ABERDEEN TEST CENTER
THE POINT POSITION

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Aberdeen Test Center: Proud of Our Past, Focused on Our Future

COL Morris L. Bodrick
Commander, U.S. Army Aberdeen Test Center

For almost 100 years, the U.S. Army Aberdeen Test Center (ATC) has stood for world-class testing, training, modeling, simulation, and experimentation—all to ensure the safety and success of the American Soldier in combat.

A premier U.S. Army test facility, ATC is the only center testing Automotive equipment, along with Firepower, Survivability/Lethality, and Warfighter systems. ATC also excels in joint air, land, and water Soldier training, and in new Test Technology development. Situated on the Chesapeake Bay, ATC operates in a constantly changing weather environment which, in the course

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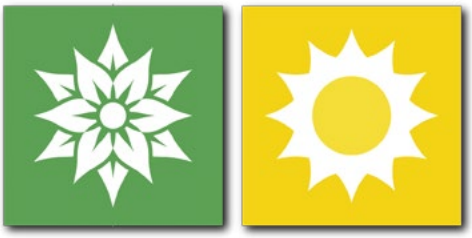
A Test for All Seasons: ATC's One-Stop Climatic Testing



Will communication systems work around trees...or buildings?

Will vehicles get stuck driving through mud?

Will navigation sensors operate effectively in falling snow?

*See **CLIMATE**, page 6*

An MRAP All Terrain Vehicle (M-ATV) gets a cold-weather workout on ATC's Churchville Test Course.

100 Years of Excellence: The ATC Story

Excerpted from an article by Lauren Nelson

The U.S. Army Test and Evaluation Command's (ATEC) ATC is a premier test facility, with a reputation founded on the work ethic and dedication of the people who work here. Our advances in technology, ranging from automotive and weapon development to breakthroughs in the test process itself, demonstrate the capabilities of this Test Center.

ATC's inception was a result of the United States' engagement in World War I. Before 1917, all of the Army's proof testing was done at Sandy Hook Proving Ground, New Jersey. As wartime work and tech-

nology advanced, Sandy Hook's location and size proved inadequate for the Army's needs. COL Colden L. Ruggles guided the search for a new location, a quest that

*See **HISTORY**, page 8*

Dynamic Vehicle Vulnerability Underbody Blast Demonstration

MRAP vehicle moving at 30 mph undergoes an underbody blast event at ATC.

Douglas C. Blankenbiller

Chief, Vehicle Systems Vulnerability Branch, Survivability/Lethality Directorate

Hundreds of underbody/under wheel mine and improvised explosive device (IED) tests have been conducted at ATC since 2007 with the push to rapidly field more survivable vehicles like the Mine Resistant Ambush Protected (MRAP) vehicle. All tests were performed with the vehicles in a static configuration, but in reality, vehicles are typically moving when they are exposed to mine and IED attacks. The static tests have produced valuable data to evaluate system and crew survivability from the initial blast loading, but how the vehicle's forward momentum contributes to vehicle and occupant responses remains largely unknown. ATC has been actively engaged in addressing this issue through developing its ability to conduct tests and collect data for dynamic vehicle vulnerability test events. To assess progress, the Dynamic Vehicle Vulnerability Demonstration was conducted at C-Field in ATC's Edgewood area.

The demonstration included one underbody mine event performed on an M1224 MaxxPro MRAP. Featured were the capabilities to remotely drive an armored vehicle downrange along a predetermined course, detonate a mine at a specified location under the moving vehicle, and collect onboard video, crew survivability, and vehicle performance data.

A Pronto4 robotic system was used to drive the unmanned vehicle along a paved road and over a 24-by-24-foot test pit filled with engineered soil compacted to a roadbed configuration. The system provided remote operation of the vehicle's gear selector, throttle, steering, and braking. Software allowed the remote operator to interface with the system to create a travel path, and path execution was achieved using Global Positioning System (GPS) waypoint following.

