

West Point

SUMMER 2014



In This Issue:
Engineering at West Point



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On May 10, 2014, we celebrated the fourth anniversary of our journey to become the premier executive leader development company in the world. As we celebrate our fourth anniversary, we are humbled by the results our staff and faculty deliver while changing people's lives every day. We are also excited that we have been ranked in the Top 30 Leader Development Companies along with Dale Carnegie, Korn Ferry, and Franklin Covey, among others.

We are extremely pleased to facilitate the visits to West Point by thousands of executives each year and afford them the opportunity to gain an appreciation for this beautiful Hudson Valley, our beloved West Point, and the leadership principles of our GREAT ARMY.

The Historic Thayer Hotel at West Point is the inspirational venue for TLDG programs and hosts guests with service excellence standards expected from the Long Gray Line. The Thayer is now a unique hospitality experience, as each of our 151 guest rooms is dedicated to an inspirational graduate. This experience allows our guests to learn the incredible impact that members of the Long Gray Line have had on the country and, in most cases, the world. Staying at the Thayer provides guests the opportunity to be immersed in West Point culture.

For those of you who have not yet had an opportunity to return to West Point or attend a TLDG leader development program, please accept my invitation to come Home to our alma mater. Your TEAM will be inspired and leave with leadership best practices and an action plan for further enhancing your organization. You will be proud to bring your TEAM to West Point to share the leadership principles that bond us as graduates.

Sincerely,

Rick Minicozzi
USMA '86
Managing General Partner
Thayer Leader Development Group at West Point and
The Historic Thayer Hotel at West Point
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West Point

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The mission of *West Point* magazine is to tell the West Point story and strengthen the grip of the Long Gray Line.
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ON THE COVER

A replica of an early 20th century azimuth once used by West Point cadets.

LETTERS

Dear Fellow Graduates:

The theme of this issue is "Engineering at West Point;" fitting because as every graduate knows, the Military Academy was founded in 1802 to become the Nation's first engineering school. And if you haven't been back to campus lately, you'd be stunned to see the number of major ongoing construction projects that sometimes make the cadet area resemble an engineer's theme park. For example, the hillside below the Cadet Chapel and above Central Area has been cleared and largely removed to make room for the new cadet barracks, and Bartlett Hall is being gutted and rebuilt from the inside out, leaving only its century-old gothic granite exterior. As I drive to work every morning I pass dozens of dump trucks moving huge amounts of rock, equipment, and material to make room for the future.

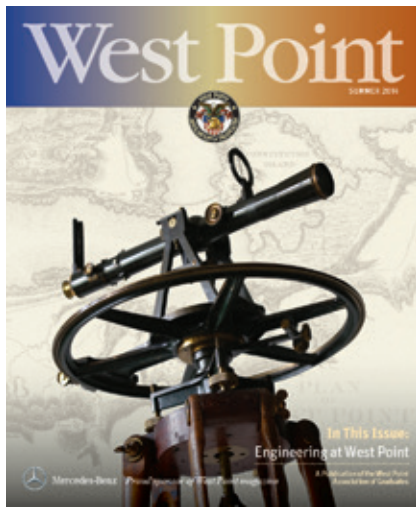
Other, no less important, ongoing construction projects include major renovations to Scott, or North, Barracks, as well as to Cullum Hall where what was the former Pershing Room will now reverently display the names of all graduates who gave their lives in defense of our Nation. The barracks and classroom building construction projects are funded with appropriated resources from the Army. Your West Point Association of Graduates is proud to partner with USMA in renovating Cullum Hall, as well as in completing the Columbaria Wall at the West Point Cemetery and six new houses for athletic team head coaches being built near the hospital. Later this year we hope to begin construction of a much needed lacrosse center at Michie Stadium, while a bit further to the future we're looking forward to begin construction of a USMA Visitors Center on South Post in Highland Falls. When the Class of 2014 returns for reunions, West Point will look very different from when they attended, an impression probably to be shared with just about every graduated class. West Point continues to change and get better.

With the recent graduation of the Class of 2014, our ranks now swell to over 49,000 and the midpoint of living graduates in the Long Gray Line lies somewhere in the Class of '88. We welcome our newest "old grads" and look forward to their contributions to our Nation, West Point, and WPAOG in the years to come. WPAOG is unique among the service academies in that we have a Board of Directors and an Advisory Council as a unified governing body that oversees the programs and staff that support both the Military Academy and its graduates. One third of each body is elected annually by the graduates, and I encourage ALL GRADS to consider seeking nomination. I particularly encourage grads from every generation, gender, ethnicity, race, and origin to become a Director or Advisor in our alumni association. The future leadership of WPAOG should reflect the diversity of the Long Gray Line, and that of our Nation's population. Please contact me directly if you have any questions.



Bob McClure '76
President & CEO
West Point AOG





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NEW ONLINE

To access web pages and videos, scan the codes at right with your phone's camera using a QR code reader app.



Watch a video of Soldier's Design teams at work.



Follow this link to the Smithsonian's (closed) exhibit on West Point and its engineering impact on America.

From Your West Point
Association of Graduates

Send your thoughts about *West Point* magazine to editor@wpaog.org or @WPAOG on Twitter. View the online version of this magazine at WestPointAOG.org/wpmag

A Letter From the Superintendent

As the preeminent leader development institution in the country, West Point develops leaders intellectually, militarily, athletically, and with regard to character.



Our Army has learned a lot over the last 12-plus years of war, and one of West Point’s objectives is to ensure we have the right leader development models that will produce the leadership outcomes that will enable our graduates to thrive within the complex security environments

in which they will find themselves in future conflicts.

Engineering has played an important role at the United States Military Academy since it was founded. In 1817, Superintendent Sylvanus Thayer made civil engineering the foundation of the curriculum to help meet our growing Nation’s need for engineers. As the oldest engineering school in the country, our graduates played a vital role in the construction of much of the country’s early infrastructure.

Engineering remains very popular at the Academy and is beneficial to our Army’s missions whether in combat in places like Iraq and Afghanistan, or providing disaster relief in Haiti. We often receive stories from our graduates who have applied principles learned in their engineering classes to the real-world problems they faced in austere environments. Their contributions were invaluable to mission success and to building relationships with our partner nations.

The strength of our engineering programs is also evident by our number three ranking in the most recent *U.S. News & World Report* “Best Undergraduate Engineering Programs.” Additionally, it ranked West Point as the number two Liberal Arts College in its “Top Public Schools” report.

Today, cadets are able to choose from nine different engineering majors (further explored in this issue, although engineering management and systems engineering are covered together) and a myriad of engineering-focused Academic Individual Advanced Development opportunities. Additionally, the curriculum at West Point requires all cadets to choose one of seven, three-course core-engineering sequences. This foundation provides all of our graduates with an innate understanding of the physical world as well as the necessary critical thinking and creative problem-solving skills they will need as young officers.

From chemistry labs to philosophy discussions, cadets hone the skills they will need as young officers faced with an ever-evolving security environment. It is almost impossible to predict the nature of future conflicts or crises, but with the right problem-solving skills, our cadets will be prepared for whatever challenge they are required to undertake.

As we look to the start of another academic year, we will continue to refine our training and curriculum to meet the needs of an Army in transition. With your support, the Academy continues to be the preeminent leader development and academic institution whose graduates thrive in tomorrow’s complex security environments and are inspired to a lifetime of service to our Army and the Nation.

Thank you and Beat Navy!

Robert L. Caslen Jr. '75
Lieutenant General, U.S. Army
59th Superintendent, U.S. Military Academy

The Thayer Leader Development Group at West Point

As graduates and former leaders of the U.S. Military Academy at West Point, we intimately understand the need to bring more visitors to West Point. Increasing tourism to West Point is in the best interests of the U.S. Military Academy, the U.S. Army and the nation.

Reaching out to the public and gaining exposure to our Alma Mater will help increase applications from the best and the brightest, and help bring potential financial contributors to West Point to help maintain our margin of excellence in academics, physical training and the moral development of tomorrow's leaders of character.

Making a meaningful impact on guests begins with their stay at The Historic Thayer Hotel at West Point. To achieve this, the Hotel has recently undergone a multi-million dollar renovation including the addition of 23 new executive suites and is showcasing some of our most inspirational graduates through a room dedication program in which each guest room is named after a graduate. Learn more about the room dedication program at rdp.thethayerhotel.com

Yet, most important is the founding of the **Thayer Leader Development Group at West Point (TLDG)**. TLDG has hosted corporate conferences and leadership training for hundreds of companies at The Historic Thayer Hotel at West Point. Most executives attending these programs have never had any military experience or

exposure to West Point. These executives are walking away from their experience at TLDG with a new found love and respect for the Armed Forces of the United States and the great work being done here at West Point. Many senior management teams in the Fortune 500 have now visited West Point to either host their own corporate conference at The Hotel or to attend leadership training at TLDG. The average rating from C-Suite executives from these great corporations is 9.5 out of 10 in terms of content, faculty, facilities and overall atmosphere of the program.

*We encourage
all graduates to bring
your friends, family
and business teams to
West Point for either
corporate conferences
or tourism...*

We are confident that TLDG will add value to your team and will also significantly contribute to enhancing West Point's image throughout this great country. Contact Rick Minicozzi, '86, Managing General Partner, rick.minicozzi@thayerleaderdevelopment.com or Bill Murdy, '64, Chairman of the Board, wfmurdy@thayerleaderdevelopment.com to

discuss how TLDG can tailor a program that suits your organization's needs.

The seven of us encourage all graduates to bring your friends, family and business teams to West Point for either corporate conferences or tourism, to ensure that USMA's reputation continues to be lauded throughout the United States. These are the ideas and the results that we, as former leaders of West Point, envisioned when The Historic Thayer Hotel was privatized.

GO ARMY!

RESPECTFULLY,

**LTG (ret)
Dan Christman**

Former
Superintendent
of West Point



USMA '65

**LTG (ret) Buster
Hagenbeck**

Former
Superintendent of
West Point



USMA '71

**LTG (ret)
Bill Lennox**

Former
Superintendent
of West Point



USMA '71

**LTG (ret) John
Moellering**

Former
Commandant of
Cadets at West
Point



USMA '59

**BG (ret)
Fletcher Lamkin**

Former Dean of
Academic Board at
West Point



USMA '64

**Mr. Tom
Dyer**

Former Chairman
of the Board,
Association of
Graduates



USMA '67

**Mr. Jack
Hammack**

Former Chairman
of the Board,
Association of
Graduates



USMA '49



Professional Soldiers and Problem Solvers: West Point Engineers

By Keith J. Hamel, WPAOG staff

It's true: *U.S. News & World Report* ranked the United States Military Academy as the second "Best National Liberal Arts Public College" in its 2014 "Best Colleges" edition. That's pretty good for an institution that was founded as an engineering school. In fact, USMA was the Nation's first engineering school, established concurrently with the Army Corps of Engineers at West Point on March 16, 1802. As others have pointed out, the Academy's founding is a hybrid of two visions: George Washington first proposed a military academy in 1783 so that the United States would never again have to rely on foreign nations for engineers and artillerymen (as it had during the Revolutionary War). Then, in 1802, Thomas Jefferson signed the Military Peace Establishment Act, which officially created the Academy, because he realized the great benefit an American engineering school could have on the expansion of the young Nation. Both visions—war fighting and nation building—continue in USMA's present mission, which is to graduate officers prepared for a career of professional excellence in the Army and a lifetime of service to the Nation.

It did not take long for West Point to prove its engineering worth. The British were unable to capture any fortification constructed by a West Point graduate during the War of 1812. "During that war," historian Henry Adams remarked, "West Point Engineers doubled the capacity of the little American army for resistance." Adams also wrote, "Had a West Point Engineer been employed at Washington, the city could have easily been saved." When Sylvanus Thayer, Class of 1808, became Superintendent in 1817, he revamped the Academy's curriculum to reflect the engineering and artillery program being taught at the École Polytechnique in France. He also requested the services of Professor Claudius Crozet, who left the French school to come to West Point, bringing with him Continental engineering techniques and textbooks (for example, *A Treatise on the Science of War and Fortification* by Colonel de Vernon). In her article "The Science That Built the Nation," Pamela Lowry notes that Crozet taught cadets about field fortification, the science of artillery, and civil and military architecture (including the design and construction of arches,



Left: A cadet "takes boards" in the early 1900s, demonstrating the engineering principles of a truss, as an officer-instructor observes. Classroom demonstrations have been part of the West Point experience since its inception and they still form a key part of classes like MC300: Fundamentals of Engineering Mechanics and Design.



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2014 E350 Sport Sedan shown in Iridium Silver metallic paint with optional equipment.

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canals, bridges, and buildings). Crozet left West Point in 1823 to become the principal engineer and surveyor for the Virginia Board of Public Works and later helped establish the Virginia Military Institute. This was not the first time someone from West Point went on to impact the founding of another school. Rensselaer Polytechnic Institute, the country's first civilian engineering school, appointed USMA lecturer Amos Eaton its first engineering teacher. Also, Crozet's student and successor, Dennis H. Mahan, Class of 1824, taught two cadets who later helped establish notable engineering programs: Henry L. Eustis, Class of 1842, was the first professor at Harvard's Lawrence School of Engineering, and William A. Norton, Class of 1831, was the first chair of Yale's civil engineering program at its Sheffield School of Engineering. According to

James R. Endler '53, in his book *Other Leaders, Other Heroes*, there were ten technical colleges in the United States by the start of the Civil War; nine of these (including the United States Naval Academy) had West Point graduates on their faculty, and all used engineering and mathematics textbooks written by USMA professors.

By 1862 the Academy had graduated nearly 2,000 cadets, 230 of whom had entered the Corps of Engineers (the typical first choice by those ranked highest in the graduating class), and about 200 more had become practicing civil engineers. Many of these graduates were already making an impact on the Nation both in terms of westward expansion and the "age of improvement." The topography for Manifest Destiny was largely drawn by West Point graduates, and several others surveyed routes for the Nation's rail lines, including

Professor Claudius Crozet, who Superintendent Sylvanus Thayer recruited to teach engineering at USMA.



West Point Engineers Impact the Nation...

1802

Congress establishes U.S. Army Corps of Engineers and also the U.S. Military Academy, both headquartered at West Point.

1812

Joseph G. Swift, Class of 1802, USMA's first graduate, is appointed as colonel and Chief Engineer of the Army.

1820

After resigning, Swift becomes surveyor of the Port of NYC, improving canals and drainage of the eastern port of the city, and later takes charge of the Baltimore and Susquehanna Railroad as a civil engineer.

1828

William G. McNeill, Class of 1817, is tasked with constructing the Baltimore and Ohio Railroad, one of nearly a dozen for which he was chief engineer during his 20-year Army career.

1832

Benjamin Bonneville, Class of 1815, who was made famous thanks to Washington Irving's stirring accounts of his adventures, leads great survey and exploration missions through regions in Utah (the salt flats there are named in his honor), Idaho, Oregon, and Nevada, filling in the places not visited by Lewis and Clark.

1838

On Jul 7, 1838, the Army establishes the Corps of Topographic Engineers to explore the Nation's western territory: 28 of the original 36 topographers were West Point grads.



four graduates who journeyed the western wilderness to determine the best route for the Transcontinental Railroad. In 1830, the third steam locomotive built in the United States was named the “West Point” in honor of those graduates who were responsible for building these early railroads, such as the Baltimore & Ohio Railroad and the South Carolina Railroad (the route for the “West Point”). West Point engineers were also responsible for building many of the Nation’s first lighthouses, canals, bridges, and city harbors. Had he not led the Confederate Army in the Civil War, Robert E. Lee, Class of 1829, likely would have been remembered more for the engineering work he did for the Army and Nation. Lee erected two dikes on the Mississippi River near St. Louis to solve the problem of silt piling in navigation



Map of the Rock Island Rapids, after they were surveyed by Robert E. Lee, Class of 1829.

lanes. He also mapped the Des Moines Rapids (Iowa) so that steamboats could better navigate and conduct commerce on the Mississippi. In testimony to the impact of West Point engineers on America in the early to mid-19th century,

when the American Society

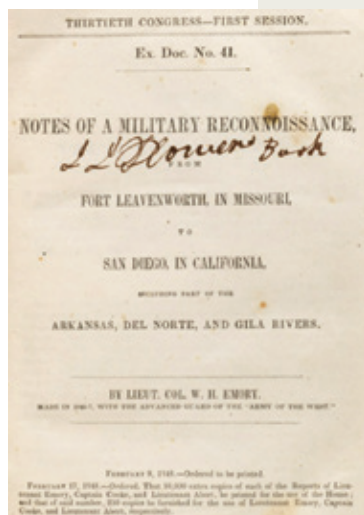
of Civil Engineers was established in 1852, four of its six honorary members were USMA graduates: Joseph Totten-1805, John James Abert-1811, Dennis Hart Mahan-1824, and Alexander Bache-1825.

The rapid expansion of state technical and engineering schools (courtesy of the Morrill Land-Grant Acts) and growing scientific knowledge in general shifted the focus of West Point’s curriculum after the Civil War. The war itself also played a role in this change,

1802–1866

1846

William H. Emory, Class of 1831, charts a supply route for the Mexican War and presents his famous and influential report “Notes on a Military Reconnaissance from Ft. Leavenworth, MO, to San Diego, CA” to the 30th U.S. Congress.



1849

In an effort to quell a cholera outbreak that claimed the lives of 10 percent of the city’s population, Samuel Curtis, Class of 1831, tunnels through a 40-foot rocky bridge to install the first major trunk of a sewage system in St. Louis, Missouri, eventually devising an elaborate plan to drain the entire metropolitan area.

1849

Topographic engineer James H. Simpson, Class of 1832, begins his survey of the western United States; by 1859 he had traversed more of the West than any other Corps of Engineers officer.



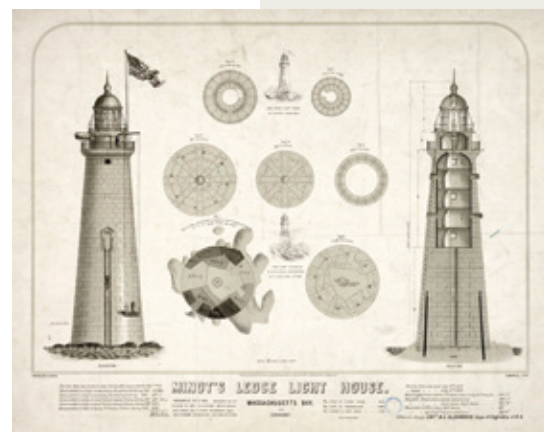
1853

Congress creates a Bureau of Explorations and Surveys (headed by Emory) to determine the best route for the Transcontinental Railroad. Four WP grads were assigned to the survey: John W. Gunnison, Class of 1837, Isaac I. Stevens, Class of 1839, Amiel W. Whipple, Class of 1841, and J.G. Parke, Class of 1849.



1864

Joseph G. Totten, Class of 1805, dies. He was the Army’s Chief of Engineers from 1838 to 1864 and supervised numerous landmark projects such as rebuilding the Minot Point Lighthouse in Massachusetts.



1866

USMA superintendents no longer are required to be Corps of Engineers officers.

as the science and technology seen in battle proved that future Army officers would need specialization in their particular branch of service. To address this need, the Army established several schools offering graduate-level instruction and had the Academy focus on a more generalized education. After its Centennial, West Point gradually liberalized its curriculum. Still, West Point graduates continued using the engineering lessons they had learned at USMA to impact the Nation. For example, Hiram Chittenden, Class of 1884, built many roads in Yellowstone Park, performed canal work on several western rivers, and devised the concept of reclaiming land through irrigation. Another notable grad in this period was Douglas MacArthur, Class of 1903, who became acting chief engineer of the Army's Pacific Division in 1905. His problem set for determining the size of

rock needed to defend San Francisco against the waves of the Pacific Ocean became classroom work for generations of cadets.

MacArthur also signaled a change in the Academy's approach to engineering when he became Superintendent after the Armistice. MacArthur adapted the curriculum in terms of World War I. He

required that cadets study national production, transportation, and social problems, along with weapons and tactics, in an effort to prepare them for the concept of total war. In addition to civil and mechanical engineers, MacArthur and his successors graduated strategic engineers trained in logistics. This development was vital to the United States' ascendancy as a world power in World War II, which MacArthur characterized as "distinctly an engineer's

The formula for reduction of wave heights that Douglas MacArthur, Class of 1903, calculated while engineering fortifications for San Francisco Harbor.



West Point Engineers Impact the Nation...

1868

John Newton, Class of 1842, devises an underwater drilling and demolition system to clear rocks, which improves navigation in New York Harbor.



1871

George Greene, Class of 1823, leads the effort to make surveys, plans, and estimates for a central underground railroad line in NYC. Earlier he had improved the city's water system by building the Croton Reservoir in Central Park.



1878

William Smith, Class of 1853, engineers and builds the first all-steel bridge, spanning the Missouri River near Glasgow, Missouri.



1879

Thomas L. Casey, Class of 1852, supervises the completion of the Washington Monument in the District of Columbia after progress stalled, stabilizing the foundation and adding another 382 feet to the obelisk.



1886

Francis Greene, Class of 1870, develops a material and a paving process that makes asphalt streets commonplace in the next century.



1892

Eugene Griffin, Class of 1875, is named General Electric's first vice president and general manager; his research into electrical rail systems revolutionizes transportation in America.

war,” and West Point engineers certainly played a role in its outcome. In 1942, the War Department ordered James C. Marshall ’18JUN, a former Department of Engineering instructor at USMA and current chief engineer of the Syracuse District, to establish a new District named Manhattan and build the infrastructure needed for assembling and testing an atomic bomb. Not progressing fast enough, the project was turned over to Leslie Groves ’18NOV, who tested a working weapon on July 16, 1945. The Manhattan Project showcased the need for a new kind of engineering—systems engineering—which developed rapidly as weapon systems and scientific exploration became more and more complex. Many attribute systems engineering (via program management) with helping Frank Borman ’50 and other graduates pioneer the Space Age.



Garrison Davidson ’27, who became Superintendent in 1956, introducing elective courses at the Academy in academic year 1960-61. Concerned with giving cadets the skills and confidence to solve complex, real-world problems, the Academy continued to expand the number of electives from two courses in 1960 to ten by 1977, although cadets had to take these electives within one of two tracks: MSE—math, science, and engineering; or HPA—humanities and public affairs. USMA then introduced a program of 16 majors split evenly

Gar Davidson, Class of 1927, who introduced elective courses to USMA as Superintendent.

1868–1941

1902

The Army formally adopts the Gold Turreted Castle insignia as the insignia of the Corps of Engineers which USMA cadets had first starting wearing as a cap ornament in 1841.



1906

William H. Heuer, Class of 1865, Charles McKinstry, Class of 1888, and Meriwether L. Walker, Class of 1893, take leadership roles in the relief and recovery operations associated with the April 18th San Francisco earthquake, which had a magnitude of 7.8, killed more than 3,000 residents, and destroyed more than 80 percent of the city.



1907

George Washington Goethals, Class of 1880, takes over as chief engineer of the Panama Canal. He and three other grads—Harry F. Hodges, Class of 1881, William Sibert, Class of 1884, and David Gaillard, Class of 1884—complete the mired project by 1914, despite difficult obstacles and setbacks.



1909

Spenser Cosby, Class of 1891, serves as White House administrator and commissioner of public buildings and oversees the design and construction of new executive offices at the White House, including the Oval Office.



1933

Howard S. Bennion, top of his 1912 class, was one of the founders of the Edison Electric Institute, a non-profit organization dealing with electrical power issues, policy, and programs, still a major voice in electrical power and business applications.

1941

Brehon B. Somervell, Class of 1914, head of the Quartermaster Corps’ Construction Division, tasks Hugh J. Casey ’18JUN and a civilian architect with coming up with plans for the Pentagon. Leslie R. Groves Jr. ’18JUN oversees the construction of the project and completes the iconic building in 16 months.



between the two tracks in academic year 1983-84. Today the Academy offers 15 programs of study related to engineering, most of which are accredited by the Accreditation Board of Engineering and Technology (ABET).

Lieutenant Colonel Harold 'Brook' Whiffen '93, who majored in mechanical engineering at USMA, says, "I believe I have benefited most from the problem solving and analytical thinking promoted by my engineering education at West Point."

Now a lead rotation analyst responsible for military unit sourcing within the Army, Whiffen believes that the classes he took for his major, such as Aerospace Engineering Design, promoted critical thinking by allowing him the freedom to solve complex problems in inventive ways. "It ultimately formulated the way I solve the problems I encounter today," he says. Lieutenant Colonel Brian Freidhoff '90, one of the first graduates to have majored in environmental engineering at West Point, says that the

engineering curriculum at USMA opened up several doors for him throughout his 23-year military career. "You never know where your engineering degree may lead you," he says. This led to an assignment as a project engineer with the USACE Far East District in South Korea and to a position as Professor of Military Science at the Rose-Hulman Institute of Technology. Rose-Hulman is ranked as the number one "Best Undergraduate Engineering Program" in *U.S. News & World Report's* 2014 rankings, but Freidhoff admits that his program often loses prospective students to USMA, which is ranked third overall in the Nation. "Rose-Hulman can't offer the military training of West Point," he says. Proving once more, when it comes to providing both problem solvers for the Nation and professional Soldiers for the Army, no engineering (or liberal arts) school is better than the United States Military Academy at West Point. ★

West Point magazine would like to thank Dr. Led Klosky, Associate Professor of Civil Engineering, for his help in organizing all the points of contact in USMA's various engineering programs and coordinating their participation in preparing the articles appearing in this issue.



West Point Engineers Impact the Nation...

1942

After building the Pentagon, Groves directs the Manhattan Project, the research and development initiative that produced the atomic weapons used in World War II.



1942

William Hoge, Class of 1916, takes charge of building the Canol Highway (now known as the Alaskan Highway), a 1,500-mile roadway running from the Montana border to Fairbanks, AK, which acted as a supply line to many airfields and military bases.

1965

Edward H. White II, Class of 1952, becomes the first American to walk in space during Gemini 4's four-day mission.



1967

William E. Potter, Class of 1928, appointed vice president of Disney: he helps manage the planning and construction of the entertainment company's Florida theme park, including EPCOT, notably the power and water treatment found in the theme parks' underground facilities.

1970

As commander of the Missouri River Division who managed water resources throughout 11 states of that river's basin, John Morris, Class of June 1943, develops the slogan "The Corps Cares," which gained much-needed public support of projects with substantial national importance.



1972

Frederick J. Clarke, Class of 1937, and Richard H. Groves, Class of 1945, set up the Susquehanna District to handle the disaster relief needed for Tropical Storm Agnes, which killed more than 100 people, caused more than \$3 billion in damages, and helped to make the devastated region habitable again.

**THE
CORPS
CARES**

1942–1972

ENDURING LEADERSHIP



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Innovative Infrastructure

By Anthony DiNoto, WPAOG staff

When Sylvanus Thayer, Class of 1808, made civil engineering the foundation of the West Point curriculum in the early 1800s, the purpose was to provide desperately needed engineers to the Army and Nation. Early USMA graduates were quickly put to work constructing the young Nation's initial railway lines, bridges, harbors, and roads, and laying claim to some of the country's most significant civil engineering projects.

Civil Engineering



Grads like Herman Haupt, Class of 1835, were prominent military and civil engineers. Haupt was a successful railroad executive who developed the “Haupt Truss” and served as a Union Army General during the Civil War. “He is somewhat of an unsung hero,” says Dr. Ledlie Klosky, Associate Professor of Civil and Mechanical Engineering (C&ME). “Haupt’s railroad designs were essential to the Union victory.” Klosky points out that Haupt is just one of the many prominent civil engineers to graduate from West Point in the early years: West Point has been producing top-notch civil engineers for the past 200 years. However, although West Point has been graduating prominent civil engineers since the establishment of the Academy, Civil Engineering (CE), the major, wouldn’t come about until USMA sought accreditation of the program by the Accreditation Board for Engineering and Technology (ABET) during the latter half of the 20th century.

Today, about 50 cadets graduate from the CE program each year. Cadets are required to take 26 common core courses and 18 civil engineering program-specified courses, including four engineering electives. The courses CE majors take include engineering fundamentals, such as solid and fluid mechanics, as well as courses that provide a deeper understanding of civil works, like structures, hydraulics, and subsurface engineering. Klosky summarizes the learning objectives of his department by saying, “The goal of CE is to produce great engineers who are ready to meet the needs of the Army and the Nation.” To accomplish this, small class sizes with one-on-one interaction between cadets and faculty members help shape the model for success within CE. “It’s what allows me to teach leadership within engineering on a much more personal level,” says Klosky. Over the past five years, Klosky has seen the CE curriculum at West Point being emulated at other universities as the program strives to weave infrastructure development into the education of CE cadets. He and Lieutenant Colonel Steve Hart ’88 have had a number of opportunities to speak about infrastructure modeling and education at seminars and conferences such as the American Society for Civil Engineer’s National Conference; Klosky was even recently invited to provide the keynote address at a National Science Foundation workshop that will teach faculty members at other universities how to teach engineering infrastructure. While the CE faculty at West Point is nationally admired for its approach in the classroom, Klosky stresses that “cadet projects are the core of a CE education at West Point.”

In 2012, the Civil Engineering program learned of an opportunity with the United States Army Corps of Engineers Construction Engineering Research Lab (CERL) to propose new ideas for Soldier housing units used in theater. Currently, the most prevalent living accommodations for Soldiers in a deployed environment are known as barracks huts or “B-Huts.” B-Huts have been the standard for well over 50 years, but they are “time consuming to construct and are extremely energy inefficient,” says Lieutenant Colonel Fred Meyer ’84, the Deputy Department Head of Civil and Mechanical Engineering. “What’s more alarming is the number of tanker

A CE cadet inspects the Fruitvale Avenue bridge in San Francisco, CA during an Advanced Individual Academic Development summer internship.

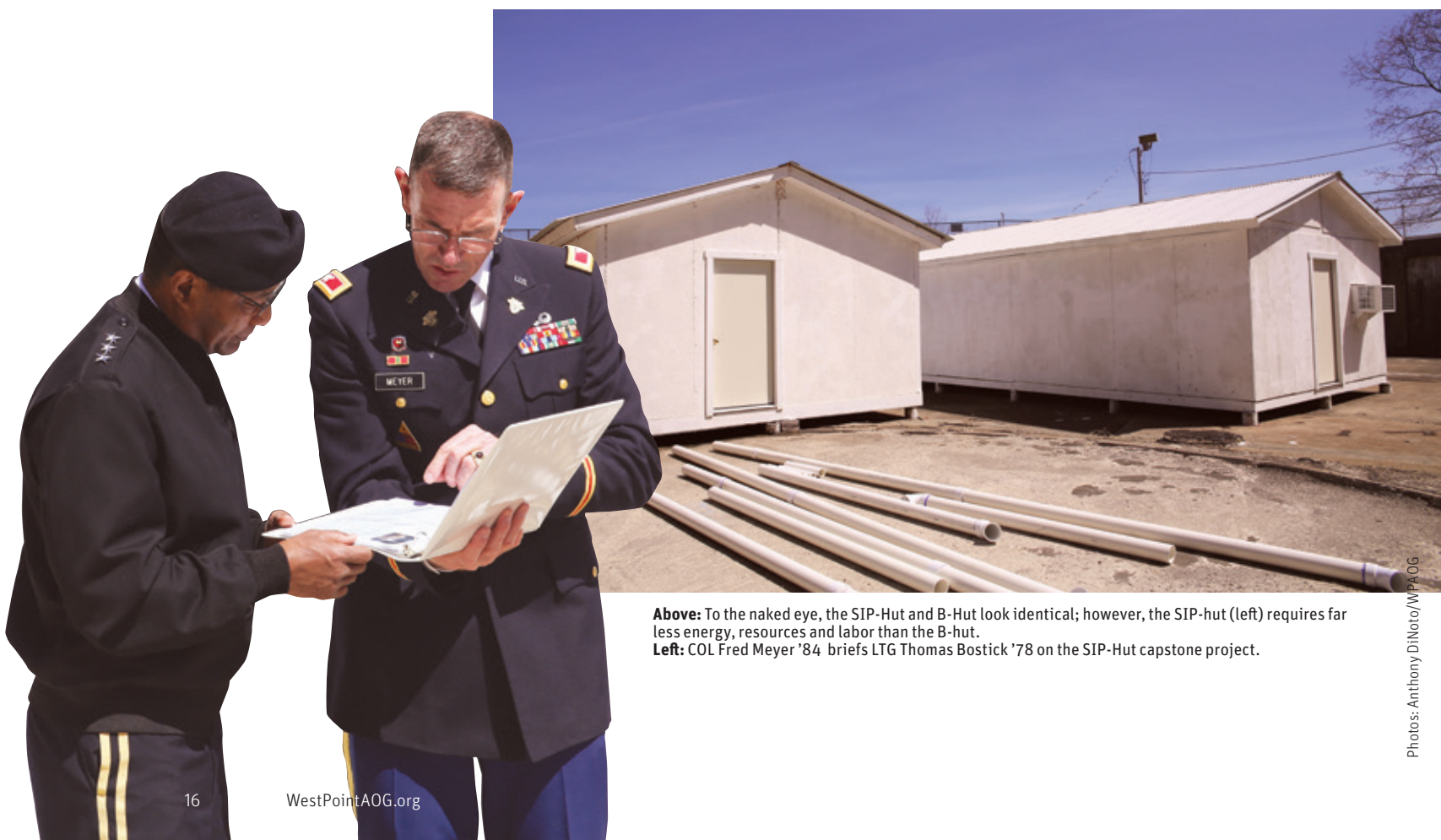
Photo: Courtesy of Civil Engineering

trucks required to supply fuel for the generators needed to support these B-Huts, a factor that increases the vulnerability of our soldiers to roadside attacks.” Recently, the Department of Defense has placed an emphasis on energy efficiency and reduction of operational energy use, which means a better option for the B-Hut is sorely needed. With the inefficiencies in mind, Meyer and Hart, along with a team of CE cadets, proposed a new and innovative solution to the B-Hut problem. As part of CE489: Cadet Civil Engineering Independent Study Project, the team came up with a solution that would revolutionize the way Soldiers live in a deployed environment. They thought creatively and came up with the idea of using a commercial product known as Structural Insulated Panels, or “SIPS.” SIPS have been used in residential and commercial construction for many decades with great success, but have never been considered for use in a deployed scenario, that is, until CE cadets designed what would later become known as a SIP-Hut.

Initial energy testing of both a SIP-Hut and a traditional B-Hut showed that substantial energy savings of nearly 60 percent could be realized using the new approach. In addition, the team estimated that the construction time for a SIP-Hut would be only a small fraction of that required for a B-Hut. A B-Hut requires a significant number of individual lumber cuts, fasteners, and skilled laborers to produce a proper building. Conversely, a SIP-Hut can be completed within five squad hours (approximately 15 percent of the time it takes to construct a B-Hut) with very few cuts, one experienced constructor, and laborers with little or no prior experience. After proposing their idea, CERL responded with an

initial \$50,000 research grant and the CE team set out to research, design, construct, and test a SIP-Hut and a standard B-Hut during the winter of 2013. Side-by-side energy testing commenced in the late fall of 2013, and the results proved their initial hypothesis was incorrect: the SIP-Hut energy consumption was about 15 percent of that used by the B-Hut—an 85 percent reduction! Furthermore, it was not possible to maintain a consistently acceptable temperature inside the B-Hut, meaning the results were even more favorable for the SIP-Hut.

Meyer hopes to see future research and construction of additional SIP-Huts, and with WPAOG helping to support these types of projects by securing private donations from individuals, corporations, and foundations, that goal may be realized. The project has quickly gained the interest of senior Army officials and is being considered for further testing and development. Lieutenant General Thomas P. Bostick ’78, Chief of Engineers of the United States Army and Commanding General of the U.S. Army Corps of Engineers, was briefed on the SIP-Huts at West Point this past April. Meyer discussed the numerous benefits of the innovative design, as well as the challenges ahead. “We still need to develop the proper air circulation system that will meet the SIP-Hut’s indoor air quality requirements, as well as identify the best method to seal the joints between roof panels,” Meyer noted. “Both are challenges that we can easily solve.” The results of the SIP-Hut project demonstrate how CE cadets working in concert with faculty members can develop innovative solutions to address U.S. Army challenges. ★



Above: To the naked eye, the SIP-Hut and B-Hut look identical; however, the SIP-hut (left) requires far less energy, resources and labor than the B-hut.
Left: COL Fred Meyer '84 briefs LTG Thomas Bostick '78 on the SIP-Hut capstone project.



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Worth a Ton

By LTC Jeffrey Starke, Guest Writer

The Department of Geography and Environmental Engineering (G&EnE) can trace its lineage all the way back to the addition of military topography and technical drawing to the Academy's curriculum in 1803, but the environmental engineering program evolved out of the "green revolution" of the 1970s (who doesn't remember the popular elective "Man and His Environment" in that era?). The Department and program were stood up in 1990 with now Brigadier General (Retired) John H. "Jack" Grubbs '64 as its first Department Head. "One of the smartest things I did as the new Department Head was to give marching orders to outstanding officers such as then Lieutenant Colonel Chris King to accredit the environmental engineering program," says Grubbs. "The result bordered on the spectacular; in the outbrief from our initial ABET accrediting visit, the lead evaluator made a comment to the effect of, 'I really can't say much negative about the environmental engineering program here because I believe it may be the finest one in the country.'" The program received its certification from the Accreditation Board for Engineering and Technology (ABET) in 1995, which has largely determined its current curriculum.

"The curriculum develops knowledge in the focus areas of drinking water, waste water, air pollution, and solid and hazardous waste," says Environmental Program Director Dr. Marie Johnson. "Building knowledge and skills to evaluate the complex interactions between these different areas, the blend of courses offered is critical to developing the broad knowledge leveraged by our graduates." This is exemplified each year in the direct interactions cadets have with the Army. For example, EV481: Water Resources Plan & Design covers several U.S. Army Corps of Engineers (USACE) projects during a New York-New Jersey Harbor Tour led by the New York USACE District. EV397: Air Pollution Engineering sponsors a guest lecture from the Public Health Command (Aberdeen Proving Grounds, Maryland) that demonstrates the importance of monitoring air quality with respect to Soldier health. Lastly, EV488: Solid and Hazardous Waste Treatment and Remediation recently conducted a day-long workshop at West Point with engineers from the Project Manager Demilitarization Group (Picatinny Arsenal, New Jersey) to apply the principles of lifecycle analysis in reducing and treating hazardous waste streams associated with the production of munitions, which is a problem under evaluation at several Department of Defense ammunition production facilities.

"The current focus of our environmental engineering curriculum is to develop a solid foundation in our cadets while advancing their knowledge and curiosity of relevant

themes and trends in academia, practice, and our changing world," says Colonel Wiley C. Thompson '89, G&EnE Department Head. Cadets majoring in environmental engineering apply their knowledge to positively impact the human condition while at the same time protecting the natural environment. This is exemplified by the Advanced Individual Academic Development (AIAD) project with the Kasiisi School Project in western Uganda, funded by the Center for the Study of Civil-Military Operations, whose goal is to build two biogas waste-to-energy systems. These systems use organic waste from farm and latrine waste streams to convert the material into a methane-rich gas by microbial-mediated processes called biogas. The biogas is used as a heating or cooking fuel as a part of the hot meal lunch program for 1,000 children at a primary school. This process improves the sanitation practices in a rural region of the second youngest country in the world while simultaneously replacing local dependence upon forests for fuel sources.



Christian Carron '14 and Lawrence Cavins '14 (with LTC Jeffrey Starke) conduct experiments to measure the amount of electricity generated from microbial fuel cells, which contain treated Mess Hall waste (i.e., milk, OJ, etc.) and domestic wastewater.

Grubbs, who retired from G&EnE and became the Dean of Engineering at Tulane University, has kept up with G&EnE progress as a member of its Board of Advisors. "I am aware of significant research initiatives and top-of-the-line presentations by our faculty, both civilian and military, such as Dr. Mike Butkus' 2006 patent for advanced disinfection practices," Grubbs says. "However, I most appreciate the interactions I've followed between faculty and cadets showing contributions to the discipline of environmental engineering, support of environmental initiatives in the developing world, and using environmental situations as a





CDT Pat Bastianelli '15 constructs the dome of a biogas system during a 2013 AIAD in Uganda, Africa.

backdrop for leadership development.” Consider the waste-to-energy capstone project of Class of 2014 Cadets Lawrence Cavins and Christian Carron. With funding from the Defense Advanced Research Projects Agency (DARPA) and in collaboration with Cambrian Innovation (Boston, Massachusetts), they are using microbial fuel cells to treat waste and produce energy in support of Army operations. “We are looking at the potential to leverage a relatively new technology that one day may change the way we manage our forward operating bases,” says Cavins, a future Engineer Officer headed to Fort Bragg, North Carolina.

G&EnE makes it a point to know “what a pound of G&EnE is worth” to our Academy, Army, and Nation. Current president and founder of VET Environmental Engineering, LLC, Sara (Fields) Hamidovic '04, who served as an Engineer Officer in Iraq, says, “The rigor of the G&EnE curriculum taught me to work smarter

“The environmental engineering graduates I meet today demonstrate a well-grounded understanding of engineering fundamentals that contributes to producing the excellent problem solvers we need for our Army and our Nation.”

— COL Heath Roscoe '90,
Commander of the 36th Engineer Brigade



Cadets in EV481: Water Resources Plan and Design pose during their NY-NJ Harbor tour, led by the NY USACE District.

and provided me with the confidence, strength, and credibility to succeed in my environmental engineering business.” Former faculty and Board of Advisor member Colonel Heath Roscoe ’90, Commander of the 36th Engineer Brigade at Fort Hood, Texas, adds, “The environmental engineering graduates I meet today demonstrate a well-grounded understanding of engineering fundamentals that, when coupled with the department’s unique blend of geographical, geospatial science, and environmental science perspectives, contributes to producing the excellent problem solvers we need for our Army and our Nation.” ★

LTC Jeffrey Starke, PE, PhD, is an Academy Professor in D/G&EnE. He served in the 82nd Airborne Division, 11th Air Defense Artillery Brigade, 116th Military Intelligence Group, and the National Security Agency/Central Security Service Georgia (NSA/CSS Georgia). He served in the Department from 2001-04; he then earned a PhD from the University of Wisconsin at Madison and returned to the faculty in 2011.

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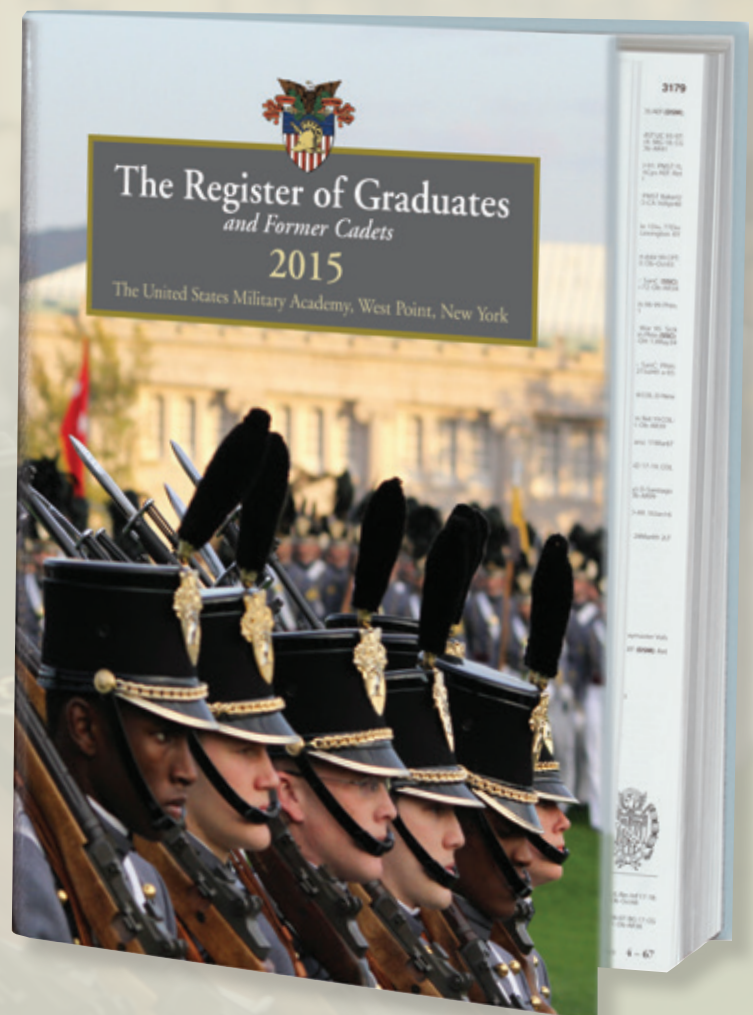


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The 2015 Register of Graduates and Former Cadets

Update your career profile and other information at WestPointAOG.org, or return the postage-paid form included in the summer issue of *West Point* magazine. If you want your contact information included, you must select that option on the form and return it to WPAOG.



Orders will be taken beginning in January, 2015.

Solutions for Soldiers

By Keith J. Hamel, WPAOG staff

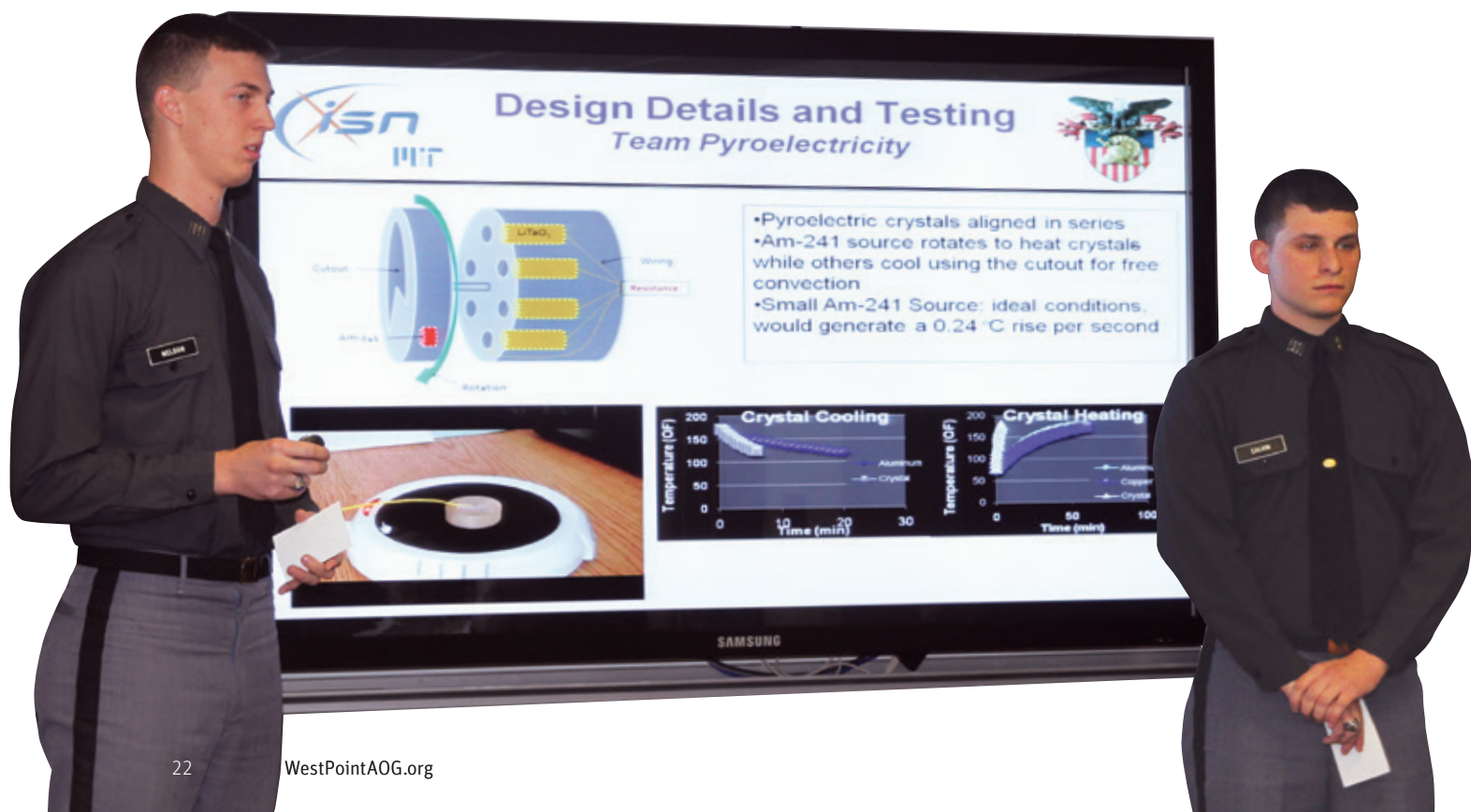
Command Sergeant Major Lebert Beharie from the U.S. Army Research, Development, and Engineering Command puts it bluntly: “We need to fill gaps in capabilities based on how Soldiers are fighting now.” Working on projects for the 11th annual Soldier Design Competition (SDC) at MIT, cadet teams from several engineering programs have been doing just that since September 2013. Each year as part of SDC, engineering students from both the United States Military Academy and MIT design new products and systems to solve the problems that Soldiers are currently facing. “Plus, when you factor Soldiers in the design from the beginning,” says Beharie, “the better the product will be at the end.”

Now-Second Lieutenants Richard Calvin '14 and Eric Nelson '14 from the Department of Physics and Nuclear Engineering developed a radioactive isotope pyroelectric generator. Hoping to create a portable recharging station or a battery-sized generator, the team proposed attaching leads to an ordinary motion-detecting crystal and using Americium-241, which gives off an alpha particle, to heat the crystal. These commercial crystals have dipoles that, when heated and cooled, change direction and polarization, creating a current of electricity. Calvin believes that this system will be a lightweight solution to the number of batteries Soldiers must currently carry, and Nelson maintains that this system will power Soldiers for decades, even centuries, for relatively little cost.

Eric Nelson '14 briefs his team's radioactive isotope pyroelectric generator.

Another team, the “Heavy Lifters” from the Department of Civil and Mechanical Engineering, worked on an air-bag system that can help rescuers extract personnel, information, or anything else trapped in an overturned vehicle. Given the size of their team, 12 cadets total, the Heavy Lifters divided their project into three areas: 1) the air bag and its stability system, 2) a repair kit for the air bag, and 3) a power source for the air bag. Now-Second Lieutenant Alessandra Coote '14 says that her team's project can lift 20,000 pounds 20 inches off the ground and hold it up for more than 10 minutes with their stability system. As the team made clear, the system is both useful in combat and in non-military rescues. In addition, as Cadet Robert Hume '15 noted, the Heavy Lifters system is “no more expensive than current products used by Soldiers and first responders in these situations.”

A third team, this time from the Department of Chemistry and Life Sciences (C&LS), which looked forward to being in the 2013 SDC but held off presenting because its project wasn't quite ready, unveiled the U.S. flag-designed Power Patch v.2. Worn on a Soldier's uniform just like the current flag patch, this one contains a photovoltaic cell on the flag that recharges copper/tin and nickel/manganese oxides contained in DNA-based nanowires. Just three millimeters thicker than the current flag patch, Power Patch v.2 produces 3.0 volts of electricity. Right now, the team anticipates



The Heavy Lifters share the Director's Prize (1st Place) with a team from MIT



Members of the Heavy Lifters set up their inflation system (inset) to lift a LMTV of the 2nd Aviation Detachment.



C&LS cadets work in the lab to create DNA hydro gel, which is then mixed with a nickel solution to create a sample of nickel nanowires (inset).



powering a passive blast detection system, which can measure the force of an IED explosion, but notes that its moldable bio-template battery film could be scaled up to cover an airfoil and power an unmanned aerial vehicle. Now-Second Lieutenant Sam Lowell '14, who has been with the project for two years, says, "We are looking to replace mechanically structured materials in a wide scope of military applications."

No matter where their team places in the competition, all cadets are learning important lessons working on their SDC projects. "It has broadened my academic horizons and understanding of the engineering community," says Lowell. "It has taught me a lot about peer leadership," says Coote, "particularly what *not* to do in a leadership role." Finally, Nelson says that engineering a device that is easy for all Soldiers to use "continually reminds me of my duties as a future leader." ★



Scan this code to see a video of SDC teams at work!



Protecting Soldiers with Machines

By Anthony DiNoto, WPAOG staff

The Vertical Takeoff and Landing (VTOL) device is designed to gather intelligence in unknown, underground regions.

Mechanical Engineering (ME) can trace its roots back to the turn of the 20th century, when West Point realized that the country needed one type of engineer to build bridges and another type to build the machines that crossed those bridges. Fast forward to 1989, and ME emerged as a separate major accredited by ABET. Since then, ME has become an enticing major for incoming cadets. Over the past decade, 65 to 75 cadets on average have graduated from the ME program each year, making it one of the largest academic majors at the Academy. There has been a notable increase in enrollment over the past three years: the classes of 2014, 2015, and 2016 have ME enrollments of 91, 122, and 121, respectively. ME is also one of the broadest of all the engineering disciplines, encompassing three primary subfields: energy, mechanisms and machinery, and manufacturing. Cadets majoring in ME are exposed to a vast array of specialty areas, where systematic problem-solving techniques and logistics contribute to the design and production of military machines. The ME program maintains a relationship with several national and regional engineering societies, including the American Society of Mechanical Engineers, the American Institute of Aeronautics and Astronautics, and the Society for Automotive Engineering.

Cadets enrolled in ME curriculum at West Point must complete 18 courses within the accredited program, ranging from ME403: Manufacturing and Machine Component Design to XE472: Dynamic Modeling and Control. To augment the classroom experience, many cadets participate in summer internships under the Academic Individual Advanced Development program. Lieutenant Colonel Bret Van Poppel '92, Director of the ME Design Group, says, "The internship opportunity gives cadets real hands-on experience at DoD laboratories and commercial companies." Some of ME's training facilities include Lincoln Labs; the U.S. Army Aviation and Missile Research, Development, and Engineering Center; the U.S. Army Tank and Automotive Research, Development, and Engineering Center; the Naval Postgraduate School; and Sikorsky helicopter. In their final year of the ME program, cadets participate in a high-quality, client-based, year-long capstone project that incorporates the content of different courses. In conjunction with DoD, cadet project teams work with the Defense Advanced Research Projects Agency, the U.S. Army Research Lab, U.S. Army Armament Research Development and Engineering Center (ARDEC), the Air Force Research Lab, the Rapid Equipping Force (REF), as well as commercial clients such as Boeing Space Defense to develop equipment that could potentially be utilized within the U.S. Army.

This year, one project team of ME cadets entered the REF Grand Challenge and was tasked to propose and develop a piece of equipment to protect Soldiers in the Middle Eastern theater while preserving a traditional way of life for the local people. Throughout Iraq and Afghanistan, there is an ancient underground tunnel system known as the “karez.” Originally developed more than 2,300 years ago, the karez tunnel system provides a continuous water supply for drinking, irrigation, and cooling. These vertical access shafts lead to subterranean open channels with small slopes to move water via gravity. “The karez is a narrow, precipitous, and largely unknown water system that has been vital to the agricultural sustainability of Middle Eastern countries for thousands of years,” says Van Poppel. In more recent times, however, insurgent forces in Iraq and Afghanistan have taken over the karez and have successfully moved men, weapons, and equipment through the arcane tunnel system. Unmanned ground vehicles have attempted to traverse the rugged caves, but they struggle to access the underground channels due to the deep access shafts, narrow entries, and standing water. This is where one ME capstone project, named Vertical Takeoff and Landing (VTOL) Intelligence, Surveillance, and Reconnaissance aims to solve the challenge of operating in subterranean environments such as the karez. Van Poppel advised four cadets from the Class of 2014—Anthony Grady, Trevor Knowles, Jay Trexler, and Kevin Zander—who developed a prototype unmanned aerial vehicle (UAV) to breach the tunnels. The prototype is a technologically enhanced UAV that could survey and map the subterranean karez system without relying on traceable

GPS signals. Using a commercially available quadcopter, the UAV adds ground station control, live video feed from an on-board camera, and an advanced Light Detection and Ranging system for two-dimensional mapping of the tunnels and caves. The system is designed to operate autonomously, leveraging image and distance sensors to localize and avoid hidden hazards or insurgents. The capstone team collaborates with several technical agencies, including the Center for Advanced Navigational Technologies at the Air Force Institute of Technology, Air Force Research Laboratory Sensors Directorate at Wright-Patterson Air Force Base, and the U.S. Army Armament Research, Development, and Engineering Center at Picatinny Arsenal. At Picatinny, cadets tested their prototype in a mock-tunnel setting that mimics the actual Middle Eastern karez water system.

In its first year of development, the VTOL project has seen many advancements, and Van Poppel says, “ME plans to continue this project in future years, perhaps offering it as a multi-disciplinary, inter-departmental project.” The ME program at USMA has afforded cadets the opportunity to impact the U.S. Army while advancing their career as an engineer. “Working on a real-world problem and being able to provide my input to the scientific community is a huge benefit for me,” says Zander. Knowles agrees and says “contributing to a project that could potentially be used in the field helps me understand my place as an Army Engineer.” ★



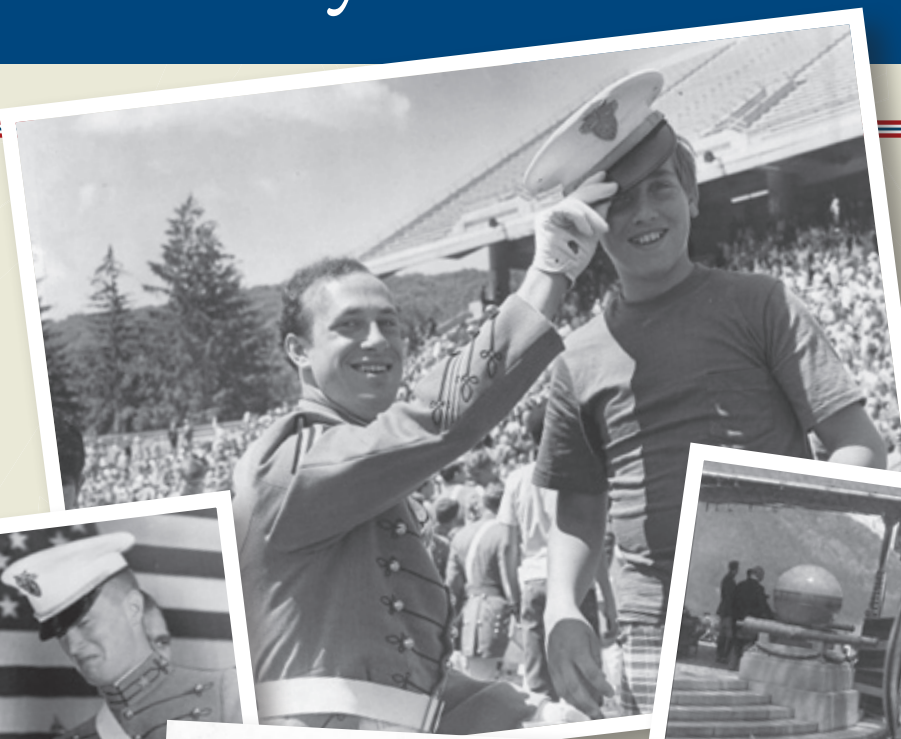
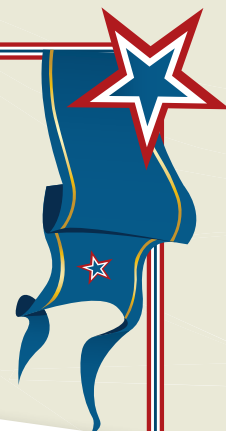
Trevor Knowles '14 and Jay Trexler '14, test their VTOL prototype.

“Contributing to a project that could potentially be used in the field helps me to understand my place as an Army Engineer.”

—Trevor Knowles '14

GRADUATION throughout the years

1904-2014



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PICTURE SECTION

The New York Times

SUNDAY,
JUNE 18, 1959



2014

POP OFF!



On May 28, the Class of 2014 received their diplomas, creating memories to last a lifetime. We asked our LinkedIn and Facebook followers “What are some of your favorite West point Graduation memories?” Below are just a few of the many responses we received from Old Grads.



Dan Robinson Just realizing the four years were over, watching the hats go up in the blue sky, and wondering what life after the Academy had in store for me. Now 46 years on, I could never have guessed all the curves in this life and how the world would change.



John Champagne It was a bright sunny day and throwing my hat (which I swore I would not do) high in the air with my classmates and my wife of 44 years, her family and my family looking on. I was so excited to graduate that when I tossed my full dress coat into the collection point, I forgot to remove my army and navy cufflinks. Beat Navy BOTL 1969



Lorelei Coplen My paternal grandfather, who I barely knew, showing up for my commissioning. He took my hands, turned them over, and ran his finger across my calluses in my palm, and then said to me: "I am proud of you; you know how to work hard."



Daniel

Daniel Hodne

Experienced Organizational Leader, Strategic Planner, Operations Director, and Executive Advisor - Colonel, U.S. Army

Saluting, and then shaking the hand of the President of the United States, our Commander-in-Chief, as he handed my diploma to me. After delivering the commencement address, then President George Bush gave all 965 graduates of the USMA Class of 1991 their diplomas, which was not typical for a single person to do during a Graduation Ceremony. What a class act! In another atypical fashion, we were also one of the very few classes, if any to my knowledge, to graduate wearing the India White uniform rather than the Full Dress over White, as a torrential downpour during the previous day's Graduation Parade ruined our Full Dress coats. Duty Shall Be Done! De Oppresso Liber! ARMY STRONG!



Elizabeth

Elizabeth Lewis

615th Horizontal Engineer Company, 52nd Engineer Battalion

One of the best parts of graduation was being able to sit next to my best girlfriend during the whole ceremony, taking the oath of officership, throwing our hats up together, scrambling to meet our families through all of the commotion, turning our (coveted) red sashes and plumes to WB9, and commissioning together on Daly Field where we had played lacrosse together everyday after classes for four years (our future husbands were both able to make it to our commissioning ceremony to top it off!). We had talked about graduation from the first day of lacrosse, so it was really a memorable experience to be able to make it the whole way together, from start to finish.

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*“The scientist explains that which exists;
The engineer creates that which never was.”*

—Theodore von Karman

Robot Army on the March

By COL Lisa A. Shay '89 and COL Robert W. Sadowski '86, Guest Writers

Electrical Engineering (EE) has been creating sparks at West Point nearly since the Academy's founding.



Electrical Engineering



Instructors in the Department of Natural and Experimental Philosophy began teaching subject matter related to electrical engineering during Sylvanus Thayer's, Class of 1808, Superintendency. By 1928, electrical engineering was formally recognized as a separate curriculum category with the creation of the Department of Chemistry and Electricity. That Department split along discipline lines after WWII, and USMA General Order 129 set the name as the Department of Electrical Engineering in the 1960s. In 1989, computer science merged with electrical engineering to create the Department of Electrical Engineering and Computer Science, the current designation. As a major, EE has been ABET-accredited since 1985 and consistently ranked as one of the top-10 undergraduate-only programs in the Nation, graduating an average of 25 majors annually. In recent years, several cadets have won external fellowships such as the Fannie and John Hertz Foundation Fellowship, the National Science Foundation (NSF) Graduate Research Fellowship, the Graduate Education for Minorities (GEM) Fellowship, and the MIT Military Fellowship. In addition, numerous cadets have been finalists for both Marshall and Truman Scholarships. EE's faculty is equally impressive. Several hold Professional Engineer licenses, conduct research for Army and Department of Defense laboratories, or serve in senior leadership roles for professional societies such as SPIE—the international society for optics and photonics, the Optical Society of America, and the Institute of Electrical and Electronic Engineers, including a candidate for IEEE president, Colonel Barry Shoop.

EE's goal is to produce technically competent leaders of character—successful Army officers who have applied their engineering, management, and leadership skills in service of their country—and its curriculum features five Army-relevant depth areas: alternative energy, robotics, information assurance,



The Department of Electrical Engineering and Computer Science's robot army.

opto-electronics, and communications. EE's capstone design projects roughly align with cadet depth areas and support external, often defense-related clients, such as Detroit Arsenal, Picatinny Arsenal, or the National Security Agency. "The EE program is fantastic," says now-Second Lieutenant Stuart Baker '14, an EE major and team captain of the program's entry in the Intelligent Ground Vehicle Competition. "The program is very hands-on and provides its students a set of practical, applicable skills."

One of EE's recent projects has focused on unmanned systems development or robotics. Robotics involves many of the core sub-disciplines within EE: controls, electronics, embedded systems, signal processing, and communications—just to name a few. Over the past decade, EE has partnered with several agencies that conduct research on robotics, such as the Department of Defense's



Above: Making adjustments on the ARIBO-IH iRobot®.
Left: EE majors working on the ARIBO-IH research project.

"West Point offers a unique environment where cadets and faculty from multiple backgrounds can design and implement long-running experiments."

— COL Jim Kelly '84



EE majors log readings at the computer while Matthew Abreu '14 adjusts a sensor on the ARIBO-IH iRobot®.

Joint Ground Robotics Enterprise (now the Defense Ground Robotics Alliance). This partnership has produced tangible results: more than \$1 million supporting developmental robotics project work, 100 tactical grade robots, renovated facilities, and a powered mobile robotics lab for field use. West Point is also currently one of four installations designated as test areas for the Applied Robotics for Installation and Base Operations (ARIBO) initiative, which takes emerging robotic technologies and puts them into real world use. “West Point offers a unique environment where cadets and faculty from multiple backgrounds can design and implement long-running experiments,” says Colonel Jim Kelly ’84, U.S. Army Research, Development, and Engineering Command-Tank Automotive Research, Development, and Engineering Command (TARDEC), Science and Technology Advocate to U.S. Army Combined Arms Support Command & Sustainment Center of Excellence.

In addition to playing roles in their development, ARIBO also offers cadets and faculty the opportunity to see the promises and limitations of these technologies. One project on which EE cadets are currently working is the ARIBO-Industrial Hygiene or ARIBO-IH project. The ARIBO-IH project involves EE majors with concentrations in robotics and opto-electronics and factors in lessons from EE487: Embedded Systems Development, XE472: Dynamic Modeling and Control, XE475: Mechatronics, and EE480: Optical Fiber Communications. The goal of this project is to instrument a military grade, iRobot Packbot® with environmental sensors so that it can perform HAZMAT detection and communicate the results to a remote operator over the existing wireless control link. Now-Second Lieutenant Matthew Abreu ’14, who was in charge of integrating the microcontroller responsible for processing sensor data and sending that information to the iRobot’s

database, says, “This capstone has shown me that robots are capable of doing more than you could imagine but are more complex than you would hope.” In the future, Abreu hopes to leverage his understanding of robotics in the development of advanced prostheses for amputees.

Working on such projects with outside entities is a win-win all around. “Outcomes and lessons learned from the cadet-led project will be used by TARDEC scientists in developing Soldier-ready systems for the Army,” says Kelly. In other words, cadets gain skills while working on relevant Army problems, and the Army gets both a technical solution and officers who better understand the promise and limitations that unmanned systems present to the future force. As Kelly states, “These cadets may very well be the major or lieutenant colonel deciding how robots are integrated into brigades and operations 10 to 15 years from now.” ★

COL Lisa A. Shay ’89, PE, is a Signal Corps officer and an Academy Professor in the Department of Electrical Engineering and Computer Science. She has a doctorate in electrical engineering from Rensselaer Polytechnic Institute and a master’s degree in engineering from Cambridge University, where she studied as a Marshall Scholar.

COL Robert W. Sadowski ’86 is a Signal Corps officer and an Academy Professor in the Department of Electrical Engineering and Computer Science. He received his MS and PhD degrees in electrical engineering from Stanford University, where he studied as a Fannie and John Hertz Fellow. For more than 28 years, he has served at home with the 82d Airborne Division and abroad with both the 11th Signal Brigade and ARCENT across Southwest Asia.



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A cadet removes the center fuel pin to examine the change in reactivity on a nuclear reactor.

West Point's House of PaNE

By **Dr. Brian Moretti '76**, Guest Writer

The roots of nuclear engineering (NE) at West Point date back to 1961, when the Department of Electricity introduced EL482: Nuclear Engineering to its curriculum. With the inception of academic majors at West Point in 1983, NE was offered to cadets only as a less specialized field of study. By 1989, the Department of Physics assumed oversight of all NE courses.

After the attacks of September 11, 2001, it became clear that weapons of mass destruction (WMD), including the use of a nuclear weapon or a dirty bomb, were major threats to the United States. Convinced that the Army and the Nation needed leaders that were technically prepared to combat such threats, the

Department of Physics petitioned the Academic Board to expand the NE field of study to an NE major. The Board approved this request, and West Point graduated its first round of NE majors in 2005. The Engineering Accreditation Commission of ABET has accredited the NE program since 2009, and in 2010 the Department of

Physics was renamed the Department of Physics and Nuclear Engineering (D/PaNE) to reflect the expanded emphasis on nuclear engineering.

Annually, an average of 15 cadets choose to major in NE, while over 70 cadets study NE as one of the seven disciplines offered in the Academy's required three-course core engineering sequence. Nuclear Engineering majors take 18 courses from four different academic departments in three principal areas important to nuclear engineers: the operation of nuclear reactors, the design and effects of nuclear weapons, and the health effects and medical uses of radiation. "In all my NE classes, we learned a problem-solving method useful to any Army officer," says now-Second Lieutenant Jenna Vercollone '14. Cadets majoring in NE also participate in Academic Individual Advanced Development programs (AIADs) with several national laboratories such as the Defense Threat Reduction Agency (DTRA), Army Research Laboratories, and other agencies. For example, now-Second Lieutenant Daniel

Murphy '14 worked with Los Alamos National Laboratory on a project to determine how electromagnetic radiation affects flash-blindness in order to protect any nuclear response team from the effects of this condition around the detonation area.

One course taken by both NE majors and sequencers is NE450: Nuclear Weapons Effects. In addition to lessons on basic nuclear weapons design and extensive coverage of nuclear weapons effects, the course features a tabletop exercise facilitated by experts from the National Defense University's Center for Study of WMD. This exercise provides cadets a multidisciplinary forum that combines military, social, political, economic, and environmental considerations with technical and policy issues in a simulated real-world case study in order to explore national security interests and options. Working on a scenario involving Iran, Vercollone says, "The exercise showed me that situations are complicated and require the perspectives of many different groups before a solution can be reached." NE450 is the only course of its type in the country taught to undergraduate students.

The clear relevance of the NE major to the Army and the Department of Defense is evidenced by the close relationship that exists between D/PaNE and the Army's Nuclear and Counterproliferation functional area (FA52). One-fourth of the Department's teaching faculty are Army FA52 officers, who are trained to apply knowledge and expertise of nuclear and related WMD matters in developing national strategy, theater strategy, plans, and policy. Additionally, DTRA established an office at West Point, the Nuclear Science and Engineering Research Center, whose mission is to enhance the involvement of cadets and faculty in WMD research issues important to the Department of Defense. This synergy with DTRA enables cadets and faculty to engage with WMD experts and permits them to use external laboratories and modeling-simulation facilities outside of West Point. In addition, the Department's own experimental capabilities are robust with a broad capacity for radiation detection and measurements. Its nuclear facilities include a natural uranium-fueled and light water-moderated sub-critical assembly, a new 1.2 MV 5SDH Pelletron particle accelerator capable of creating proton and alpha-particle beams, a Nuclear Regulatory Commission license to store and use radioactive materials, and its own field lab environment on the West Point military reservation (Camp Shea). Lastly, the ongoing revitalization of the Bartlett Hall Science Center, to be completed in 2016, will result in state-of-the-art NE teaching and laboratory facilities.

A key part of the NE major curriculum is a two-semester capstone design project for all First Class cadets. Working in teams of two or three, cadets work on real-world, client-based projects often inspired by DoD requirements. For example, working for the Defense Threat Reduction Agency, Murphy used simplified models of Army vehicles to determine each one's Neutron Protection Factor, or its ability to protect its occupants against radiation. Other recent projects include the study of concrete additives to enhance neutron attenuation for dry cask fuel storage, the validation of nuclear fallout models through analysis of early nuclear weapons test films, and dosage testing on radioactive serum used in medical imaging



Cadets pose with ADM John Richardson, Director of Naval Reactors, at the American Nuclear Society Hall of History in Washington, DC (November 2013).

procedures. These capstone projects culminate with cadets presenting their work both at internal (e.g., Projects Day) and external (e.g., American Nuclear Society) conferences. Via work on their capstone projects, cadets gain confidence in their ability to perform world-class undergraduate science and to brief those results in professional venues. ★

Brian E. Moretti PhD '76 is the Nuclear Engineering deputy program director in the Department of Physics and Nuclear Engineering. He served 28 years on active duty as a Field Artillery Officer and as a Nuclear and Counterproliferation (FA52) Officer. He served in the Department of Physics from 1984 to 1987 and from 1996 to the present. He retired from the Army in 2004 as a colonel and is now a member of the West Point civilian faculty.



Azezat Olatunde '14 at Camp Shea on November 19, 2013, conducting research for NE452: Instrumentation and Shielding.

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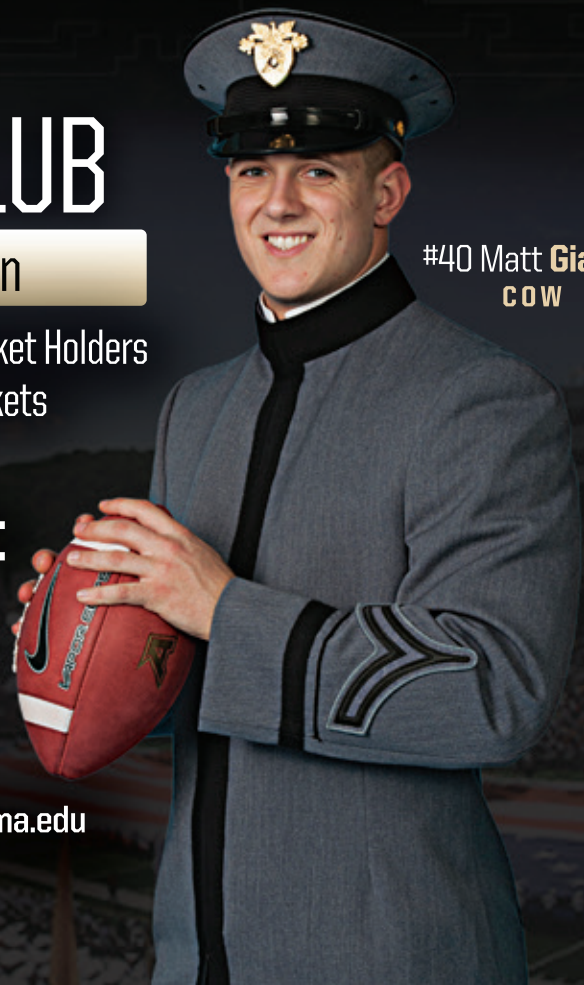
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Where Humans Meet Machines

By **COL James Ness**, Guest Writer

There's no denying it: to maintain its status as the world's premier land power, the United States Army will perpetually require more sophisticated technology; however, technology is only as good as the humans using it. Because of this, human-centered design will be a crucial factor in building the next generation of equipment Soldiers use to fight and win America's wars. This is where engineering psychologists come into the picture. As the interface between machines and human beings, engineering psychologists make sure that each interacts well with the other, and they use theoretical and applied research to design ergonomic equipment and introduce that equipment into an organization. The Engineering Psychology Program within USMA's Department of Behavioral Sciences and Leadership (BS&L) is one of only two dozen American undergraduate programs integrating engineering and psychology, and one of two with a military focus (Air Force is the other).

The program in engineering psychology was envisioned shortly after the establishment of BS&L in 1978 as a means of exploiting the science and engineering of human performance on the battlefield. The emphasis of the program was and remains on the design of Army systems and programs to affect combat outcomes. The first director of the program was Major Tim O'Neill, who spent 15 of his 25 years as an Army officer serving as an instructor in BS&L. Originally called Human Factors Engineering, the

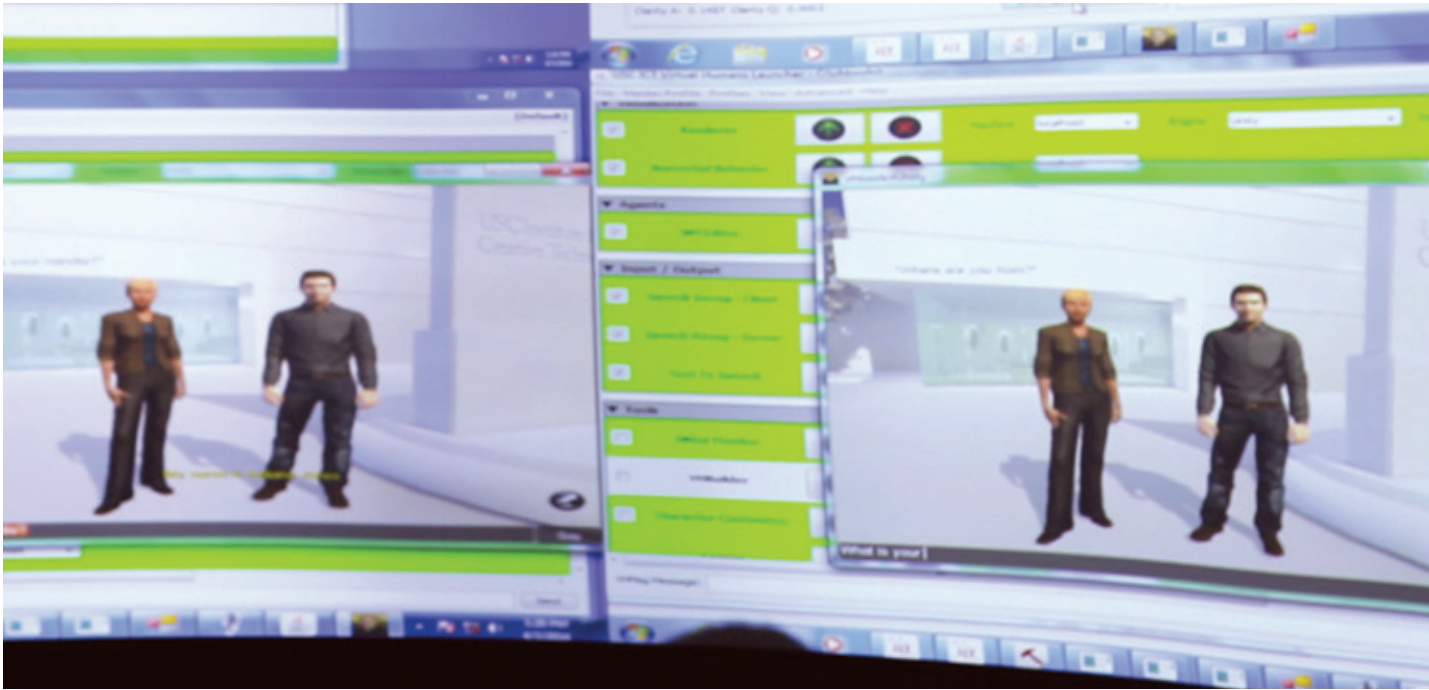
program's name was changed in the late 1980s to Engineering Psychology. Ergonomics was also considered as a potential title, but Engineering Psychology was chosen because it was deemed more comprehensive with regard to the human dimension.

Cadets majoring in engineering psychology are required to take 10 courses in order to graduate, including MA376: Applied Probability and Statistics, reflecting the experimental and research-design nature of this discipline. The curriculum is also highly integrated and cumulative, each higher level course built upon lower level ones. For example, cadets learn about the structure and function of the nervous system in PL390: Biological Psychology, which is needed to understand the lessons of PL391: Sensation, Perception, and Psychophysics as well as PL392: Cognitive Psychology. In their four semesters as an engineering psychology major, cadets design and conduct several experiments, analyze data using appropriate statistical procedures, write scientific research reports, and orally present research results to peers and faculty.

The first long-term research program in engineering psychology began in 1986 with a project sponsored by the Army Research Institute for BS&L designed to identify the individual attributes and skills that allow a Soldier to find and identify targets on the battlefield. At the same time, faculty and cadets teamed up on a series of projects to identify problems and solutions in contemporary battlefield camouflage. In fact, it was O'Neill who

Cadets interact with one another to form dialogue used in the Virtual Human Toolkit. Conversations are recorded and transcribed, then integrated with the software.





First Class cadets majoring in Engineering Psychology use Virtual Human Toolkit software, developed by USC's Institute for Creative Technologies, to build an interactive training system that requires the trainee to interact with three computer avatars in order to gather information about an IED explosion.

created the basis of the camouflage pattern now seen on the Army Combat Uniform. According to an article titled "West Point explores science of camouflage" at Army.mil, "O'Neill's work in camouflage began prior to graduate school with field testing at Fort Knox, Kentucky." When he came to West Point as an instructor for BS&L, O'Neill tested his "Dual-Tex" pattern in a USMA laboratory with the assistance of cadets and fellow faculty. The article also notes that O'Neill worked on eye tracking while he was head of the Engineering Psychology Program, "conducting a number of studies on how the human visual system detects and recognizes camouflaged targets." These research threads have continued and include cadet projects that support the Army camouflage test and evaluation program. Captain Jacob Frechette '10 worked on such a project with O'Neill, who is now a camouflage consultant for the Army. "There's a lot more science to it than putting some colors in a random pattern," Frechette says. Also, noting how engineering psychology taught him about how Soldiers think and feel about their equipment, Frechette says, "This is definitely one of the most applicable majors for being an officer in the military."

The Engineering Psychology Program maintains its roots as an education in Soldier-oriented research, which is designed to meet the cadets' future as officers in the U.S. Army. The breadth of practical military-relevant work ranges from a multi-disciplinary collaboration with a Nobel Laureate in medicine and physiology studying the natural history of a whole blood marker for depression, to designing immersive training simulations involving interactive artificial intelligent agents. ★

COL James Ness PhD is an Academy Professor and Director of the Engineering Psychology Program in the Department of Behavioral Sciences and Leadership. His prior assignment (2010-11) was as Command Inspector General, NATO Training Mission/Combined Security Training Command Afghanistan. He earned a Bronze Star for his efforts in reforming the Afghan National Military Hospital and for establishing an internal assessment program within the Ministry of Interior to inform Afghan leadership of the effectiveness of initiatives to build a professional police force.



One of the targets tested by a BS&L team at Aberdeen Proving Ground, MD. This was a field validation of "texture-match" design (now inaccurately called "digital"), designed at West Point and dominating military camouflage worldwide.

All Systems Go

By Keith J. Hamel, WPAOG staff

All engineering programs at the United States Military Academy tackle problem-solving, but those in the Department of Systems Engineering (DSE) tackle problem-solving in a unique way. The foundation of its curriculum is built upon the Systems Decision Process (SDP), a holistic approach for systems engineering that is introduced to cadets in the first course they take for the major—SE301: Fundamentals of Engineering Design and Systems Management—and governs all their coursework going forward. Many graduates say it also governs their lives. “I constantly find myself using the SDP to help me make informed decisions on a number of personal and professional matters,” says Major David Hughes ’01, who majored in systems engineering as a cadet and came back to teach in the Department in 2009. Some attribute the popularity of the four programs in this Department (graduating 150-200 majors in any given year) to cadets grasping the practical application of what they learn in DSE to life after West Point. “Our graduates will soon be Army officers responsible for life and death decisions at a young age,” say the authors of “From Cornerstone to Capstone: Systems Engineering the West Point Way.” “The systems engineering major at West Point educates cadets in applying the Systems Decision Process in order to provide our officer corps with the ability to apply a systems thinking framework to the complex, interdisciplinary problems they will face around the world as well as a disciplined, engineering thought process for solving such problems.”

DSE planted its flag at the United States Military Academy on July 1, 1989. The engineering management program existed prior as part of the Department of Engineering but moved over to DSE because of its synergistic relationship with the new systems engineering program. According to Brigadier General (Retired) Jim Kays ’62, DSE’s first Department Head, systems engineering was not really a new idea but an evolution spurred on by the rise of complex changes in history at the time. Kays says, “When we were developing the program, Lieutenant General Dave Palmer ’56, the Superintendent at the time, said, ‘We want something different, so think about how you could get an officer to think, react, and lead in a 21st century

environment—interdisciplinary is key.” Not surprisingly, Kays and others used the systems engineering process they would teach to build the Systems Engineering department’s curriculum. “We understood that the two environmental constants for our graduates would be rapid change and uncertainty, so we asked, ‘What engineering education could best prepare them for this?’” Kays says. The new DSE faculty then described the attributes they wanted its graduates to have and created courses that would teach those attributes. They also created a feedback loop to assess how well the Department was meeting its program educational objectives and outcomes. Naturally, a number of the objectives related to the graduates’ profession as Army officers, and Kays believes this explains the quick rise in the number of systems engineering majors. “If you stay in the Army, you are going to work with organizations, technology, operational concepts, and other pieces of a system; DSE will get you thinking about the big picture and how the pieces all interact,” he says.

“I think that we will see many future Army colonels and generals who are systems thinkers.”

— MAJ David Hughes ’01



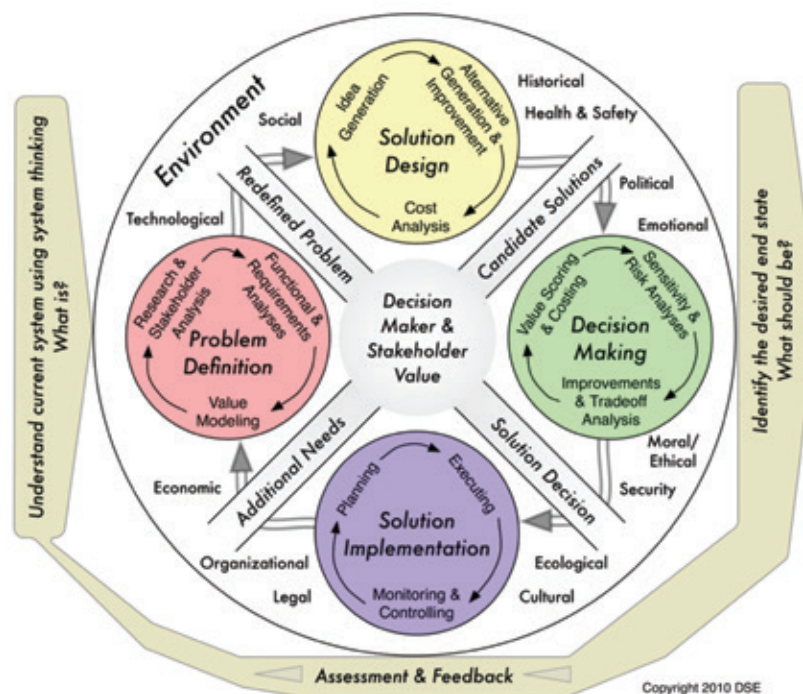
Jackson Matheson ’14 (foreground) operating the Raptor X command and control network node, which simultaneously processes high resolution GPS network information and ground radar sensor tracks over a separate wave relay network.





Jackson Matheson '14, Neal Covell '14, Frank Fink '14, and Patrick Hart '14 work on a high resolution GPS repeater in support of their GPS network as part of the DASA R&T Adaptive Red Team Technical Support & Operational Analysis pilot experiment at Camp Roberts, CA.

After SE301, Systems Engineering majors take a series of method classes that are designed, according to Colonel Dan McCarthy '90, former Systems Engineering Program Director (2008-12) "to put tools into their tool kit." These are primarily skills that cadets can apply to the SDP, such as statistics, simulation and math modeling, production-operations, project management, and decision analysis. Lastly, there is the year-long SE402/3: Capstone Design course in which cadets work in small groups with a real-world client on a real-world project. The clients even pay for cadet services, which offsets administrative and travel costs the cadets incur while working on their project. In academic year 2013-14, cadets worked on projects for 47 clients. One of these projects, supervised by Dr. Patrick Driscoll '79, is already making a tremendous impact on the way in which the Army acquires new technologies. In 2010, Driscoll was having a conversation with Dr. Niki Goerger of the Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology. They were discussing troubling issues in the force protection of combat outposts (COPs) in Afghanistan and the number of technical systems provided by the Army's Rapid Equipping Force that were not being used by warfighters. After interviewing relevant parties, Driscoll and his team started to see evidence of a problem. "Some of the features that manufacturers were including in their system's design were incompatible with what warfighters were expecting at the COPs," Driscoll concludes. The team developed an assessment system, called the Adaptive Red



The Systems Decision Process (SDP), the foundation of systems engineering's curriculum.

Team, which now synthesizes all force protection systems under three headings: performance expectations, human factors, and supportability. They also established a live experiment that cycles every 90 days to test 28-34 technologies as they relate to deployable force protection. The assessment system has been so successful that it is now starting to conduct experiments on Army programs of record. “This is probably the biggest project this Department has ever had,” Driscoll says, “and it has been a vehicle for the professional development of our systems engineering cadets, our junior rotating faculty, and our senior-level researchers.” A recent

DSE graduate, Now-Second Lieutenant Frank Fink ’14, who did data analysis for the Adaptive Red Team project, believes that his systems engineering background and his capability to test and evaluate new technologies will greatly impact his future as an Army leader.

“DSE is graduating dozens of cadets every year that have a foundation in solving real problems for real clients using SDP,” says Hughes. “I think that we will see many future Army colonels and generals who are systems thinkers.” ★

“In the Army, you are going to work with organizations, technology, operational concepts, and other pieces of a system; DSE will get you thinking about the big picture and how the pieces all interact.”

— BG (R) Jim Kays ’62, DSE’s first Department Head



Cadets in SE301: Fundamentals of Engineering Design and Systems Management use DragonFly software to design an Unmanned Ground Vehicle (UGV), capable of conducting ground reconnaissance and attack operations, and participate in a simulation exercise that utilizes SDP methodology in order to derive stakeholder needs, wants, and desires, leading to a detailed requirements analysis that is instrumental in the UGV design.

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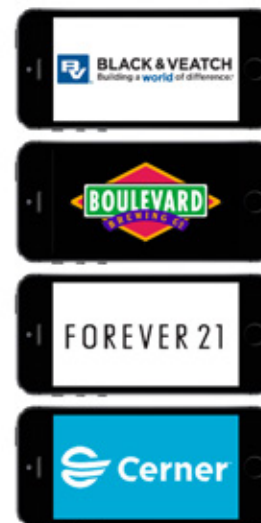


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Fueling the Future Force

By Keith J. Hamel, WPAOG staff

CDT Adam Callahan '16 feeds MRE waste into a waste-to-energy rotary gasifier, a system that aims to greatly reduce the accumulation of waste and the energy needs of the Army's forward operating bases.

As the United States Military Academy was celebrating its 200-year history in 2002, USMA's chemical engineering program (ChE) was just starting its first year of existence. Two years prior, a Dean's curriculum review demonstrated the need for this diverse major, which combines chemistry with mechanical engineering, math, and economics to find new ways to turn raw materials into usable products. Just three cadets elected ChE as their major that first year. More than a decade later, ChE has become one of the most desirable programs for incoming cadets and now boasts 65 cadets as majors. "I expect this growth to continue," says Don Glaser, the president of Simulation-Solutions and a member of ChE's Advisory Board. "As the only chemical engineering program at any of the service academies, USMA's ChE program offers students a unique opportunity to combine a military career with an undergraduate degree in chemical engineering."

Tony Pavone, Engineering Director for IHS and another member of ChE's Advisory Board, says that in its short existence USMA's ChE program has gone through "major changes and major improvements." Early on, ChE only had two faculty members in the Department of Chemistry and Life Science: Lieutenant Colonel Jim Placke and Dr. Andrew

Biaglow. To augment this, the program leveraged courses for its majors from other programs, such as civil, mechanical, and electrical engineering. It still has its majors taking courses through these related departments, but when ChE decided to pursue national accreditation through ABET, the Accreditation Board for Engineering and Technology, it began creating its own courses, and it now has five faculty members teaching in the program. Also, according to Pavone, "As a result of the accreditation process, the ChE program has even influenced those other departments to incorporate more lessons related to chemical engineering into their courses."

In following ChE's curriculum, cadets develop knowledge in several areas related to chemical engineering, including general, organic, and physical chemistry; heat, mass, and momentum transfer; and process design, dynamics, and control. Regarding this last item, Glaser points out that ChE provides its students with extensive use of life-like refinery, chemical, and power plant simulators. Cadet responses on departmental surveys show that these simulators have improved their understanding of a variety of process factors and enhanced their knowledge about plant operations. "ChE's use of these simulators leads the Nation in such



efforts,” says Glaser, “and ChE majors graduate prepared to assist operating and troubleshooting refineries, chemical plants, water treatment facilities, and power stations downrange in the field.” Case in point—one of ChE’s graduates served as a liaison between the Corps of Engineers and Iraqi civil authorities to keep a water plant running after the 2007 troop surge.

“USMA is graduating chemical engineers who can compete anywhere,” says Pavone, “but the strength of the program is that it is tailored to the unique requirements of the Army.” This is especially true of ChE’s research projects. One such project is a portable gasifier unit. Led by Colonel Russ Lachance ’85, this ongoing, multi-year project sponsored by the U.S. Army Armament Research, Development, and Engineering Center aims to turn waste into gas fuel at forward operating bases. Gasifier technology has been around since the 1920s, but what is new about ChE’s gasifier is that it does not require a dry feed. This is important when dealing with garbage, as the historical problem with gasifiers is that water in wet feeds absorbs most of the generated heat energy. ChE majors are researching a portable gasifier that can power an 18 kilowatt generator on such waste. In terms of cost, this project could likely save the Army a considerable amount of money. “Hundreds of millions of dollars in potential savings if it comes to fruition,” says Biaglow, the director of the chemical engineering program. This gasifier technology

would also impact the Army’s ability to sustain military operations when it would otherwise be constrained by cost, an obvious advantage in war.

“USMA is graduating chemical engineers who can compete anywhere, but the strength of the program is that it is tailored to the unique requirements of the Army.”

— Tony Pavone, Engineering Director for IHS and a member of ChE’s Advisory Board

Now-Second Lieutenant Louis Tobergte ’14, who worked on ChE’s gasifier project last year, says that the research he did brought together all of his ChE coursework and improved his ability to solve problems. Working with now-Second Lieutenant Jessica Niemiec ’14, Tobergte developed a new scrubber design, a cleaning system that removes clogged tar deposits in order to provide near-continuous gasification operation with low maintenance. “We used lessons from our first chemical engineering course, CH362: Mass



(From left to right) Louis Tobergate ’14, Jessica Niemiec ’14, and Floren Herrera ’13 work on improving the scrubber system of a waste-to-energy gasifier at a facility in Cobleskill, NY, during their 2013 spring break.

and Energy Balances, to find the losses and inefficiencies in the initial design,” Tobergte says. “Furthermore, knowledge of fluid properties from our physics, chemistry, and thermal-fluids classes inspired us to substitute problematic diesel oil with vegetable oil, which eliminated water entrainment in the wet scrubber and enabled us to remove 99.4 percent of tar from the syngas coming out of the gasifier.” He also notes that the foundation of their scrubber design comes from principles learned in their separations processes class. “Many of the problems we faced in this project and in our ChE classes seemed far beyond our grasp initially,” Tobergte says, “but through study and research we were able to solve most of them.”

From the textiles and chemicals used in uniforms, to the development of armor, explosives, fuels, and even the design of MREs, chemical engineering as a field has had an enormous impact on almost every aspect of modern warfighting. It is almost impossible to name a system, object, or material in use by today’s Army that has not had a chemical engineer involved in some phase of its development. ChE is now beginning to place uniformed chemical engineers into the Army where soldiers are actually using many of these systems, and down the road ChE will be playing an increasingly important role in Army planning and operations. According to Biaglow, “The first step toward this is obtaining ABET accreditation, which would go a long way toward cementing ChE’s national prominence and recruiting top students into the Academy.” ★

“As the only chemical engineering program at any of the service academies, USMA’s ChE program offers students a unique opportunity to combine a military career with an undergraduate degree in chemical engineering.”

— Don Glaser, the president of Simulation-Solutions and a member of ChE’s Advisory Board

Gripping Hands

“Grip hands—though it be from the shadows—while we swear as you did of yore, or living or dying, to honor the Corps, and the Corps, and the Corps.” —Bishop Shipman 1902

1982

Houlihan Named White House Champion of Change



Ellen Houlihan '82, Vice-Chair of the Board of Directors of the West Point Association of Graduates, has been named a White House Champion of Change. She was among a group of ten Women Veteran Leaders selected for their incredible contributions to our nation’s business, public, and community service sectors. Houlihan, is Vice-Chair, Board of Directors, West Point Association of Graduates (WPAOG). She is the first

West Point woman graduate to be elected to a senior leadership role of the 50,000 West Point graduate members. Her service includes leadership of the overhaul of WPAOG Bylaws and governance model, providing efficient and effective operational transparency of the Board of Directors and management staff.

1988

James Schenk named CEO, PenFed



On April 1, 2014 James Schenk '88 became President and CEO of Pentagon Federal Credit Union (PenFed). As part of its executive leadership team since 2001, Schenk has led most of PenFed’s operating divisions. Since 2011, he has been Executive Vice President

at PenFed and President of its wholly-owned subsidiary, PenFed Realty. He is also a former President of the PenFed Foundation.



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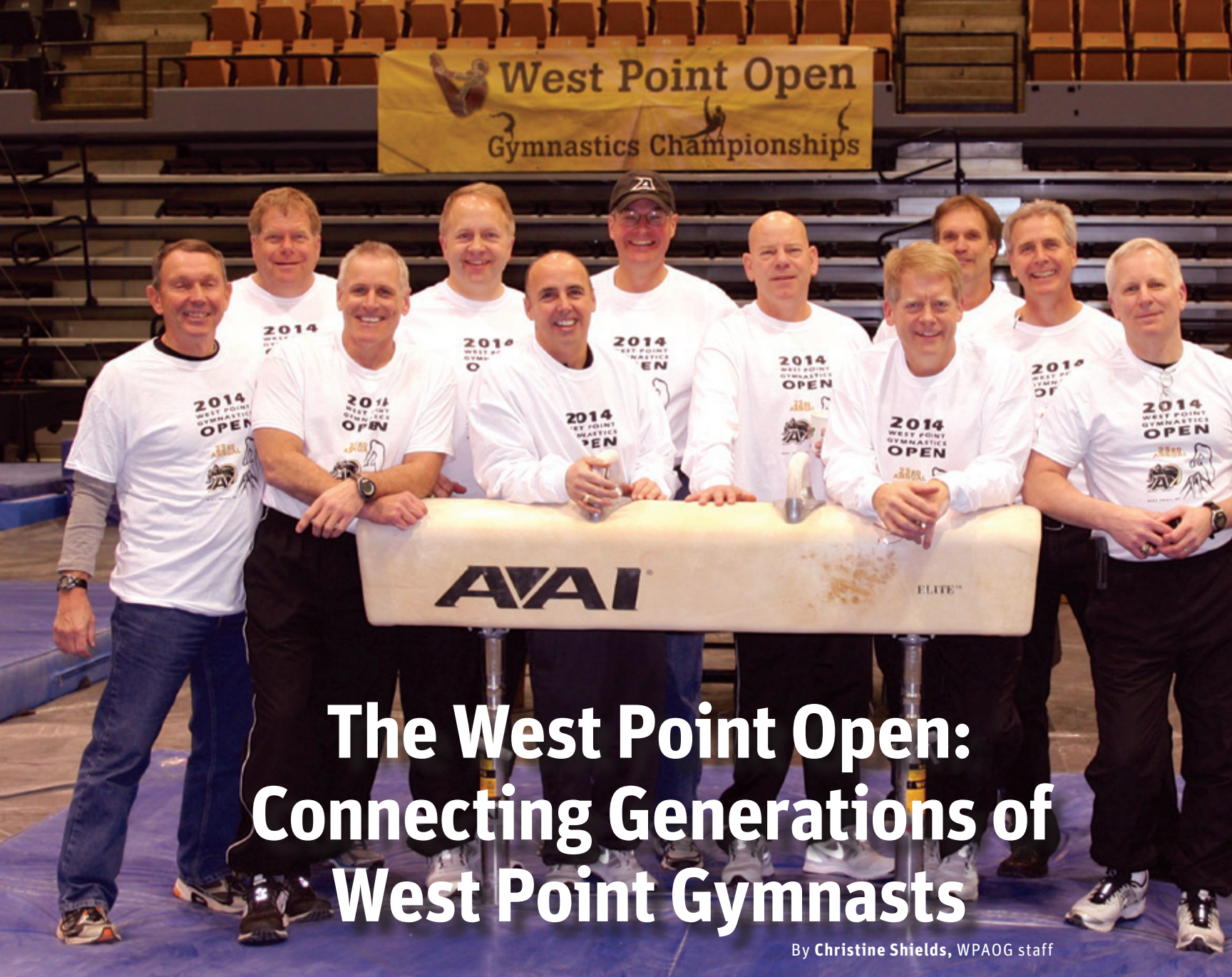
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— Mark Shattan '91 & MyLinh Brewster Shattan '91



The West Point Open: Connecting Generations of West Point Gymnasts

By Christine Shields, WPAOG staff

Twenty-three years ago, Doug Van Everen, Head Coach of Army Men's Gymnastics, had an idea. "I wanted to have an event where we could showcase our program amongst some of the country's best athletes, and where we could make sure that every athlete, every parent, every coach, felt like they were part of something special," he says. That idea developed into the West Point Open, a three-day gymnastics competition that brings approximately 650 elementary through college-level students to West Point every year. "We get kids registering from all over the country every single year," says Van Everen, and the event has received rave reviews from competitors, parents, coaches, and spectators, who return year after year. "It has just grown and grown and grown, and now the reputation is such that this is the event to go to."

But the West Point Open is more than just a national platform for promising young gymnasts; it has served as a catalyst to energize and organize a base of dedicated former gymnasts who are

committed to helping the Open and the entire Army Gymnastics program succeed. Over the years, Van Everen has worked tirelessly to bring together former Army gymnasts from all class years and encouraged them to give back to the program in any way they can, whether it be volunteering at competitions like the West Point Open, serving as mentors to cadet gymnasts, or building a financially sound program. Van Everen refers to this cadre of graduates as the program's "network of excellence," and it has revolutionized Army Gymnastics.

The West Point Open is perhaps the most apparent example of the above network's impact. While the Open is now a well-established, organized event, this wasn't always the case. "When we started the Open, it was one emergency after another," remembers Van Everen, who initially worked with only three volunteers to host the Open. Those volunteers are still involved and are now part of an approximately 12-member team of former Army gymnasts who refer to themselves as Van Everen's Warrior Team. They have flown



in from across the country and around the world to volunteer on their own dime and time to work 12 to 18 hour days, lugging mats and equipment up and down stairs, all for the love of the gymnastics program. Running the West Point Open and volunteering for the gymnastics program “is a labor of love,” says former Army gymnast Dave Fulton ’86, who first started volunteering in 1997. “We do it not for the free West Point Open t-shirts,” he jokes, “but for the opportunity to rally in support of the current team and to give back to the program, the Academy, and each other.”

“We show up, we know what our jobs are, and we do what we need to do,” says fellow Warrior Team member Army Ferrando ’78, who has been volunteering for the gymnastics program for more than 10 years and often travels with the team to the

All-Academy Competitions in addition to volunteering at the Open. The range of duties that the Warrior Team takes on is vast and varied, and over the years, many have assumed specific roles and responsibilities that they reprise year after year. The group takes care of awards and scoring; they announce, take tickets, march in the younger competitors; and they’ve even developed a West Point trivia game for the audience to play between events so that spectators unfamiliar with West Point can learn more about its history and the Corps of Cadets. “The West Point Open has become a well-oiled machine,” says Ferrando. “Even ESPN says this is the best-run meet it’s ever been to.”

But members of the Warrior Team do more than just physical grunt work and logistical management; these graduates, and many more former gymnasts, also give back to the program by serving as

Top, left: Members of the Warrior Team from this year’s West Point Open. From left to right: Former USMA instructor Tom (Doc) Horne, Randy Fulton, LTC (R) Army Ferrando ’78, LTC (R) David Fulton ’86, Assistant Coach of Army Gymnastics Carmine Giglio, Ray Zoellner, Army Head Coach Doug VanEveren, COL (R) Chris Fulton ’81, Jim Bicknel, Dave Peterson, COL (R) Jim Ferrando ’81, CPT Joe Baumann ’07, and Dave Wysocki. **Top, right:** This year’s Army Gymnastics Team after a great finish at the 2014 West Point Open. **Bottom, right:** Sam Kusnitz ’17 qualified for NCAA in his first year.

mentors to cadets. Though one of the smaller Division I teams at West Point (this year's team has 22 athletes), the gymnastics program boasts a proud record of illustrious graduates to which cadets can aspire. "All you have to do is look at our history to gauge where you can go," says Van Everen. In fact, the gymnastics program has a higher retention rate of graduates remaining in the military than any other USMA team and the overall Academy average: its graduates include 36 generals and 156 colonels, not to mention several doctors, lawyers, educators, astronauts, and corporate executives. The Warrior Team alone includes graduates with backgrounds in medicine, field artillery, infantry, aviation, and even the non-profit sector, and these volunteers often lend their insight and experience to cadets. "Typically around the West Point Open, all the firsties have identified their branch," says Fulton, "and we are able to talk to cadets about their career choice and share our experiences with them as they relate to their own careers."

"Talking to the old grads has really helped the team's as well as my own development," says Army gymnast Cadet Jesse Glenn '16. "Their advice, educational information, and stories have been helpful because they were on the same team we are on today, and they also provide insight about the future based on their experiences." Glenn says that the West Point gymnastics team greatly benefits from the support of graduates and the example they provide.

Another aspect of Van Everen's network of excellence includes a committee of dedicated graduates who support the program's financial stability. The team endowment, which was established in 2005, has grown into a healthy source of annual funding for the program. Former Army gymnast Major General (Retired) Neal Creighton '53 has helped lead the program's fundraising efforts to ensure its viability and has remained in regular contact with Van Everen for the last 10 years as a regular presence at gymnastic competitions. "In the years after I graduated from the Academy, many colleges and universities dropped their gymnastic teams because of costs," says Creighton. "I think that building an endowment to cover rising expenses is one of the best ways to insure that West Point will continue to be one of the NCAA premier gymnastics programs." And though Van Everen says the endowment still has a "long way to go," he recognizes the many ways it has already impacted the gymnastics program, including new equipment, a new sound system, and most recently a new coaching position, which Van Everen believes will enhance the training offered to cadets.

The West Point Open is also financially important to the gymnastics program as it provides a regular source of revenue and publicity for the program each year. Moreover, the event has served as a platform for the program to demonstrate its expertise in executing successful competitions; this has helped West Point secure the bid to host the NCAA Championships, a feat for a program competing against top-tier schools known for bringing in exceptionally large crowds and media. But rather than emphasizing ticket revenue in his proposal to host these championships, Van Everen emphasized the program's experience in hosting high-caliber, high-turnout events. "I knew we could put on an event better than anyone else," says Van Everen, who



Medalists stand on the winners' podium at the 2014 West Point Open.

relied on the time and talent of his network of excellence to help deliver the NCAA competition, "and we did such an incredible job that we won the bid in 2005 and again in 2010." And in 2017, they'll do it all again. Hopefully, Army gymnasts of all generations can witness the impact of the Warrior Team and the entire network of excellence, as Van Everen and his team of dedicated graduates are planning a gymnastics reunion in conjunction with the NCAA competition, which takes place April 20-22, 2017. "I'm excited about this," says Van Everen. "I hope I can get a couple hundred gymnasts back here."

Reflecting on the time spent finding and assembling this network of graduates to help him develop the West Point Open, host championship competitions, and establish an endowment, Van Everen acknowledges that mistakes were made and that not everything was done perfectly. Yet, he also realizes that by having these graduates by his side year after year, they've learned and grown from their mistakes together and this has ultimately developed a stronger program. "I think there were some who thought that we were too small of a group to make a difference," Van Everen says, referring to the beginning stages of his graduate network, "but we just never stopped...we kept reaching out to people and organizing them." Van Everen acknowledges that the process was time consuming, but also very rewarding. "The most rewarding part was meeting all these former Army gymnasts and realizing they are all the same—Neal has the same thoughts on

Army Gymnastics as the guys from the 70s, and those guys have the same thoughts as recent grads.”

As for the future of Army Gymnastics, Fulton and Ferrando agree that the base of graduates that Van Everen has put together will continue to grow and strengthen the program in the future. “We have seen greater interest and participation from more recent grads,” says Ferrando. “For example, Joe Baumann ’07 makes a point of coming back every year as part of the Warrior Team.” Even recent grads return, which makes Ferrando and other senior members of the Warrior Team feel good about turning over what they’ve accomplished to a new generation when the time comes.

So, do these experienced, well-trained Warrior Team members have any advice for younger grads? “I would tell young grads to make sure they stay in contact with the team and coaches,” says Fulton. “They are forever part of the Army Gymnastics family and their continued presence and support is recognized and appreciated.” Ferrando seconds this saying, “Keep in mind what the program did for you and return the favor at some point in your lives.”

Former Army gymnast Brandon Long ’12 is already returning the favor. Long, who is currently working at West Point due to a medical injury, regularly volunteers at gymnastics competitions and has worked at the West Point Open both years since graduation. “When I was a cadet,” says Long, “I remember seeing all the older grads coming back and helping out, and I wanted to be

part of that as a graduate.” Although he is still a cadet, Glenn is already thinking about how he will stay connected to the gymnastics program in years to come. “I want to join the ranks of old grads who come back to help with competitions, donate, and travel with the team to provide their support,” he says. “Because the coaches and the team are such a large part of my life and have given me so much, I want to come back as much as possible and support the team and coaches in as many ways as I can.”

It’s clear that no matter where former gymnasts have gone after graduation and no matter where their careers have taken them, their allegiance to and love for Army Gymnastics remains as strong as ever. The West Point Open offers a particularly unique venue where students as young as seven can aspire to cadets’ athletic expertise, where cadets can witness the camaraderie and commitment of their predecessors, and where graduates can serve as role models for cadets and give back to the program that gave so much to them. “We’re learning the ropes now,” says Long, referring to his fellow, younger graduates, “So that whenever [the older graduates] hand over the reins, we can take this on. We are prepared to keep the West Point Open going strong; as long as there is the Open, we’ll be there.” It’s safe to say that Van Everen’s original goal for the West Point Open—to make sure every athlete, parent, and coach, felt like they were part of something special—has been achieved. ★

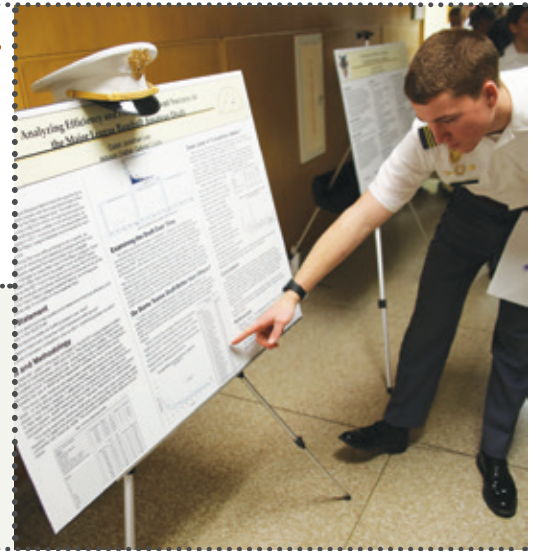
Be Thou at Peace

Deaths reported from Mar 1–May 31, 2014.

COL Charles L. Register, USA, (R)	1937	MG Herbert A. Schulke Jr., USA, (R)	1946	LTC Leo H. Lennon, USA, (R)	1952	LTC Roger Q. Gaines, USA, (R)	1959
Col Nathan L. Krisberg, USAF, (R)	1940	LTG Charles J. Simmons, USA, (R)	1946	LTC Frank E. Robinson, USA, (R)	1952	LTC Frank J. Bochnowski, USA, (R)	1960
COL Robert E. Clark, USA, (R)	1941	LTC William L. Stone III, USA, (R)	1946	Col Kenneth A. Simonet, USAF, (R)	1952	Mr. Joseph D. O’Keefe	1960
COL Richard T. Batson, USA, (R)	1943JAN	BG Philip T. Boerger, USA, (R)	1947	COL Robert F. Daly, USA, (R)	1953	LTC Richard K. Queeney, USA, (R)	1960
Lt Col James R. Dempsey, USAF, (R)	1943JAN	Mr. George Levenback	1947	COL Frederick P. Reynolds III, USA, (R)	1953	Mr. Russell M. Cornelius	1961
Brig Gen Ralph J. Hallenbeck, USAF, (R)	1943JUN	LTC John G. Paules, USA, (R)	1947	COL Frederick J. Siebert, USA, (R)	1953	MAJ John R. McCormick, USA, (R)	1961
COL Roger Hilsman Jr. PhD, USAR, (R)	1943JUN	Lt Col Richard P. Berry, USAF, (R)	1948	COL Jack D. Wilson, USA, (R)	1953	Mr. Erik G. Johnsson Jr.	1962
LTC Charles M. Jones Jr., USA, (R)	1943JUN	COL Boyde W. Allen Jr., USA, (R)	1949	COL Wade Hampton, USA, (R)	1954	COL Ronny J. Sayers MD, USA, (R)	1962
Mr. Darwin J. Mendoza	1943JUN	Col Roy C. Brunhart, USAF, (R)	1949	Col Charles R. Linton, USAF, (R)	1954	Mr. John T. Anderson	1965
LTC Richard C. Orphan, USA, (R)	1943JUN	Mr. Howard H. Callaway	1949	LTC George T. Neu, USA, (R)	1954	Dr. E. G. Forrest III	1965
Lt Col William G. Watson Sr., USAF, (R)	1943JUN	COL Robert L. Erbe, USA, (R)	1949	Col Gerald H. Parshall, USAF, (R)	1954	Mr. Stephen C. Ganshert	1965
Maj Robert B. Callan, USAFR, (R)	1944	BG Alfred B. Hale, USA, (R)	1949	LTC Edward E. Roderick, USA, (R)	1954	LTC Rance H. Rountree, USA, (R)	1965
Lt Col Joseph R. Waterman, USAF, (R)	1944	COL Meredith E. Hendricks, USA, (R)	1949	Col Lem D. Sugg Jr., USAF, (R)	1954	Mr. William R. Canning	1966
LTC Kincheon H. Bailey Jr., USA, (R)	1945	COL Russell J. Lamp, USA, (R)	1949	Mr. Thomas F. Van Natta Jr.	1954	COL Richard A. Grube, USA, (R)	1967
Mr. Robert N. Boehm	1945	COL J. H. Metzger, USA, (R)	1949	Mr. Edward W. Nidever	1955	Mr. Gerald J. