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Vol. 63, No. 2

Arnold AFB, Tenn.

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January 25, 2016

Recognizing the 25th anniversary of Desert Storm:

AEDC tested technology that gave U.S. military the edge

By Deidre Ortiz
ATA Public Affairs

Twenty-five years ago on Jan. 16, 1991, coalition aircraft led the largest air campaign since the conflict in Southeast Asia. That conflict, known as Operation Desert Storm, followed a Congressional concurrence with United Nation efforts to enforce a resolution to withdraw Iraq from Kuwait and prevent seizure of other neighboring Persian Gulf states.

Several weapon systems used by U.S. military during Desert Storm were tested at AEDC, and according to AEDC Historian Christopher Rumley, these systems directly aided in the outcome of the war.

"The technology perfected in part at AEDC gave American Forces an unprecedented advantage in the air and ground war," he said.

Prewar predictions downplayed the Air Force role. Experts insisted the invaders would need to be forced out by the bayonet. Some predicted 10,000 to 30,000 casualties. These new technologies were untested in war and no one was sure how they were going to change the battlefield. The magnitude of the air war success astonished even the AF planners who quickly re-doubled their targeting efforts over Baghdad once it became clear we could operate with impunity.

For the Air Force, the initial phase air campaign sought air superiority. More than 30 aircraft types were used and more than 69,000 sorties were flown, which ultimately led the Air Force to gain and maintain control of the air do-



AEDC personnel check a quick-opening at the F107 turbofan engine's exhaust nozzle. The door was opened as air was supplied to the engine's inlet to simulate an in-flight start. The F107 engine powers Air-Launch Cruise Missiles, such as the AGM-86C used by the B-52 bomber. (AEDC Photo)

main.

Military aircraft flown during Desert Storm include the A-10 Thunderbolt II, B-52 Stratofortress, C-12 Huron, C-130 Hercules, C-141 Starlifter, F-117A Nighthawk, AV-8B Harrier, the F-15/F-15 E Eagle, F-111 Aardvark, F-16 Fighting Falcon, F/A-18 Horn-

et, F-4 Phantom II and F-14 Tomcat, among others.

According to an Air Force Association report, B-52 bombers were the first aircraft to launch on Jan. 16, 1991, from Barksdale AFB, La. They were armed with the AGM-

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John Lamb, AEDC wildlife biologist, uses a torch to light brush for a training exercise during the basic wildland training course held near the University of the South in Sewanee. The course provides an overview of fuels, weather and topography on fire behavior. (U.S. Air Force photo/Deidre Ortiz)

AEDC Natural Resource Managers and partnering agency take part in wildland fire training

By Deidre Ortiz
ATA Public Affairs

AEDC natural resource managers and Tennessee Wildlife Resource Agency, which provides support to Arnold AFB, participated in a Basic Wildland Firefighting training course at the University of the South in Sewanee.

Represented at the course held Jan. 4-8 were the AEDC Civil Engineering Branch, AEDC contractors for Facility Support Services and TWRA.

Troy Morris, AEDC Natural & Cultural Resources Planner, said AEDC pre-

scribed fire staff appreciates the opportunity to take part in the training hosted by the Environmental Stewardship at University of the South.

"The course is meant to prepare students for careers in forestry and wildland fire management, and it meets National Wildlife Coordinating Group (NWCG) certification guidelines for wildland firefighters," he said.

During the course, participants learn about fuels, weather and topography on fire behavior. It also introduces tools and

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AEDC committee announces Black History luncheon

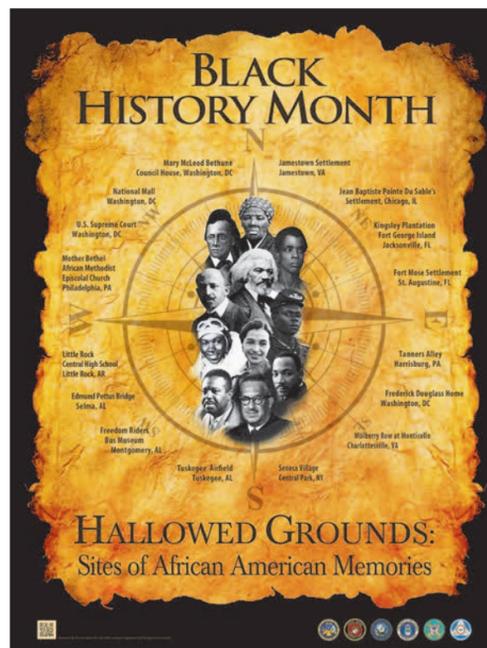
Recognizing 'Hallowed Grounds: Sites of African American Memories'

By Raquel March
ATA Public Affairs

The African American Heritage committee will hold a Black History luncheon Feb. 12, 12 p.m., at the Arnold Lakeside Center where they will recognize sites of African American memories.

The 2016 Black History theme, established by the Association for the Study of African American Life and History, is "Hallowed Grounds: Sites of African American Memories." The theme reflects on the places where African Americans have made history; from port cities where Africans disembarked from slave ships to battlefields where their descendants fought for freedom.

The ASAALH executive summary regarding the theme states, "The Kingsley Plantation, DuSable's home site, the numerous stops along the Underground Railroad,



The Association for the Study of African American Life and History theme (Defense Equal Opportunity Management Institute image)

Seneca Village, Mother Bethel African Methodist Episcopal Church and Frederick Douglass's home – to name just a few – are sites that keep alive the

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HIGH MACH

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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 AEDC support contractor ATA. Deadline for copy is Wednesday at close of business the week before publication.

This commercial enterprise newspaper is an allowable ATA contractor publication for personnel at AEDC.

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Team AEDC remembers, celebrates Dr. Martin Luther King Jr.



The AEDC African American Heritage Committee held a remembrance walk Jan. 14 at the Complex where Team AEDC walked in remembrance of the sacrifices made by civil rights leader Dr. Martin Luther King Jr. Participants are pictured at the beginning of the walk. (U.S. Air Force photo/Holly Fowler)

Base Legal Office offers tax help

By Leslie McGowan
AEDC Legal Office



Leslie McGowan

The 2015 income tax season has arrived and the Arnold Air Force Base Legal Office is offering free Volunteer Income Tax Assistance (VITA) for eligible personnel.

All service members on active duty and retirees and their dependents are eligible to receive these free services. This year the legal office will also be able to provide tax services to other categories of filers including DOD civilians whose income is less than \$60,000.

IRS-trained volunteers assist tax-filers in preparing, reviewing and electronically filing their income tax returns. Most customers receive their refund within two weeks.

Tax assistance appointments are available and continue until the yearly tax filing deadline of April 15. Eligible personnel may call the Legal Office at 454-4657 to schedule an appointment. VITA volunteers can provide tax preparation up to advanced and military certification levels which include rental properties and Schedule A itemizations. However,

taxpayers filing taxes that are beyond the VITA scope of training and certification, with complicated returns such as non-deductible IRAs, business with losses, and complicated capital gains and losses, will need assistance from a paid professional preparer for tax assistance.

Military members should access and print their W2s from the MyPay website at <https://mypay.dfas.mil/mypay.aspx> before arriving for their appointment.

If you prefer to "do-it-yourself tax returns", Military One Source has a free federal tax preparation and e-filing program available to military members and their dependents through their website at www.militaryonesource.com. The website allows

tax filers to utilize a free online version of the H&R Block tool.

The software is a simple question and answer program that is a quick and easy way to complete and e-file your federal tax returns. The program allows military members the option to e-file their state returns for a small fee. You can also receive military specific advice regarding tax questions at no cost by speaking to a trained Military OneSource tax consultant at 1-800-242-9647.

If you prefer to file your federal and state taxes using the paper forms, these forms are now available online for download and printing at www.irs.gov or through the individual state tax websites. The IRS also offers a free tax program, Free File, at

www.irs.gov where individuals who makes less than \$60,000 can e-file for free. For more information, call the legal office at 454-4657.

For those who are not eligible for the military tax assistance programs, the IRS VITA program is offered at the Coffee County Lannom Memorial Library in Tullahoma by appointment only. For a tax appointment at Tullahoma, please call (931) 409-3602.

If you live outside the Tullahoma area and wish to locate your nearest VITA site, call the IRS information VITA line at 1-800-829-1040.

If you are interested in assisting taxpayers with tax preparation at the Arnold Legal Office, call 454-4657.

Make a difference

By Chief Master Sgt. Mike Heath
30th Medical Group

VANDENBERG AIR FORCE BASE, Calif. (AFNS) –

Will you make a difference in someone else's life today? We have all heard someone say, "Take care of your people and their families." Have you ever stopped to think why we hear this so often?

As Airmen, our number one responsibility is to accomplish the mission. However, without smart, dedicated, hard-working people and the unconditional support of their families, the mission would not get accomplished. This philosophy is not new. In fact, it's

been a fundamental concept in our Air Force culture for many years, but are we truly putting forth our best effort on a daily basis to be involved in the lives of our people and understand the needs of our Airmen?

Genuinely caring for your Airmen is essential and helpful when providing honest and realistic performance appraisals. Mentor those whose development with which you are charged. Make sure they can do your job someday. Teach them from your experiences – the good, the bad and the ugly.

Share your successes and failures and tell them how you handled them.

Make it a teaching moment so you can make them better leaders.

Taking the time to develop Airmen is not an easy task and it's not something that can be done only online or by computer based training. It takes human interaction, patience, effort, and an ability to evolve. Enable and motivate people to accomplish the mission. Give a sense of accomplishment and make sure they are recognized for it. If done properly, no doubt you will instill confidence in others and ensure the success of tomorrow's leaders.

It's not about you. It's about other people. When you take care of your peo-

ple, help them accomplish their goals and live up to their potential, and great things will happen. Not only will the mission get accomplished, but innovation and excellence will ensue. These things can happen when you realize it's not about you and you take care of your people. You and I share a common blessing in that we are members of the finest country in the world. I have faith that you will endeavor to make our country even better in the future by making a difference in someone else's life today.

I was entrusted with the incredible responsibility to be a supervisor more than 25 years ago.

I started something that first morning as I prepared for work. As I was so proudly putting on my Air Force uniform I looked into the mirror and said, "Will you make a difference in someone else's life today?" I have asked that question every day since. When I get home at the end of my duty day, as I take off my uniform, I look in that mirror again and ask myself, "Did you make a difference in someone else's life today?" Sometimes the answer is no, so what do I do the next day? Try harder!

So I ask you; will you make a difference in someone else's life today? If you do, it could inspire an Airman for a lifetime.

Smoking Policy

1. The following revised AEDC smoking policy is effective immediately. Smoking is permitted solely in designated areas identified by a plastic "smoke genie." This receptacle is for the sole purpose of cigarette butt disposal. If there is no receptacle, smoking is not permitted in that area. It is the responsibility of all smokers to clean up the area surrounding the receptacles for any cigarette butts on the ground. Smoking in government-owned vehicles is strictly prohibited. Personnel are allowed to smoke in their personal vehicles at any time. Smoking areas will be held to the absolute minimum and will be located in low traffic, low visibility areas away from points of building ingress/egress and air intakes. A map of all authorized smoking areas is available on the Team AEDC SharePoint site. Smoking near a facility in an area not designated on the map is prohibited and any smoking receptacles located in areas not shown on the map will be removed. All "smoking permitted" and "no smoking" signs will be removed unless specifically required by OSHA.

The fact a person smokes has no bearing on the number of breaks they may take. Breaks should be taken in accordance with the company/agency personnel policies that apply to all employees.

Smoking, including the use of electronic cigarettes and smokeless tobacco, is prohibited in any area, at times when official business is being conducted with government clients, test customers, outside visitors and dignitaries, and where official business is being conducted including conference rooms, auditorium settings, business meetings, or in any other area where Air Force regulations specifically prohibit use. 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. Due to the nature, appearance, and safety concerns of electronic cigarettes (also known as "e-cigs"), the use of said products will abide by the same rules for tobacco products stated above and governed by AFI 40-102, *Tobacco Use in the Air Force*.

2. Supervisors at every level will ensure this policy is followed. Disciplinary action is appropriate for repeated violations.

3. Updates to this policy will be made in the future to further align with Air Force guidelines.

4. This policy remains effective until rescinded. (This policy is dated December 20, 2013)

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. They can access the Action Line in one of two ways: via the AEDC intranet home page, and by calling 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. Rodney Todaro
AEDC Commander

Innovation Grant spurs 3D printer donation to AEDC STEM

By Marshall Polk

AEDC Space and Missiles Branch

The innovation grant program at AEDC has been a great success with more than 60 grants issued.

Starting in 2013, the program has provided funding to several AEDC employees so that they could explore ideas to develop out-of-the-box products or processes. Now, the knowledge and hardware from one of the early grants is helping teach kids about the exciting technology of 3D printing.

The initial grant intended to use a consumer grade thermoplastic 3D printer to prototype parts for the diagnostic technology branch.

"At the time we purchased the best printer which fell within the grant budget," said AEDC employee Danny Catalano, a member of the grant investigation team. "We learned a lot about designing parts specifically for additive manufacturing, but unfortunately the printer was not able to meet the resolution we needed for our prototypes."

However, the design skills went on to greatly benefit the technology group as they began fabricating more advanced

hardware with industrial grade printers, but the grant printer mostly sat idle at AEDC.

That was until recently when the printer was used to support a Science, Technology, Engineering and Mathematics (STEM) class at Westwood Middle School. The innovation grant printer was used to print several toy bracelets and whistles for kids attending the camp.

"The kids loved it," said Jere Matty, AEDC STEM educational outreach specialist. "We ran a 3D printer in the background for two days at the camp and kids were constantly going over to watch it in action."

The technology level of the grant printer turned out to be a perfect fit for kids and the camp. The grant team immediately recognized the benefit that printer could have on the AEDC STEM Center and with just a few emails to Jacobs Technology, the company was on board to donate the hardware in support of this cause.

"This worked out well for everyone involved," Catalano said. "Our group gained valuable design knowledge from the grant and the AEDC STEM Center camp gets to expose students to this exciting new technology



Above, students Colleen Wainright, Brooke Sanders and Kinsey York watch as the AEDC Science, Technology, Engineering and Mathematics Center 3D printer works to create an object layer by layer at Westwood Middle School, Manchester, Jan. 12. The printer, initially obtained through an Innovation Grant for a project at AEDC, was recently donated to the AEDC STEM Program. (U.S. Air Force photo/Jere Matty)

due to the quality support from our grant team."



Deb Wimberly (left), science teacher at Westwood Middle School in Manchester, student Eli McLean and AEDC Commander Col. Rodney Todaro check out the 3D printer donated to the AEDC Science, Technology, Engineering and Mathematics Program by Jacobs Technology. Eli holds a shark that was just made using the printer Jan. 12. (U.S. Air Force photo/Jere Matty)

TRAINING from page 1

techniques for safely lighting and fighting fires. Other exercises include practicing using fire shelters and personal protective equipment as well as learning about the incident command system or how to respond to planned and unplanned fire events.

AEDC Natural Resource Manager Shannon Allen stated the hands-on activities and training provided skills that will be beneficial to the base.

"The U.S. Forest Service is the premiere wild-

land fire agency, so receiving the course from them ensures that AEDC will have high-quality, prescribed fire experts," she said.

The weeklong course was instructed by members of the USFS from Cherokee National Forest and was coordinated by the Air Force Wildland Fire Center. It was set up in part by Kevin Hiers, director of Environmental Stewardship at the University of the South who formerly served as acting

chief of the AFWFC at Eglin AFB.

"It's the connection between the AFWFC and the university that made this training possible for the natural resource managers at Arnold AFB," Morris said.

Hiers added the University of the South and AEDC has a long history of collaborating when it comes to topics of natural resources and fire protection.

"As a prior chief of the AFWFC, I'm familiar

with Arnold's wildland fire program," he said. "Troy Morris and I began looking for ways to deepen the connection between the two programs and we thought collaborating on

required basic wildland fire training was a natural fit."

"We are already looking forward to additional follow-up opportunities to add training in prescribed

fire, which is a critical management tool for both Sewanee and AEDC."

This most recent wildland fire training marks the second year the class has been taught at Sewanee.



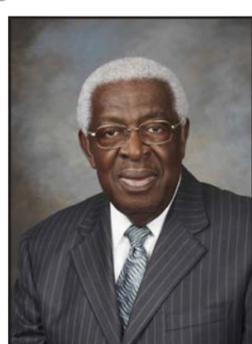
A course participant in the wildland fire training takes a chance to warm up while watching how the flames react to the windy conditions. (U.S. Air Force photo/Deidre Ortiz)

LUNCHEON from page 1

The luncheon speaker is Manchester Mayor Lonnie Norman.

Norman was the first black mayor of Manchester, elected in 1991, and was re-elected as the 45th mayor in 2012.

Governor Haslam appointed Norman to the Tennessee Duck River Development Agency Board of Directors in 2011 and he is a member of the Coffee County E-911 Board of Directors. He served on steering committees for Vice President Al Gore's 2000 campaign and former United States Congressman Har-



Lonnie Norman, Mayor of Manchester, Tenn.

old Ford Jr.'s 2006 Senate campaign.

Norman served as an alderman for Manchester from 1984-1991 and served as Vice Mayor for

three administrations.

In 2003, he retired from AEDC as a supervisor with 41 years of service. He held several positions at AEDC including custodian, instrument technician and lead technician.

Reservations and cash or check payment for the luncheon must be made no later than Feb. 5. The cost of the luncheon is \$12 for non-Services members and \$11 for Services members. Make reservations by emailing AEDC.AAHC@us.af.mil or by calling 454-5706, 454-7661 or 454-7096.

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2016 Engineers Week Activities

-  **MathCounts competition**
Feb. 6, 8 a.m.-1 p.m., UTSI
-  **Student Design Competition**
Feb. 22, 9 a.m.-2 p.m., Hands on Science Center - Tullahoma
-  **Engineer-for-a-Day**
Feb. 24, 7 a.m.-3 p.m., AEDC & local companies
-  **Engineers Banquet**
Feb. 25, 5:30 p.m.-8:30 p.m., Manchester/Coffee County Conference Center

AEDC contributions to International Space Station remembered during Tennessee Space Week

By Raquel March
ATA Public Affairs

As milestones have been made with the 17-year progression of the International Space Station, AEDC contributions to the development of the ISS are remembered during Tennessee Space Week, Jan. 24-30.

In 1995, the berthing mechanism for the space station underwent extreme temperature tests which provided thermal model validation, defined station keeping power requirements and verified material properties.

The berthing mechanism, built by Boeing, is a primary mechanical interface assembly linking the station modules together. Two test configurations were tested – an active common berthing mechanism and a passive CBM.

Jim Sisco, then AEDC project engineer, stated at the time of the tests, “These are the two, six-foot diameter rings that seal the joint between station modules upon mating. The first ring, called active, houses the powered bolts and actuators that drive the two halves together. The passive, or second ring, provides a seal between the modules when the two halves are mated.”

The CBMs were tested in the 12V Aerospace Thermal Vacuum chamber at the Complex, which measures 35-foot high and 12-foot diameter and is able to simulate a space environment temperature of -400 degrees Fahrenheit. Vacuum pumps were used to evacuate the air from the chamber simulating the vacuum of space. Xenon arc lamps provided a solar simulation, equivalent to the sun, which would project a beam of light upon the CBMs during rotation in the chamber.

As of Dec. 9, 2015, the U.S. Cygnus spacecraft, also known as Orbital Sciences CRS Flight 4, berthed to the ISS using the technology tested at the Complex. The next U.S. resupply mission to the ISS, tentatively scheduled for March, is when the SpaceX spacecraft Dragon will dock with the berthing port on the module named Harmony, a utility hub.

The module, originally called Node 2, received the name Harmony through a competition geared toward kindergarten through 12th grade students from 32 states in 2007.

Tennessee Space Week

The Tennessee Education Association Tennessee Space Week is a statewide project designed to increase student and teacher’s interest and performance in science, technology, engineering and mathematics fields through a focus on aerospace programs and accomplishments.

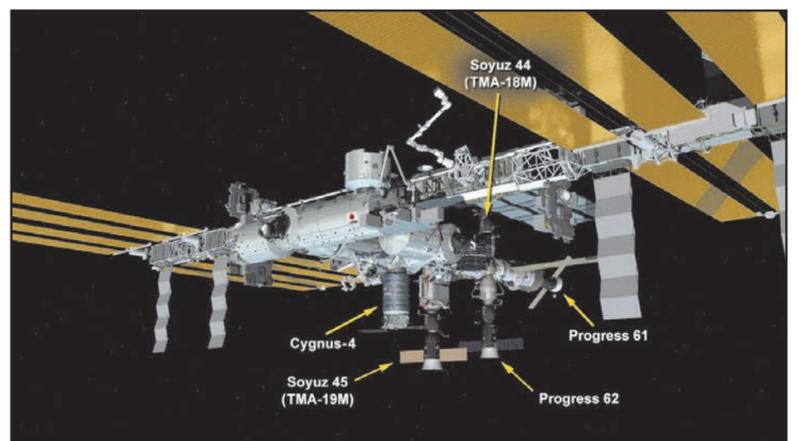
Following the Space Shuttle Challenger explosion, Jan. 28, 1986, TEA acted to honor the life and teaching of fellow National Education Association member, Christa McAuliffe, who was aboard the Challenger as America’s first teacher in space. In her honor, Tennessee Space Week is held each January, the last school week preceding or the school week including Jan. 28.



An AEDC rigger helps lower an International Space Station component, called a common berthing mechanism, into the 12V Aerospace Thermal Vacuum chamber at the Complex for simulated space environment testing in 1995. (U.S. Air Force photo/Gary Barton)



Using the International Space Station’s robotic arm, Canadarm2 (right) NASA Flight Engineer Kjell Lindgren prepares to capture Orbital ATK’s Cygnus cargo vehicle Dec. 09, 2015. The space station crew and the robotics officer in mission control in Houston positioned Cygnus for installation to the orbiting laboratory’s Earth-facing port of the Unity module. The connection to the port uses a common berthing mechanism that was developed by testing at AEDC. Among the more than 7,000 pounds of supplies aboard Cygnus are numerous science and research investigations and technology demonstrations, including a new life science facility that will support studies on cell cultures, bacteria and other microorganisms; a microsatellite deployer and the first microsatellite that will be deployed from the space station; several other educational and technology demonstration CubeSats; and experiments that will study the behavior of gases and liquids, clarify the thermo-physical properties of molten steel, and evaluate flame-resistant textiles. (NASA photo)



This graphic depicts the International Space Station Configuration as of Dec. 23, 2015. (Clockwise from top) The Soyuz spacecraft is docked to the Poisk mini-research module. The ISS Progress 61 spacecraft is docked to the Zvezda service module. The ISS Progress 62 spacecraft is docked to the Pirs docking compartment. The Soyuz spacecraft is docked to the Rassvet mini-research module. The Cygnus-4 cargo craft is berthed to the Unity module. (NASA graphic)

DESERT STORM from page 1

86C Conventional Air-Launched Cruise Missile, the first missiles to use satellite guidance. Tomahawk Land-Attack Missiles were also used, as were F-117 stealth attack aircraft, which at the time had never been flown against modern air defenses. The launch of these aircraft would kick off a six-week air campaign.

While testing of the B-52 aircraft didn't occur at AEDC until after Desert Storm, the capability for the Air-Launched Cruise Missile was developed in the Propulsion Wind Tunnel and Engine Test Facility during the mid-to-late 1970s. These missiles, the AGM-86B and AGM-86C/D, were developed to increase the effectiveness of the B-52H bombers by diluting an enemy's forces and complicating defense of its territory.

The 600-pound-thrust turbofan jet engine, the F107, completed Preliminary Flight Rating Tests at AEDC in 1975, and testing of a full-scale operating model of the ALCM prepared the missile for its first powered flight by March 5, 1976. The missile was dropped from a B-52 bomber at 15,000 feet above sea level and flew for 11 minutes.

The AGM-86C/D uses an onboard Global Positioning System coupled with its inertial navigation system to accurately guide itself to the target. The final acceptance and qualifications for GPS were conducted at AEDC in 1977, the same year of its initial launch. A space-based radio navigation system, GPS provides reliable positioning, navigation and timing services to military.

Rumley said these were very important during Desert Storm.

"GPS allowed for accurate missile guidance and allowed our ground forces to know exactly where they were in relation to the enemy in a featureless desert environment. The work by AEDC on satellites and Patriot Missiles was a major contribution to the war effort," he said.

In addition to the B-52, an aircraft used for its close air support of ground forces was the A-10, which specializes in defense against ground targets including tanks and other armored vehicles.

Preliminary store separation testing of two A-10 prototypes was conducted in AEDC wind tunnels, and exploratory testing of the General Electric TF34-GE-100 turbofan jet engine and the Avco Lycoming ALP502, the two potential power sources for the A-10, also took place at the Complex.

Scale models of the aircraft and several types of stores began testing at AEDC on Jan. 31, 1974. These tests, sponsored by Air Force System Command's Aeronautical Systems Division determined if the stores would separate cleanly when dropped or launched at various flight speeds.

In April 1974, a series of developmental tests of the 30-mm ammunition to be used with the new A-10 close air support aircraft were completed. Since Desert Storm, developmental tests of the TF34 Engine for the A-10 have continued at AEDC, with Accelerated Mission Testing in the sea level test cells.

The F-111 Aardvark

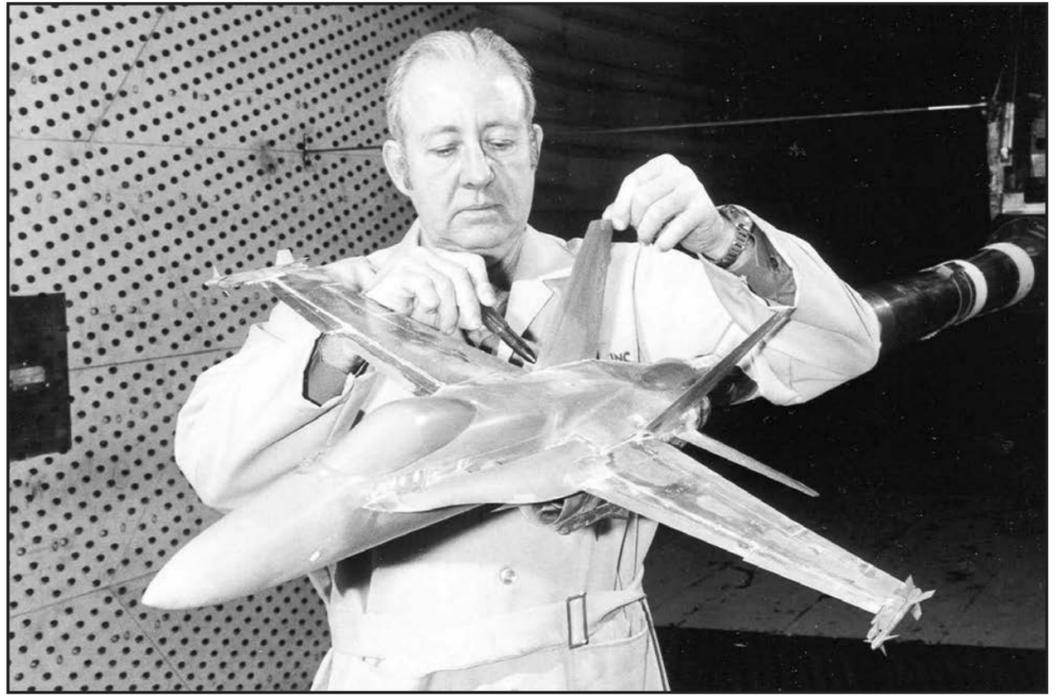
also played a part in Desert Storm as a multipurpose tactical fighter bomber capable of supersonic speeds and altitudes up to 60,000 feet. Production of the F-111 prototype began in the fall of 1963, and in that same year, the first wind tunnel models of the F-111 were tested in AEDC's Propulsion Wind Tunnel facilities. Soon after the aircraft's Pratt & Whitney TF30-P103 turbofan engines were being tested in the Engine Test Facility. The first F-111 rolled out Oct. 15, 1964.

This aircraft proved versatile in the skies over Vietnam in 1972-73 and again in spring 1986 against terrorist targets in Libya. Then on Jan. 17, 1991, the F-111 was used during the bombing raids of Desert Storm. More than 100 F-111 aircraft of different versions joined the first strikes against Iraq both as bombers and radar jammers.

Another aircraft tested at AEDC that aided in gaining air superiority in Kuwait was the F-15 Eagle, a tactical fighter, and the F-15E Strike Eagle. The aircraft has been extensively tested at AEDC since the early 1970s. Several AEDC facilities were instrumental in the engine testing and weapons separation testing of the various munitions systems used by the F-15. The weapons separation tests in the 4-foot transonic wind tunnel were the first steps in certifying the Air-Guided Missile (AGM)-154A Joint Standoff Weapon and the Joint Direct Attack Munition Guided Bomb Unit (GBU)-31.

AEDC engineers also performed a great deal of testing on the F-16 Fighting Falcon and its engines. Store separation investigations of the aircraft and work on external munitions and payloads were also conducted. In 1982, a test was conducted on external load effects of external navigational and targeting pods, including a Low Altitude Navigation Targeting Infrared for Night pod on the inlet of the F-16. This capability has been deemed useful because it significantly increases the combat effectiveness, allowing aircraft to fly at low altitudes, at night and under-the-weather to attack ground targets with a variety of precision-guided weapons.

The U.S. Navy's F/A-18 Hornet, the nation's first designated strike-fighter designed for traditional strike applications, underwent aerodynamic tests at AEDC in the 1970s that examined the flight characteristics. Additionally, aerodynamic loads and store separation testing was conducted on the



Extensive wind tunnel tests have examined the flight characteristics of the Navy's F/A-18 fighter. In the first phase of the tests, drag measurements were made at simulated flight speeds from Mach .6 to 1.55. (AEDC Photo)

aircraft's payloads, including the GBU-10, GBU-24 B/B, Joint Standoff Weapon, Joint Direct Attack Munition and Standoff Land Attack Missile Extended Range.

In 1990, a year prior to Desert Storm, the F/A-18 returned to the Complex so that AEDC engineers could determine if the High-speed Anti-radiation Missile (HARM) would safely separate from the aircraft. Using HARM missiles, the Air Force destroyed Saddam Hussein's air defense network of surface-to-air missiles.

Known for its stealth technology, the F-117 Nighthawk was deployed in Desert Storm and validated its potential as an aircraft, demonstrating it could penetrate the dense threat environment at night. About the size of an F-15 Eagle, the twin-engine could employ a variety of weapons and was nearly undetectable by radar.

The F-117 has undergone extensive testing at AEDC since the war that assisted in the continual development of its capabilities. For example, in 1998, a weapons separations test was performed to obtain Mk-84 and Bomb Live Unit-109 Joint Direct Attack Munitions weapons certification.

As a carrier-based, strike aircraft, the F-4 Phantom II was utilized during Desert Storm as well. AEDC involvement with the F-4 involved validation of a number of pioneering test and data collection technologies and techniques, and in March 1972, a scaled model of the modified F-4E Phantom II, was tested in 4T to determine flight characteristics of bombs, fuel tanks and missiles dropped or launched from an aircraft with the wing leading edge modified to improve maneuverability.

A model was back in the same wind tunnel in July of that year for study of the aerodynamic effects of external stores on the fighter's flight characteristics. Scale models of advanced guided cluster weapons and external fuel tanks were mounted on the F-4 model to determine their effect on basic aircraft stability, drag characteristics and transonic trim changes. Conditions simulated flight speeds from 300 to 950 mph at various angles of attack.

Less than a year prior to Desert Storm, in April 1990, a model of the Navy's F-14 Tomcat aircraft, configured with the General Dynamics/Westinghouse concept for the Advanced Air-to-Air Missile, underwent wind tunnel testing in 4T to ensure the structural integrity of the aircraft/missile matchup and reduce risks during the demonstration/valida-

tion phase.

The Tomcat's armament was occasionally updated to maintain pace with new technology. Years after the war, in 1995, the Naval Air Systems Command (NAVAIR) asked AEDC to perform wind tunnel tests on the aircraft configured with an Air Intercept Missile-7F Sparrow missile and a Guided Bomb United-24 B/Bs, a laser guided bomb.

Coalition air, ground and naval forces were also greatly aided and made more combat lethal due to employment of space technology — weather satellites, US LANDSAT multi-spectral imagery satellites, GPS, early warning satellites, tactical receive equipment and related applications satellite broadcast, the Tactical Information Broadcast Service and communication satellites.

In all, Desert Storm introduced stealth, pre-

cision-guided munitions, widespread use of space assets, and parallel warfare to modern war. It was followed by 12 years of aerial blockade of Iraq or Northern and Southern Watch, which ended when the US launched Operation Iraqi Freedom in 2003.

Long after Desert Storm ended, AEDC continues to play a role in advancing the latest technology, and Rumley notes that the U.S. military remains dependent upon these advancements.

"Technology is still a theme that continues as we strive to create the next generation of game-changing technologies in an environment that is much more competitive than it was in 1991," Rumley said.

Much of the information used in this release was taken from the AEDC publication "Beyond the Speed of Sound".

A look back at Desert Storm, 25 years later

By Senior Airman
Hailey Haux

Secretary of the Air Force
Public Affairs

WASHINGTON (AFNS) – Twenty-five years ago, the Air Force participated in Operation Desert Storm, the largest air campaign since the conflict in Southeast Asia. The campaign's purpose was to drive the Iraqi military out of Kuwait, release the country from Saddam Hussein's invasion and re-establish its sovereignty.

On the morning of Aug. 2, 1990, Iraq invaded nearby Kuwait. In less than four hours, Iraqi forces occupied the capital, Kuwait City, and Hussein soon annexed the country as the 19th province of Iraq. The U.S. government initiated Operation Desert Shield in response.

Several months later on Jan. 16, 1991, following Congressional concurrence with United Nations efforts to enforce a resolution that demanded Iraq's withdrawal from Kuwait, Desert Storm was launched.

"The real mission, the immediacy of that mission ... was to deploy as many forces as possible to deter further aggressiveness by the Iraqi military and of course the Air Force was the first on the list, along with the Navy



F-16A Fighting Falcon, F-15C Eagle and F-15E Strike Eagle fighter aircraft fly over burning oil field sites in Kuwait during Operation Desert Storm. (U.S. Air Force archive photo)

and the aircraft carriers, to deploy in the region," said retired Lt. Gen. Bruce A. "Orville" Wright, a Desert Shield/Storm veteran. "It was a rapid deployment of forces from the continental United States (and some forces from Europe) to put enough airpower in place so the Iraqi military would be discouraged, if not deterred.

"We took out their eyes and ears, their control capability," he continued. "The entire ground operations lasted about 100 hours and that's a credit to the joint coalition airpower that was employed against the Iraqi military. We were all excited, that's what we trained for our whole career. To take 24 F-16s and a squadron of very capable

highly-trained pilots and maintenance professionals ... and defeat what was then the largest ground force."

The air campaign marked the initial phase of the war and for the Air Force, air superiority was the goal. With more than 68,800 total force Airmen being rapidly deployed in support of Desert Storm,

there were approximately 69,406 sorties flown by 30 different types of aircraft.

"I remember thinking, 'Saddam Hussein has no idea what's coming,' and after the first 60 minutes of the war, he will be largely disconnected from his tactical forces and he was. They tried to reconnect, but in many ways we began the decapitation of the leadership within the first 15 minutes of the war," said Maj. Gen. Paul T. Johnson, an operational capability requirements director and Desert Shield veteran. "I really hope we can remember how we came together as a joint and a coalition team, nations from all over the world, all of the services supporting each other, generating effects for one another to achieve an effect in an incredibly short period of time."

Desert Storm marked the first conflict in history to make comprehensive use of stealth and space systems support capabilities against a modern, integrated air defense, allowing the Air Force to succeed in their endeavor of air superiority.

"Over time I have come to understand the enabling capabilities that came to us from space, came to us out of stealth (and) that came to us out of new weapons and ammunitions that allowed us to do things in ways that we hadn't done them before," Johnson said. "Our ability to dynamically command and control across an entire theater there were things that, looking back now in hindsight, fundamentally began the transformation of airpower. There are so many things that we take for granted to-

day ... that saw their beginnings in Desert Storm."

As with any mission, operation or task, there are lessons learned. Desert Storm taught the Air Force that being on the cutting edge of revolutionary technology is critical to success.

"That was the first time the investments, that had been made in some cases a decade or two decades earlier, came together on the battlefield and for the first time the world saw what the United States Air Force could do," said Air Force Secretary Deborah Lee James. "Looking back and learning from Desert Storm, it is more important than ever before that we continue to modernize our force, gaining the advantage to defeat any adversary we may face in the future."

On Feb. 28, 1991, following six weeks of air attacks and 100 hours of a ground campaign, President George H.W. Bush declared a cessation of operations and announced that Kuwait had been liberated.

"The memories and lessons learned from Desert Storm continue to define today who we are," Wright said. "We have the ability to defend the nation that's founded on, not just the history of Desert Storm but the history of airpower from World War I to World War II to Korea, Vietnam, Desert Storm and today. We have been in this fight now for 25 years and those Airmen who are out there today are critical. They are critically important to the safety of our fellow citizens and critically important to the future of the United States of America."

Team AEDC reminded to prepare for winter weather

By AEDC Safety

Sometimes winter storms are accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chill. Strong winds with these intense storms and cold fronts can cause coastal flooding and beach erosion as well as sink ships at sea. In the West and Alaska, winds descending off the mountains can gust to 100 mph or more damaging roofs and other structures.

Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. Infants and elderly people are most susceptible. What constitutes extreme cold and its effect varies across different areas of the United States. In areas unaccustomed to winter weather, near freezing

temperatures are considered "extreme cold." Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. In the north, below zero temperatures may be considered as "extreme cold." Long cold spells can cause rivers to freeze, disrupting shipping. Ice jams may form and lead to flooding.

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and dis-

rupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. In the mountains, heavy snow can lead to avalanches. The cost of snow removal, repairing damages, and loss of business can have large economic impacts on cities and towns.

Primary concerns are the potential loss of heat, power, telephone service, and a shortage of supplies if storm conditions continue for more than a day.

Have available:

- Flashlight and extra batteries.

- Battery-operated NOAA Weather Radio and portable radio to receive emergency information.
- Extra food/water. High-energy food, such as dried fruit or candy, and food requiring no cooking/refrigeration
- Extra medicine and baby items.
- First aid supplies.
- Heating fuel. Fuel carriers may not reach you for days after a severe winter storm.
- Emergency heating source, such as a fireplace, wood stove, space heater, etc.
- Learn to use properly to prevent a fire.

- Have proper ventilation.
- Fire extinguisher and smoke detector
- Test units regularly to ensure they are working properly.

Be prepared before the storm strikes:

- Plan your travel and check the latest weather reports to avoid the storm!
- Fully check and winterize your vehicle before the winter season begins.
- Carry a WINTER STORM SURVIVAL KIT: Blankets/sleeping bags; flashlight with extra batteries; first-aid kit; knife; high-calorie, non-perishable food; extra clothing to

keep dry; a large empty can and plastic cover with tissues and paper towels for sanitary purposes; a smaller can and water-proof matches to melt snow for drinking water; sack of sand (or cat litter); shovel; windshield scraper and brush; tool kit; tow rope; booster cables; water container; compass and road maps.

- Keep your gas tank near full to avoid ice in the tank and fuel lines.
- Try not to travel alone.
- Let someone know your timetable and primary and alternate routes.

National Museum of the U.S. Air Force fourth building to open June 8

By Arnold Air Force Base Services

DAYTON, Ohio – The National Museum of the U.S. Air Force's new \$40.8 million fourth building including aircraft such as SAM 26000 (Air Force One) and the only remaining XB-70 Valkyrie, will open to the public on June 8.

The 224,000 square-foot building, which was privately financed by the Air Force Museum Foundation, will house more than 70 aircraft, missiles, and space vehicles in four new galleries - Presidential, Research and Development, Space and Global Reach, along with three science, technology, engineering and math (STEM) Learning

Nodes.

Construction of the building first began in July 2014 and will be completed in January 2016 by the Columbus office of Turner Construction Company and overseen by U.S. Army Corps of Engineers, Louisville District.

The museum's restoration division is currently moving aircraft into the building and assembling other artifacts for display such as the massive Titan IVB space launch vehicle and satellite booster rocket weighing 96 tons.

According to Museum Director retired Lt. Gen. Jack Hudson, visitors can now begin making their summer travel plans and include a visit to see the museum's new fourth building.

"We're extremely excited to open the fourth building with some of our most popular aircraft at the beginning of the summer vacation season," Hudson said. "The museum is within a day's drive of more than 60 percent of the U.S. population so we're not too far from many of the places folks will be travelling to, and with free admission and parking it is well worth a stop to see the new additions at the Air Force's national museum."

Although the building will open to the public on June 8, special weekend activities and demonstrations are being planned to continue celebrating the building opening, June 11-12. More information on these events will be released as it becomes available.

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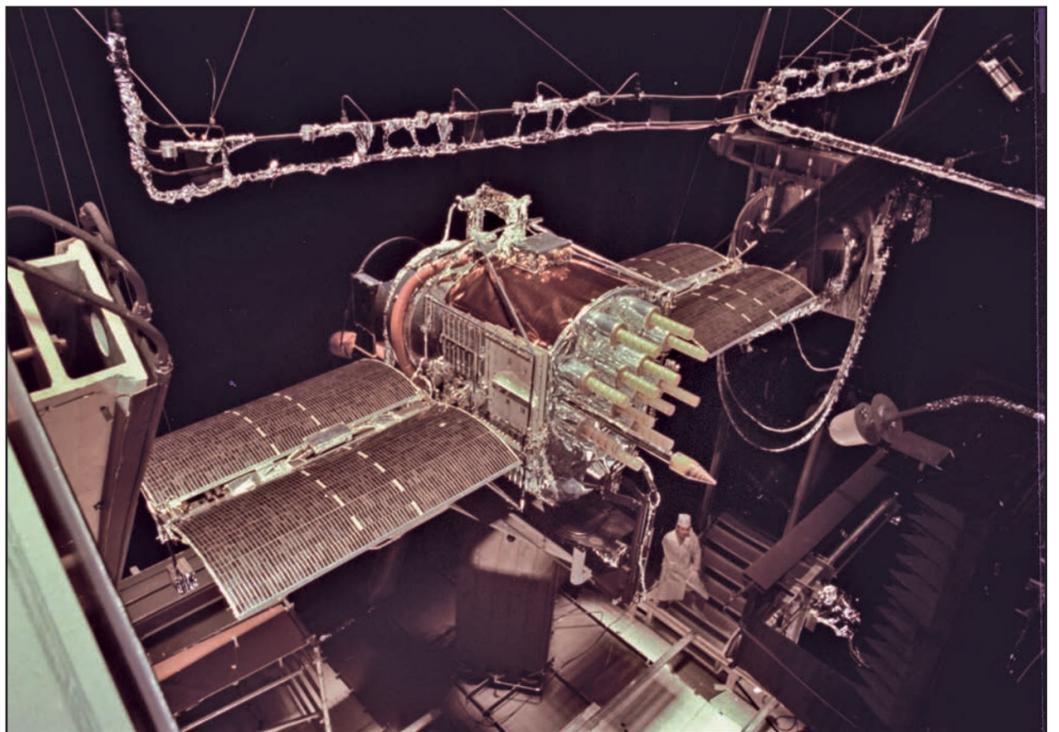
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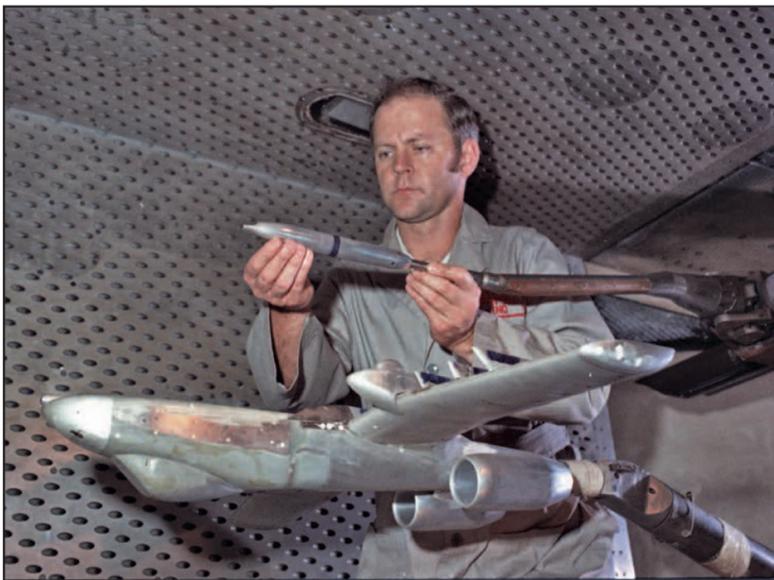


YouTube

AEDC contributions to Desert Storm



A full-scale Global Positioning Satellite System was tested in the Mark I Space Chamber at AEDC in 1977. (AEDC Photo)



This photo from 1973 shows A-10 stores being prepped for testing in the 4-foot transonic wind tunnel at AEDC. (AEDC Photo)



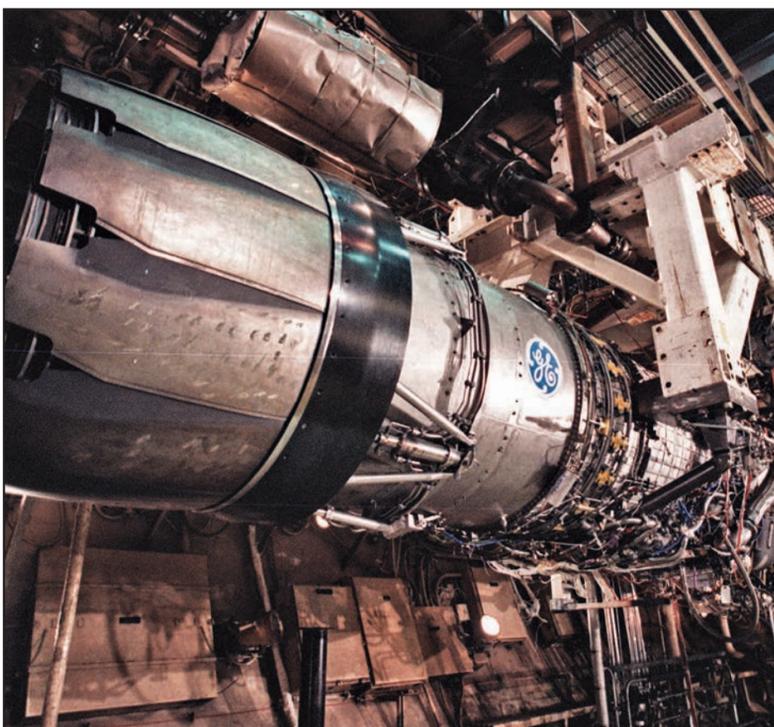
An F-14 Tomcat model is readied in 1990 for a store separation test in 4T. (AEDC Photo)



Seven F-15 design changes were verified in tests in 16T. AEDC did extensive support during the re-research and development stage of the F-15 program. (AEDC Photo)



Store separation testing, using 5-percent scale models, began in 1985. More than 500 configurations have been investigated to ensure that the F-15 Eagle can safely deliver its wide array of weapons to accomplish its air-to-ground & air-to-air missions. (AEDC Photo)



The F110-GE-129 engine is shown in the J-2 engine test cell at AEDC. The engine used improved materials and controls to increase performance up to 20 percent over the F110-GE-100 engine used in the F-16 Fighting Falcon. (AEDC Photo)



AEDC completed a highly detailed study of stability/performance of inlets that provide air to the engines of the F/A-18 fighter. Simulated flight speeds of 0-1,000 mph over a number of angles of attack and sideslip. (AEDC Photo)

AEDC Woman's Club members study history and prepare for spring



David Hiebert (center), from Tullahoma, spoke about the history of AEDC with the ladies from the AEDC Woman's Club during the January meeting. Pictured left to right are AEDCWC members Suzanne Rutley, Jane Anne Driver, Lynn Van Patten, Peg Austin, Ernestine Badman and Karen Todaro. (Courtesy photo)

By Barbara McGuire
AEDC Woman's Club

The Jan. 5 meeting of the AEDC Woman's Club featured David Hiebert from Tullahoma who spoke on the planning and formation of Arnold Air Force Base.

Hiebert described the U.S. government program that brought in specialized scientists, equipment and management models to the United States in the wake of World War II. Themes included the controversial concept "conspiracy", the moral dilemma and the Paperclip influence on Middle Tennessee.

Table donations of \$200 went to the Fisher House of Murfreesboro.

The next meeting of the AEDCWC is Feb. 2 at the Lakeside Center.

During the meeting, the ladies of the Woman's Club will be introduced to J. Jordan Boutique Fashions and Accessories on the east side of the square in Shelbyville. AEDCWC ladies will model trendy fashions including cute trending tops, leggings and dresses of all sizes.

The table donations from the February meeting will go toward the AEDCWC Scholarship Foundation. A celebration of scholarship donations will be planned at the end of the meeting.

The February meeting is open to the public and provides the opportunity to meet the AEDCWC members and become a member. You don't need to have military connections or be involved with Arnold Air Force Base to visit and become a member.

For information about the AEDCWC call 455-3569.

The social hour of the meeting starts at 9:30 a.m., with the business meeting and program beginning at 10 a.m.

Reservations and cancellations for the meeting must be made no later than noon, Jan. 26. Make reservations or cancellations by calling 931-636-4152.

Disclaimer: This is a private organization which is not part of the Department of Defense or any of its components and has no governmental status.

Tenn. AIAA Section holds January meeting: AIAA SciTech Review

The American Institute of Aeronautics and Astronautics Tennessee Section will have a luncheon meeting on Jan. 28, 11:30 a.m., at UTSI, room H-111.

The event is open to

the public. Reports from representatives from the following AIAA Technical Committees will be made: Aerodynamic Measurement Technologies; Meshing, Visualization

and Computational En-

vironments; and Ground Testing.

In addition, authors will present summaries from their SciTech technical papers.

The cost is \$12 for professional society

members, \$15 for non-members and \$5 for students which is payable at the door.

The deadline to make reservations is close of business Jan. 26. Rsvp by calling 454-7627.

Pentagon says F-35 program on the right track

By Mitch Shaw
Hilltop Times

HILL AIR FORCE BASE, Utah (AFNS) – Lockheed Martin and the Pentagon's F-35 Joint Program Office say they've finished delivering jets for 2015, increasing their yield from last year by 25 percent.

Joe DellaVedova, a spokesman with the F-35 office at the Pentagon, said 45 F-35s were delivered, which met Lockheed and the program office's delivery goal for the year and exceeded last year's deliveries by nine jets.

"Meeting aircraft production goals is a critical stepping stone in demonstrating the program is ready for the expected significant production ramp up," Lt. Gen. Chris Bogdan, the F-35 program's executive officer, said in a press release.

Lorraine Martin, Lockheed's F-35 program general manager, said the 2015 deliveries were "a clear demonstration of our growing maturity and stability."

The performance boost represents good news for Hill Air Force Base, which accepted its first two jets in September and will continue to count on a steady income of fighters until 2019 to fill three F-35 squadrons.

Base spokesman Rich Essary said it has received a total five jets so far, with the next one scheduled to arrive in January. Essary said the plan is for Hill AFB to continue to accept jets at a rate of one or two each month until they receive their full allotment of 72.

By August 2016, the base hopes to have 15 jets in place in order to reach what the Air Force calls "initial operational capability," which means Hill AFB has met the minimum goal to use the jets for normal operations.

On Dec. 11, Maj. Jayson Rickard, a reservist with the 466th Fighter Squadron, flew the 100th F-35 sortie at Hill AFB since the first combat aircraft arrived in September.

Of the 45 jets delivered in 2015, the lion's share has gone to the Air Force, which has received 26 F-35As. The Marine Corps received eight F-35Bs and the Marines and the Navy each accepted four F-35Cs, which can take off and land vertically from aircraft carriers.

DellaVedova said 154 operational F-35s have been delivered to the Department of Defense and partner nations since the program's inception. The fleet has more than 45,000 flight hours. The multirole fighter will eventually replace the Air Force's entire fleet of F-16 Fighting Falcons and A-10 Thunderbolt IIs.

New Year's Eve Casino Night a win for players

By Arnold Air Force Base Services

Players at New Year's Eve Casino Night, were given fake money, amounts based on club membership, to play an assortment of casino games at the Arnold Lakeside Center, Dec. 31.

The attendees won thousands of dollars in fake cash and used their winnings to bid on prizes provided by top sponsors and donors in the Tullahoma community.

We thank Sprint, our top sponsor and Sherrill Pest Control, a partnering sponsor for your support. Prizes this year ranged from a flat screen TV to Dollywood theme park tickets.

If you missed the out NYE, don't worry. Casino Night is coming in August and in December.

To find out how to support this morale boosting event, call the Commercial Sponsorship Coordinator at 454-3171.



Services team members Emily Howell (left) and Anna Ballard welcome players to the New Year's Eve Casino Night at the Arnold Lakeside Center Dec. 31. The center will host another Casino Night in August and December. (Courtesy photo by Emily Howell)

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<p>8 Café 100 National Potato Lovers Day Baked Potato \$4.50 Limited toppings</p>	<p>9</p>	<p>10 FC Push Pull Sit UP competition Anytime during the day Open 5am-7:30pm Top prize in each area for men and women</p>	<p>11 ALC Brushes & Bottles \$25 GLC 6pm Sign up by Feb 5 454-3350</p>	<p>12 Arnold Golf Course Winter Special Dollar-a-Hole now - 31 Mar 9 holes/\$9 18 holes/\$18 454-GOLF (4653) good 7 days a week - cart fee extra Open to the public</p>
<p>15 Café 100 Closed Presidents' Day Federal Holiday</p>	<p>16 ALC Book Fair Café 100 9am-1pm</p>	<p>17 ALC Dining Room Thu 5-8pm Fri 5-9pm Sat 5-9pm</p>	<p>18 Movie: Jem and the Holograms</p>	<p>19 Café 100 National Chocolate Mint Day \$3 Grande Peppermint Mocha Espresso</p>
<p>21</p>	<p>22 Café 100 National Biscuits & Gravy Day (21) Get Large Biscuit & Gravy for \$3</p>	<p>23</p>	<p>24</p>	<p>20 ODR American Heart Month Trekking Class 10am \$3 Crockett Cove Sign up by Feb 13 454-6084</p>
<p>28</p>	<p>29</p>	<p>25 Movie: Alvin and the Chipmunks: The Road Chip</p>	<p>30 ALC Last Friday Trivia 6:30pm</p>	<p>27</p>

ALC – Arnold Lakeside Center, 454-3350
Café – Café 100, A&E, 454-5885
ODR/ITT – Outdoor Recreation, 454-6084
RRRP – Recycling, 454-6068
Marketing/Sponsorship – 454-3128
Barber Shop – 454-6987

GC – Arnold Golf Course, 454-GOLF
MG – Mulligan's Grill, GC, 454-FOOD
FC – Fitness Center, 454-6440
WI – Wingo Inn, lodging, 454-3051
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