A four-laser system and a vehicle-borne reflector were used to provide vehicle location and speed inputs to the Countdown Automation Procedure, Version 3 (CAP III) system that detonated the mine under the vehicle. Each laser was positioned along the center of the paved road at a specified distance from the detonation point. As the vehicle passed over each laser, a signal was sent to the CAP III system. The system verified the vehicle's course, calculated its speed, and accounted for its location relative to the mine. The system then determined a go/no-go scenario based on the vehicle's speed and course, and, given a go scenario, armed the system and timed the mine detonation to occur at the proper location under the vehicle.

An integrated networking and power system facilitated the collection of onboard video, crew survivability, and vehicle response data. A Consolidated On-board Interface Network (COIN) mounted inside the vehicle contained the data acquisition and power interfaces for the onboard real-time and high-speed video cameras, accelerometer instrumentation, and crew anthropomorphic test devices (ATDs) with associated Data Acquisition for Anthropomorphic Devices. ATC personnel in the system control room digitally communicated with the instrumentation through the COIN fiber connection and a 1,000-foot fiber tether.

The results of the demonstration validated that ATC now has the capability to conduct underbody testing on vehicles in motion and to collect data throughout the entire event, which includes not only the initial blast loading, but also vehicle flight, subsequent slam-down, and possible rollover. Continued improvements in ATDs and injury criteria will further advance this capability. However, this test was an important step in demonstrating a capability that will allow system survivability to be more completely evaluated, ultimately leading to improved component and system level designs to mitigate the effects of mines and IEDs for enhanced Soldier survivability.

The Long Reach of ATC

LOCB unlocked - after spanning the gap at the AB5 bridge test site, the LOCB is ready for vehicle crossing demonstrations.

Steven G. Hensley

Senior Test Officer, Force Projection & Watercraft Branch, Warfighter Directorate

In a war zone, where bridges are nonexistent or have been destroyed, the military bridge is critical to Soldier success and safety.

Historically, tactical bridge deployment needed cranes and other equipment, plus a large crew - a liability in wartime.

The Line of Communication Bridge (LOCB) will help our Soldiers advance under adversity with minimal crew, equipment, and time required.

The LOCB is the highest capacity bridge in the U.S. Army inventory. Its 4.2-meter-wide roadway consists of 50-meter segments, any of which will connect a 50-meter gap. All segments, linked and supported by intermediate piers installed by crane, will span gaps of up to 300 meters. To deploy, a series of rollers is placed on the near shore. The LOCB is fully assembled on top of the rollers. A vehicle with tow bar, attached to the bridge, provides the force to roll the bridge across the gap. Day or night, a typical crew of 29 Soldiers can complete a 50-meter bridge build, or bridge removal, in about 48 hours.

A separate pedestrian walkway can be bolted onto the bridge manually or by using a forklift or crane. The bridge segments and components are transportable worldwide inside 20-ft^2 standard containers. The LOCB can support any vehicle in the Army inventory with capacity to spare. In fact, the entire length of the bridge could be covered with semitrailers with no excess weight problem.

Many bridges are built by commercial entities and sold to the Army: the LOCB is all-Army. Design, manufacture, and testing are performed by Army professionals. Developmental testing at ATC will determine LOCB effectiveness, suitability, and survivability. Testing will ensure the bridge is safe to build, can handle a wide range of vehicles, is transportable by standard commercial industry methods, and is durable enough for continual use in a war zone.

In bridge testing, a data acquisition (DAQ) system measures and records the strain of critical structural members, bridge deflection, and crossing vehicle speeds. Typically, the customer receives test results as a formal written report, but an ATC Command directive propelled the LOCB test team to present the data to the customer in near real-time. The test instrumentation team combined multiple DAQ techniques and integrated the results into a customer-accessible database. Data on crossing vehicle position was used to calculate the expected strain and deflection values. A match between the calculated and the actual values meant that ATC could

Taking the high road - a heavy equipment transporter carries the M1 Abrams battle tank, weighing almost 62 tons, across the LOCB.

*See **LOCB**, page 7*

Blazing an Unmanned Trail

No tailgating! The AMAS test vehicles demonstrate adaptive cruise control. Without driver input, the system applies the vehicles' brakes and throttle to maintain proper gap distance in relation to the speed of the lead vehicle.

Brian Wise

Senior Test Officer, Unmanned Vehicle Division, Automotive Directorate

Adaptive cruise control, lane change alerts, assisted parking, emergency brake assist, collision avoidance, and pedestrian detection are becoming widespread on our highways, making the roads safer through technology.

One automaker has publicly declared its vision that by 2020, nobody should be seriously injured or killed in one of their new cars.

How can these technologies protect Soldiers on the battlefield?

ATC, the Army's premier automotive test center, is putting military versions of these systems to the test.

Active safety features and autonomous vehicle technology are focal points of the Autonomous Mobility Appliqué System (AMAS) test program at ATC. An "appliqué system" offers technology which complements and enhances an existing vehicle platform. Features of the AMAS By-Wire Active Safety Kit (BWASK) include lane departure warning/assist, forward and rear collision warning/assist, blind spot monitoring, adaptive cruise control, and hill hold and descent control. Using radar and camera input, AMAS-BWASK senses the surrounding conditions and obstacles and independently controls the throttle, applies the brakes, and provides assistive steering to the driver. For the Federal Highway Administration, ATC is also testing some vehicles for adaptive cruise control using inter-vehicular communication.

At ATEF, a Soldier operates a truck equipped with AMAS-BWASK to assess the situational awareness and active safety capabilities of the system.

ATC's Automotive Technology Evaluation Facility (ATEF) experts tested the AMAS-BWASK driver warning and assist functions using four heavy-duty Army tractor trucks and two Army flatbed semitrailers. The test crew used plastic vehicle targets with metallic enhancements and robotic devices to represent pedestrians, vehicles, and traffic. ATEF drivers, data collectors, mechanics, technicians, and engineers first tested the vehicles equipped with AMAS-BWASK in various scenarios to gather system characteristics data and identify any safety hazards. Once all safety concerns were rectified, system demonstrations were performed by five U.S. Army Soldiers. The Soldiers provided valuable feedback for future system development.

The test proceedings culminated with a VIP event held at the ATEF Paved Wide Section and attended by representatives of various Army Acquisition organizations. The test sponsor, U.S. Army Tank Automotive Research, Development and Engineering Center, ATC leadership, and test personnel oversaw the Soldier demonstrations of the vehicles equipped with AMAS-BWASK, including a ride-along portion. Along with tractor trucks and semitrailers, the U.S. Army Armament Research, Development and Engineering Center

*See **UNMANNED**, page 7*

High-speed image sequence of an airborne homemade explosive-characterization (HME-C) target during test detonation.

ATC Gets Dirty — To Save Our Soldiers

Stephen McClung, Jr.

Chief, Threat Detection and System Survivability Branch, Survivability/Lethality Directorate

The HME-C effort had an additional goal beyond that of HME threat characterization for LFT: the development and recommendation of an engineered test soil medium for future LFT&E underbody blast testing.

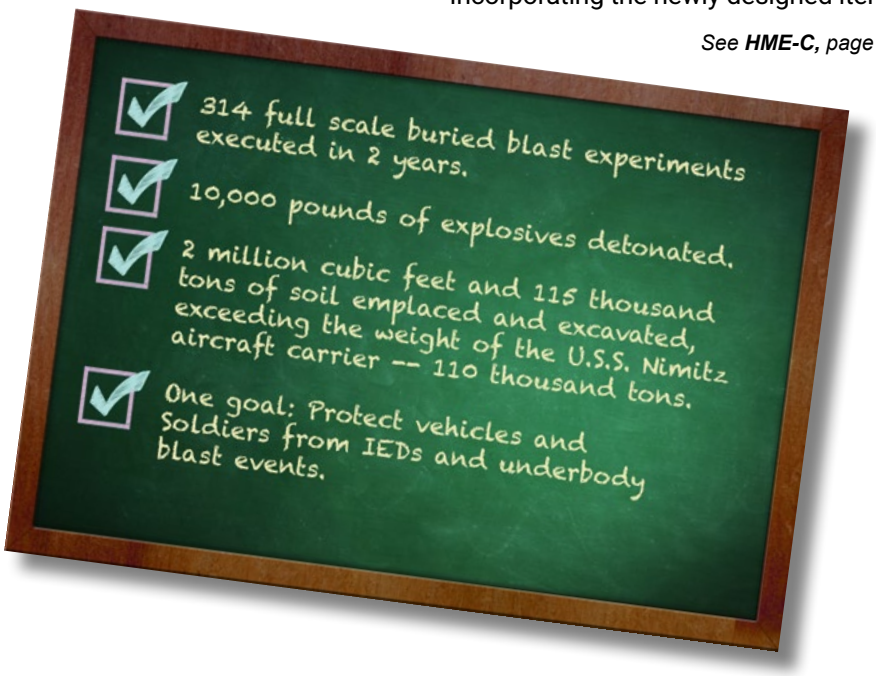
During Operation Enduring Freedom (OEF), roadside and under-road improvised explosive devices (IEDs) were a prevalent threat. Many IEDs are manufactured using non-standard, homemade explosives (HMEs) and result in fatalities and catastrophic tactical and combat vehicle damage. Through lessons learned in OEF, the Director, Operational Test & Evaluation (DOT&E), Office of the Secretary of Defense, stipulated that the HME threat must be fully characterized for use in Live Fire Test & Evaluation (LFT&E). ATC's HME-C Test Team met this directive through innovative thinking and a cooperative approach to problem solving. Senior Test Officer Bonnie Kolaya and Test Officers Jaimi Yowell and Leonard Lombardo were supported by a diverse contract test support crew.

Beyond threat characterization for LFT&E, the HME-C effort had an interrelated goal: to develop and recommend an engineered test soil medium for future LFT&E underbody blast (UBB) testing to ensure repeatable LFT results; from a test bed standpoint, from shot to shot and from system to system. The team partnered with the U.S. Army Research Laboratory , U.S. Army National Ground Intelligence Center and U.S. Army Engineering Research and Development Center to engineer a single new soil for repeatable test bed conditions in roadbed and cross-country wartime emplacement scenarios. This is a leap forward for vehicle UBB survivability testing—the current standard was adapted from Cold War era test methodologies and soil conditions based on land mines and their standard minefield application. The engineered soil solution is realistic and repeatable.

These two program goals are not disparate; one requires the other for program success. Each will help the other develop methodologies for expedient characterization of emerging threats for use in LFT; establish correlations to past and ongoing LFT; and develop methodology to prepare test soil standards and test bed emplacement conditions to replicate soil in any theater of operations.

For the HME-C program, controlling the variability of the soils used to prepare the test beds was critical. Incorporating the newly designed items

*See **HME-C**, page 6*



CLIMATE, *From page 1*

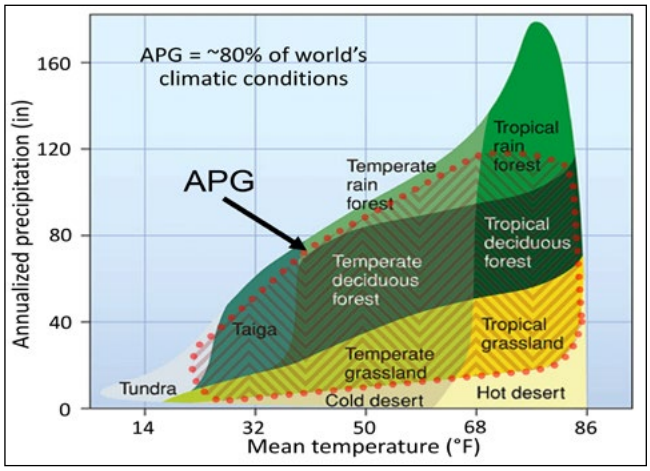
Environmental concerns such as these in military testing require a facility in which vehicles and systems can demonstrate their full capability in a variety of climatic situations.

This is what sets ATC apart from other test facilities: the natural distribution of temperature and precipitation that creates environmental conditions resembling 80% of worldwide climates.

In short, every conceivable climatic testing scenario can be explored rather than simulated, and testing can be planned in a reliable, consistent way.

The climate of a program's operational environment will affect how systems, subsystems, components, and support packages perform and, more notably, fail. Bushings, bearings, brake lines, hydraulic hoses, and body panels are all susceptible to accelerated wear. Sensors, seals, filters, belts, switches, intakes, exhausts, accesses, and wheels are all prone to being hit, displaced, or jammed by mud. Water penetrates, rust develops, corrosion decays, ice binds, salt grinds, vegetation blinds, and dust chokes. All of these effects, and more, must be assessed when exploring program affordability, suitability, reliability, availability, and maintainability.

When analyzed using independent climate classification systems, ATC has unquestionably featured dependable temperature and precipitation cycles throughout the past 10 years. The Köppen-Geiger classification, based on the concept that native vegetation is the best expression of climate, is divided into five main groups representing climate conditions, four of which -- A, C, D, and E -- ATC has reliably demonstrated; and eight of the ten Whittaker Biome classifications (Temperate Deciduous Forest, Temperate Grassland, Tropical Grassland, Taiga, Tropical Deciduous Forest, Tropical Rainforest, Temperate Rainforest, and Tundra) have been met every year between 2006 and 2015.



Worldwide climates with APG distribution superimposed.

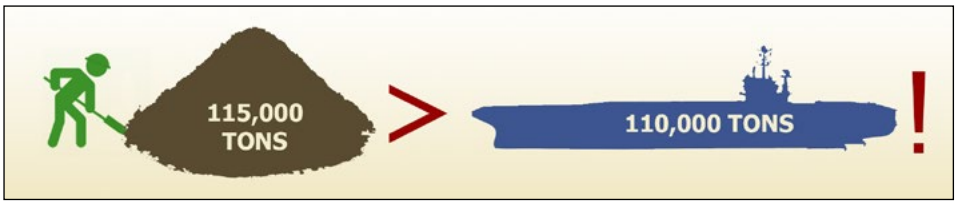
These climatic conditions, and ATC's proximity to the Chesapeake Bay, lead to clockwork seasonal changes and vegetation cycles, creating a consistent environment. ATC testing uses these known factors to realistically assess how programs will perform in their intended operational environments and to efficiently execute testing. Program costs — especially Operating and Sustainment — cannot be adequately planned without accounting for climatic conditions. ATC has world-leading expertise evaluating climatic effects and life cycle elements during performance, reliability, suitability, and survivability testing. ATC's subject matter experts, and their unique operationally authentic outdoor laboratory, can help program managers field effective, suitable, and survivable systems.

Testing at ATC does not result in an evaluation affecting just one Soldier in one kind of environment; all scenarios can be realistically planned, including the testing itself.

Robert McKelvey,
Office of the Commander, ATC

HME-C, *From page 5*

into the soil emplacement procedures produced consistent, uniform soil lifts with repeatable results. An on-site soil laboratory was also established, drawing from the expertise of scientists, engineers, and technicians. The laboratory rapidly analyzed test soil for management of conditions, reuse of soil, quality assurance for validation and verification of soil vendor laboratory analyses, and performance of Proctor analysis, which drove the emplacement procedures and compaction goals of each lift and the overall test bed. Reuse of soil from shot to shot saved the program over $2 million in soil costs and will provide engineered soil for UBB LFT for multiple near-term programs. The HME-C Test Team is working to transition this laboratory and its methodologies to the Vulnerability/Lethality Division for their use in UBB LFT.



2 million cubic feet and 115 thousand tons of soil emplaced and excavated, which exceeds the weight of the U.S.S. Nimitz aircraft carrier.

To that end, the Director DOT&E will issue the order to transition to the new, repeatable engineered test soil and multi-condition emplacement procedures no later than August 2016, with the goal of ensuring the improvement of vehicle and, most importantly, Soldier survivability for fielded and developmental tactical and non-tactical vehicles.

UNMANNED, *From page 4*

made available an autonomous Light Capability Rough Terrain Forklift and a Rough Terrain Container Handler with container alignment assist to demonstrate a more complete logistic scenario. The forklift and container handler were used to load the trailers being pulled by the tractors.

The goal of the AMAS test program, to save lives by preventing accidents and removing Soldiers from harm's way, goes hand in hand with reduced equipment damage and increased efficiency in logistics, manpower, and fuel. Future AMAS development will include such advanced features as leader/follower and autonomous convoy operations.

Backup plan - an Army tractor truck demonstrates the AMAS-BWASK backup-assist feature. With no driver input, the system detects the vehicle behind the tractor and applies the brakes to avoid the impending accident.

LOCB, *From page 3*

expedite customer satisfaction with a high degree of fidelity and confidence.

Next up for the LOCB is a 100-meter-gap launch with the same series of vehicles as those used to cross the 50-meter gap. After the 100-meter test, the bridge will enter the Durability Test Phase. To determine the LOCB's service life, the ATC Bridge Crossing Simulator (BCS) will replicate approximately 98,000 vehicle crossings. Simulated crossings match the strain profiles generated during live vehicle crossings and accomplish hundreds of crossings per day at much less cost to the customer than live testing. In the event of a "bridge failure," the BCS shuts down without risk to personnel.

After durability testing, the U.S. Army Evaluation Center (AEC) will evaluate the results. Once approved by AEC, the LOCB will be fielded to Army Multi-Role Bridge Companies across the globe, further closing the gap between our Soldiers and the defeat of enemy obstacles.

Bring it on! The M88 armored recovery vehicle tows an M113 personnel carrier across the LOCB. Military load classification for the LOCB is 120 wheeled/100 tracked in normal cross; 150 wheeled/120 tracked in caution cross.

PROUD, *From page 1*

of a year, resembles nearly 80% of worldwide climates.

ATC takes pride in being a responsible community member through its on-Post safety policy and routine public outreach. ATC's long history of environmental stewardship includes developing methods to clean and reuse soil for military construction projects, sharing information on archeological sites on Army property, and being a designated habitat for the largest concentration of bald eagles in the Upper Chesapeake Bay.

As a multifaceted test center, ATC's challenge, each day, is to ensure our Soldiers' effectiveness and safety as they defend the United States, and to do so efficiently, accurately, and safely.

ATC means Excellence in Testing!

HISTORY, *From page 1*

would lead him to the northern Chesapeake Bay. Ruggles first explored Kent Island as a possibility, but he met with great opposition from the local inhabitants, the residents of Annapolis, and the state of Maryland.

The Aberdeen area was suggested to Ruggles by a fellow West Point graduate, the retired Major Edward V. Stockham. The fertile farmland on the northwestern shore of the Bay met the Army's needs. The location was only two hours from Washington, DC and Philadelphia, important industrial centers. The Pennsylvania Railroad was easily accessible, assuring easy transport of materiel and personnel. Aberdeen's weather was reported to be favorable year-round, and the area was large and remote enough to permit uninterrupted work without undue danger or disturbance to nearby communities.

Following two Presidential Proclamations, one in October and one in December 1917, as well as an Act of Congress, Aberdeen Proving Ground (APG) came into the possession of the U.S. Army. Construction of the proving ground began in December 1917, and the Proof Department, ATC's predecessor, began testing on January 2, 1918.

16-inch gun located on the Main Front at Aberdeen Proving Ground, circa 1930.

During those first days, ammunition and gun testing were the principal functions of APG. Development work was also conducted and chiefly consisted of experiments with various types of fuses and igniters. Approximately 425,000 rounds of all different calibers were fired at APG in 1918 (about five times more than the rounds fired during the Franco-Prussian War, which used more ammunition than any in previous history). At the height of operations during World War I, APG employed about 7,500 people: 5,000 military personnel and 2,500 civilians. The first year of testing at APG produced great advances in test technology as well as weapons systems. The Aberdeen Chronograph, a velocity-measuring instrument, was developed to improve the testing of projectiles and guns. Rocket Science also developed greatly during this time. Dr. Robert Goddard, the famous physicist and inventor of the liquid-fueled rocket, conducted many tests at APG in 1918. Along with his colleague, Dr. Clarence Hickman, Goddard created our first air defense rocket prototype. Goddard's research at APG contributed to the later development of the bazooka, the high profile rocket launcher of World War II.

Testing a smooth bore centrifugal gun at Aberdeen Proving Ground, circa 1918. The gun proved to be highly inaccurate.

Continued next issue

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Thank you to everyone who contributed to this edition of The Point Position.