Inclement weather kept the aircraft grounded, but McKenna reported a productive day of reviewing operations and discussing syllabus development.

Then, on Day 3, after completing several flights on smaller RC aircraft, McKenna successfully piloted the first USAF flight of an Agility Prime sponsored vehicle, navigating the Heaviside through the sky as the External Pilot at Kitty Hawk's test site. By the end of the day, McKenna had conducted 3 successful flights, focusing on vertical maneuvers, takeoff and landing, manipulation on all axes, auto-hover, and manual flight.

McKenna described that operating as the External Pilot allows pilots to get a feel for what the aircraft is capable of as it moves through the sky.

"It's a different paradigm for operating the aircraft," McKenna said. "A crucial thing that the RC controller allows you to do that a completely unmanned or a completely ground-controlled station based approach does not is [gain] that intuition about the flight characteristics of the aircraft that are so important [for operational employment]."

Days 4 and 5 concluded the week by training McKenna on fixed-wing flight, outbound and inbound transitions to vertical flight, and flying full profiles. McKenna reported enthusiastic satisfaction with the tested training methods from Agility Prime, AETC Det 62, and Kitty Hawk.

"I feel very confident in the training [including] pre-study, ground academics, simulation work, and surrogate flights to get us to this point," McKenna said.

Syllabus development in partnership with AETC's Detachment 62

While McKenna indeed learned to remotely pilot the Heaviside, a crucial objective of the weeklong exercise was to evaluate and improve the training plan itself for future operations.

"The main objective is to help collaboratively develop syllabi for these platforms with Kitty Hawk and our AETC detachment [Det 62]," McKenna said.

To monitor and evaluate McKenna's training process, the Air Education and Training Command (AETC) sent out Det 62 personnel to lend their experience with developing flight training plans. The Det 62 team worked closely with Kitty Hawk and the Agility Prime test team to draft an initial syllabus for McKenna for test and training. The team coordinated with Kitty Hawk's analysts, as well as Agility Prime, to observe, gather data, review training processes, and conduct detailed debriefs along the way. Moreover, Brittney Tough, Kitty Hawk's Senior Flight Training Manager, also brought extensive knowledge and experience to the table and served as an asset to government flight test teams.

"There's an opportunity between the military and the civilians to learn from each other on good practices and approaches to training plan development," Lane said. "I'm certain that there's going to be some learning going in both directions."

Looking forward to the potential military utility of the Heaviside, Lane expressed the vitality of the AETC's presence at and contribution to the project.

"It's huge that AETC sent out this detachment, and they're doing this early work to lower risk and pave the path for integrating one or more of these companies' systems into military use, and trying to make sure that's as seamless as possible," Lane said.

Lane and McKenna both emphasized the importance of Agility Prime's early involvement and cooperation with industry in order to accelerate the development of the eVTOL market.

"There's three legs to the stool: training, the aircraft itself, and the logistics to support it," Lane explained. "The typical goal is to have your training system in place, so that when you field a system, you have people that are ready to use it."

McKenna spoke to the success of Air Force early involvement through Agility Prime with eVTOL companies like Kitty Hawk.

"That interaction is paying dividends, and it's continuing to grow," he said. "Firsthand, I've seen that interaction prove fruitful on both ends."

Additional successes: BVLOS flight and FlyOhio

The first USAF-piloted flight of an eVTOL builds on recent highlights and milestones in the Agility Prime program. On Nov. 10, 2021, Kitty Hawk successfully completed its first beyond visual line of sight (BVLOS) flight during the Ohio Advanced Air Mobility Showcase, organized by FlyOhio, at the Springfield-Beckley Municipal Airport, near Wright-Patterson Air Force Base.

"The Air Force has been a strong partner for us as we bring eVTOLs closer to being ready for human flight," said Sebastian Thrun, CEO of Kitty Hawk. "In Ohio, we hit an important milestone making us the first UAM provider to fly a remotely-piloted aircraft BVLOS in a non-restricted air space."

Using SkyVision, a ground-based detect-and-avoid system developed by the Air Force Research Laboratory, in conjunction with the Ohio Department of Transportation (ODOT), Kitty Hawk safely maneuvered Heaviside among other manned flight traffic.

"The Heaviside BVLOS testing provides an excellent example of Agility Prime's aim to partner with industry and provide access to key government test resources, such as SkyVision, and [this] expertise continues to help advance the commercial eVTOL industry," said Col. Nathan Diller, AFWERX director.

Heaviside's goals and ecosystem impact

The Heaviside's utility extends into both the commercial and military worlds. Kitty Hawk hopes to provide a commercial air taxi service, but their eVTOL presents a multitude of opportunities for both civilian and government use.

Ultimately, Kitty Hawk hopes to lower costs with their vehicle, making aerial ridesharing more accessible and affordable to the general population.

McKenna noted that potential military and industry use cases largely overlap for the Heaviside: the aircraft could transport injured personnel, evacuate people from hostile territories, deliver cargo or first aid, make emergency medical services more accessible in rural areas or congested cities, and assist with firefighting or search and rescue operations, among many other potential scenarios.

"What we're trying to do is develop a training pipeline in the Air Force to understand these types of aircraft," McKenna said. "If we can get a joint Air Force-industry experimentation team, we can now open the aperture on engagements for these types of aircraft dramatically."

Regardless of how these vehicles are put to use post-certification, Lane drew attention to the practicality of implementing eVTOL aircraft into society. Though Prime focuses on how the Heaviside and its competitors affect the National Airspace System (NAS), new eVTOL technology will impact the entire aviation ecosystem.

"Most simplistically, it's more than just aircraft; it's these airsystems and the entire ecosystem that they will fly in and that need to support them," Lane said. "There's research and testing activity going on to develop, enhance, and bolster the National Airspace System (NAS) so that we can start incorporating these new capabilities."

Overall, both McKenna and Lane praised the teamwork necessary to achieve this milestone flight.

"We're establishing the interaction and the processes to make sure everything is vetted and approved and done in a safe manner," McKenna said. "It's a great way to accelerate innovation, supporting industry and keeping up with them. It's been a great team effort, and I'm excited about how it came together."

Maj. Benjamin Naumann and Maj. Mark Smith, 40th Flight Test Squadron pilots, fly the F-15EX Eagle II preparing to fire an AIM-120D missile during a Weapons System Evaluation Program mission near Tyndall Air Force Base, Fla., Jan. 25. This was the first live fire performed from the Air Force's newest aircraft. ***(U.S. Air Force photo by Tech. Sgt. John Raven)***

Eagle II fires first missile during live-fire event

By Samuel King Jr.
96th Test Wing Public Affairs

TYNDALL AIR FORCE BASE, Fla. (AFNS) – Flying over the Gulf of Mexico, the Air Force's newest fighter, the F-15EX Eagle II, successfully fired an AIM-120D missile Jan. 25.

The 40th Flight Test Squadron aircrew and aircraft fired the weapon pursuing a BQM-167 aerial target drone as part of the 53rd Wing's Combat Archer, an air-to-air weapons system evaluation program, or WSEP.

During the flight, the F-15EX detected the drone using onboard sensors, acquired a weapons-quality track and launched the missile at the target. After tracking the missile's release and flight toward the BQM-167, the shot was determined a WSEP success, at which point the missile flight was terminated.

The successful release marked the first weapon fired from the aircraft and another major milestone following more than six months of integrated developmental and operational flight testing for the shot.

"This was an end-to-end verification of the entire weapons system, which will pave the way for more complex missile shots in the future," said Colton Myers, F-15EX test project manager with the Operational Flight Program Combined Test Force.

Not only was this the first F-15EX live fire, it was also the first missile shot for experimental test pilot Maj. Benjamin Naumann. A large part of Combat Archer is providing firsthand, live-fire experience. Many pilots perform their first live fire at WSEP.

"I am humbled to have the opportunity to fire the first weapon, but the bigger success is the verification of the F-15EX capability to live-fire a missile," Naumann said. "This shot is another important step towards fielding the aircraft to combat units."

Along with weather, extra safety precautions and aircraft settings, test aircrew also have to account for and fly at specific test parameters when firing to ensure the appropriate data is collected for analysis.

"Ultimately we're a part of an iterative development process, validating expected results and providing feedback to the team on successes or things to improve," Naumann said. "We act as the liaison to bring combat capabilities to the warfighter."

The missile shot is one of many milestones for the F-15EX test team at Eglin Air Force Base. Only two months after arrival, the F-15EX deployed to Northern Edge in Alaska. The aircraft was pushed to its limits in the multiservice exercise and a significant amount of data was collected on the aircraft's internal performance and how it performed with and against other aircraft.

"The fact that both aircraft were able to turn around from a streamlined acceptance period and immediately deploy to a major exercise is a testament to the maturity of this platform, as well as the expertise of the combined test team as a whole," Myers said.

The F-15EX Eagle II fires an AIM-120D missile during a Weapons System Evaluation Program mission near Tyndall Air Force Base, Fla., Jan. 25. This was the first live fire performed from the Air Force's newest aircraft. ***(U.S. Air Force photo by Tech. Sgt. John Raven)***

Following the deployment, the F-15EX underwent developmental flight and ground testing to include survivability testing in various electromagnetic environments. This series of tests lead to the discovery of and resolution of issues identified in the F-15EX's Suite 9 software system, leading to a more mature and stable product, according to Myers.

"For a new platform, we've made an incredible amount of progress in a short period of time," Myers said. "I don't know of any other platform that has undergone such a rapid test program and it's been incredible to be a part of the team that's bringing this to reality."

After the developmental testing, it was time for some operational testing in October. The aircraft deployed to Nellis AFB, Nevada for another exercise focused on the air-to-air dominance mantle it will inherit from the F-15C. This exercise proved that while the platform still needs more development, it is completely capable of fulfilling its expected air dominance role, according to Myers.

Myers said the advancement of the program and the F-15EXs successes over the past 10 months are due to the integrated testing efforts by the 96th Test Wing and 53rd WG.

"The combined DT/OT (developmental testing and operational testing) strategy has been critical to our test success, allowing us to break the mold of 'traditional' testing, while ultimately resulting in an overall better product for the warfighter, and in a shorter timeline than if we adopted the traditional approach," Myers said.

The 83rd Fighter Weapons Squadron is responsible for the air-to-air WSEP, a monthly event here.

"The squadron was thrilled to help orchestrate and support this historic shot with our sister organization from Eglin," said Maj. Andrew Smith, F-15C WSEP program manager. "The F-15EX represents the next era of air-to-air capabilities and the opportunity to execute a first shot utilizing that platform was monumental."

Arnold AFB Milestones

40 YEARS
Joel Grissom, TOS
James Stringfield, TMAS

35 YEARS
Joel Gregory, TOS
Farid Haddad, TOS
Kimberly Mead, TMAS

30 YEARS
Susan Rymer, TMAS

25 YEARS
Mark Bymaster, TOS
Jason Farris, TOS
Thomas Johnson, TOS
Mitchell Luthi, TOS
James Mansfield, TOS
Kenneth Maxwell, TOS
Tracy Seals, TOS

15 YEARS
Christopher Cunningham, TOS
Dwane Kimmel, FSS
Zach Lowry, TMAS
Constance Rogers, TOS
John Sizemore, TOS
Adam Walsh, TOS

10 YEARS
Justin Garrard, TOS

5 YEARS
Bartolome Aganon, TOS
Chris Cleek, TOS

RETIREMENTS
Debra Barnes, TOS
Tanya Bryan, AF
Joseph Burns, TOS
Paul Chadwick Jr., TOS
Jerry Davidson, TOS
Billy Emberton, TOS
Sonia Gault, TOS
Joseph Martin, TOS
Judy Mohler, AF
Donald Rotach, TOS
Sidney Steely Jr., TOS
Master Sgt. Adam Whitehurst, AF

NEW HIRES
Brett Bearden, TOS
Joseph Bedell, AF
William Childress, AF
Caleb Choate, TOS
Alison Dunn, TOS
Christopher Evangelista, TOS
Michelle Frame, AF
Charles Gilliam, TOS
Forrest Harley, TOS
Baxter Hayes, TOS
Jeremy Holloway, TOS
Andrew Huston, TOS
Brian Mackenzie, TOS
Michael Mwembeshi, TOS
John Ortiz, TOS
Brittany Prince, TOS
Jerry Reyes Sr., TOS
Jamie Sain, TOS
Christopher Szatkowski, AF
Dhruv Vasant, TOS
Nina Zagar, TOS

James Stringfield, TMAS
40 years

PROMOTIONS
Lindsey Amacher promoted to NH-04 – Source Selection Advisor, AFTC/PZ Arnold

FEBRUARY

Admin 454-7779
Marketing 454-3128
Unite Program 454-7530
M-F 7:30am-4pm
Varied Telework schedules
Closed federal holidays

2022 AIR FORCE SERVICES

Hours/Changes due to increased HPCON
INFO UNTIL FURTHER NOTICE - SUBJECT TO CHANGE
Call to confirm. Other restrictions may apply.

GOLF COURSE: M, T, W, F, S, S 8am-dusk
Closed Th Mask required inside **454-GOLF**
Single rider carts unless same household

OUTDOOR REC: M-F 10am-5pm
Mask required inside **454-6084**

CAFÉ 100: TO GO ONLY
Recommend call in orders 454-5885
Jan: M-F 7am-1pm Feb: M-Th 8am-1pm NEW HOURS
Closed Feb Fridays & Feb 21
Mask required Touchless payment encouraged

FITNESS: APPT ONLY *Limited areas* **454-6440** Mask required
M-F 5am-7:30pm *(1-1:30 sanitizing)* **Sa 8am-1pm Closed Feb 21**

ALC: TO GO ONLY Th-F 5-8pm Closed Feb 18
Carry Out or Curbside Pickup 454-3350 *All events cancelled*

WINGO INN: Daily 8am-4pm 454-3051

Expect increased telework posture where applicable

Arnold Lakeside Center
TO GO ONLY
Thu & Fri 5-8pm
454-3350

CARRY OUT OR
Mask required inside

CURBSIDE PICKUP

Call your order in and have us deliver to your car!
pay in advance for quicker service

starting Feb 4
Café 100 Closed Every Friday

Café 100 February Special
Chocolate Covered Cherry Mocha
Tall 4.00
Grande 4.25
Venti 4.50
available in dark or white chocolate

Activities subject to change based on current CDC guidelines and social distancing restrictions. Mask requirements follow latest CDC guidelines.

As of 1-27-22.
Subject to change.
Please call to verify.
Services eligibility required except Golf-Open to Public.
Contractors follow company policy when necessary.

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STOP

Before you toss that in the trash…

THINK

Is it something that can be recycled?

RECYCLE

If YES, please toss in a recycling bin instead of trash can.

Thank You from THE GREEN TEAM
Eric Hopp Bud Schell Jake Jordan
931-454-6068

Please Recycle

DAF announces Spark Tank '22 finalists

By Isabel Zaru-Roque
Secretary of the Air Force
Public Affairs

ARLINGTON, Va. (AFNS) – The Department of the Air Force's Spark Tank program enters its fifth year and is poised to again highlight the creative and innovative spirit amongst our Airmen and Guardians. The Air and Space Force vice chiefs, along with other senior leaders across both services, selected six ideas to advance. The finals will be held at the Air Force Association's Aerospace Warfare Symposium as senior leaders decide who will be declared winner of Spark Tank '22 and take possession of the coveted 3D printed Spark Tank trophy.

As the Department's flagship innovation event, Spark Tank plays a central role in establishing the Department's strategic mindset for delivering future capabilities. In his 2020 whitepaper titled "Accelerate Change or Lose," Air Force Chief of Staff Gen. CQ Brown, Jr. said, "The United States needs an Air Force that can fly, fight, and win in the air domain as a member of the joint team. In recent years, faced with lesser adversaries, we have taken air superiority for granted, and it is easy to forget that the joint force loses without access to the air and the ability to deny that access to our enemies."

Similarly, in "Spacepower, Doctrine for Space Forces," Chief of Space Operations Gen. John W. "Jay" Raymond stated, "As a lean, mission-focused, digital service, the United States Space Force values organizational agility, innovation, and boldness. Elevating these traits starts with empowering small teams and prizing measured risk-taking as opportunities to rapidly learn and adapt. These principles apply equally to operations and day-to-day tasks. The United States Space Force must draw upon these traits to relentlessly advance military space power for the nation."

"Spark Tank presents each Airman and Guardian with the opportunity to leave a mark of excellence on our core competencies through an improvement or innovation born of their subject matter expertise and ingenuity," said Brou Gautier, Spark Tank director. "It also affords us occasion to celebrate those risk-takers, idea makers and intrapreneurs who refused to accept the status quo and developed solutions that advance our capabilities or improve our return on investment in order to inspire more of the same."

Co-produced by the Office of the Deputy Under Secretary of the Air Force, Management Rich Lombardi, and AFWERX, this annual event is designed to unleash our total force innovation capacity, reflecting leadership's continued efforts to empower intrapreneurs, celebrate their problem-solving skills and give them a stage to share their ideas with fellow service members, the Department's senior leaders, and the world. Only the top 3% of ideas submitted to the Spark Tank campaign were selected to compete as finalists.

Spark Tank 2022 Finalists:

Blood Delivery by UAV

Maj. Giselle Rieschick
99 Medical Support Squadron
Nellis Air Force Base, Nevada
Air Combat Command

Time is a critical aspect in combat casualty care. The sooner a combat casualty receives definitive care, particularly within the "golden hour" after injury, the better the chance of survival. The timely availability of blood products within the "golden hour" is essential to saving lives. Recent advancements in the medical use of unmanned aerial vehicles (UAVs), commonly known as drones, highlight the increased efficiency and reduced costs across a number of uses including blood delivery.

Aerial Tow Rehookup - Novel Range Extension

Cadet Grant Schlichting
United States Air Force Academy
Cadet Wing
USAFA, Colorado
United States Air Force Academy

The Airborne Aircraft Carrier has become a reality. Instead of constraint designs to fit within the mothership, the Aerial Tow Rehookup solution is to tow aircraft behind the mothership. This opens up the design space for aerial recharging of electronic vertical take-off and landing, supersonic towing of various platforms, and towing stealth assets to the frontlines of highly contested environments. This could provide Intelligence, Surveillance and Reconnaissance assets to loiter over enemy territory longer and spend less time during ingress and egress.

F-22 Project FoX (Fighter Optimization Experiment)

Maj. Allen Black
412th Test Wing
Edwards AFB, California
Air Force Materiel Command

The F-22 Raptor was recently upgraded with an Open Systems Architecture Rack (OSA) which opens the door to revolutionize the way in which F-22 mission systems are developed and acquired. Project FoX, or the Fighter Optimization Experiment, provides a transformative way to accelerate the delivery of new software capabilities to the aircraft while decreasing the cost by taking a tablet connected to a government interface that puts the aircraft data into a common format. This allows the aircraft to have some of the best applications downloaded that are portable across platforms and provide real test, training, and tactical benefits.

DAGGER: Developing Airmen and Guardians with Games for Enhanced Readiness

Matthew Correia
Eaker Center
Maxwell AFB, Alabama
Air Education and Training Command

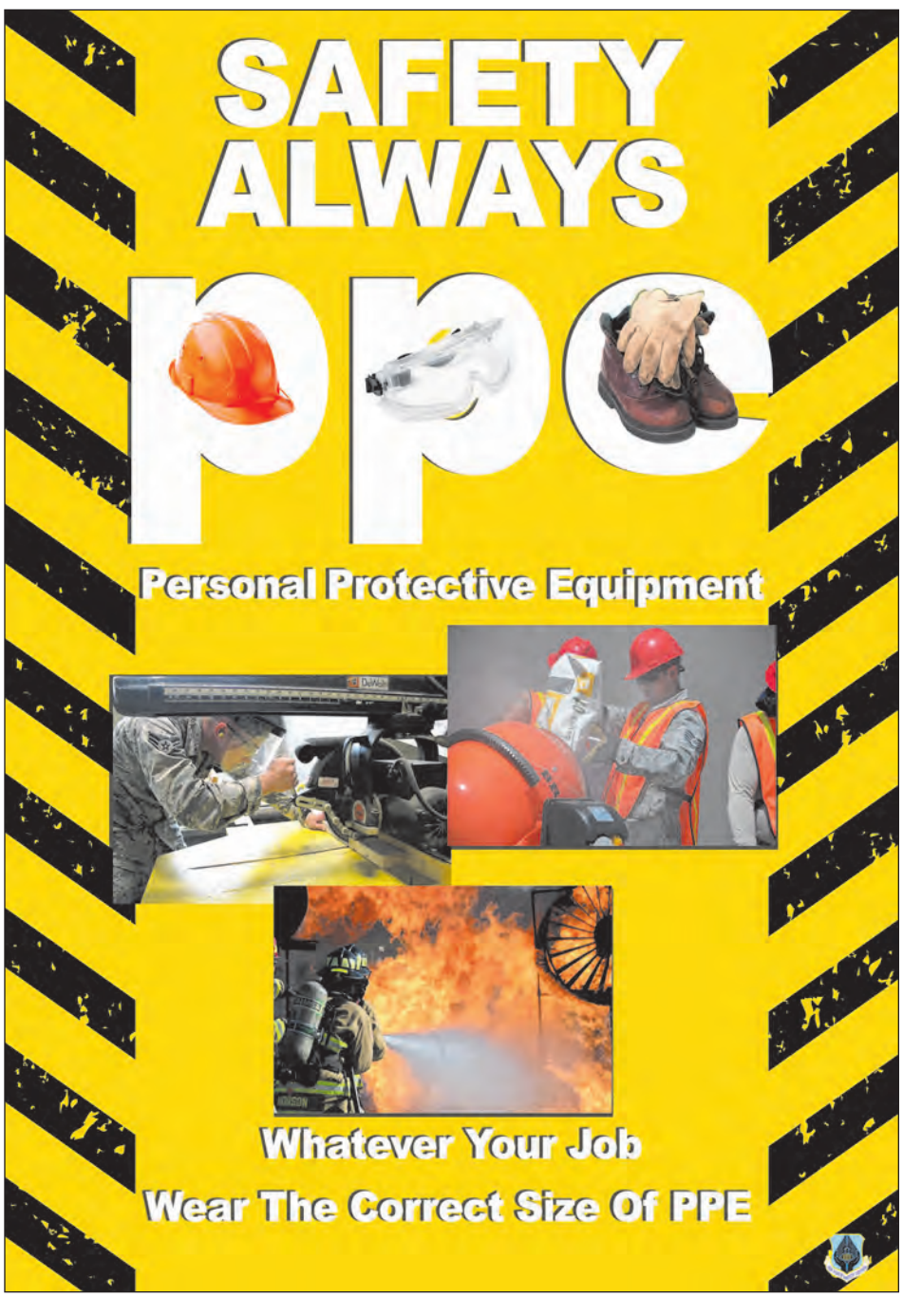
DAGGER: Developing Airmen and Guardians with Games for Enhanced Readiness is the application of sound, proven educational practices with game-based learning. It addresses the Air Force Chief of Staff's Action Order – Airmen to transform the way we deliberately professionally grow our Airmen and Guardians, by building better Airmen and Guardians on Air Force foundational competencies and core values.

Custom Facemasks for Fighter Pilots and Beyond

Maj. Ryan Sheridan
10th Air Base Wing
USAFA, Colorado
United States Air Force Academy

Are our pilots struggling with oxygen masks that don't fit? Where is the line between "fit" and "comfort"? We have the capability, but not the capacity to solve a problem that many warfighters suffer with in silence. Advanced 3D imaging, local design, and rapid prototyping will utilize a robust network infrastructure to align civilian partnerships to support the diverse facial features of our pilots with customized masks to optimize the human weapon system.

Project Arcwater

Senior Master Sgt. Brent Kenney and Tech Sgt. Matthew Connelly
52nd Fighter Wing
Spangdahlem AB, Germany
United States Air Forces in Europe – Air Forces Africa

Water and power are nonnegotiable when standing up a forward operating location. But it's not to get fuel and water on location. What if we could generate from thin air? Project Arcwater is an agile combat employment system that aims to significantly decrease the logistics of transporting water and energy needs at off-the-grid locations through solar panels, a water harvester, and AC/heating tool, creating 26 gallons of potable water out of thin air.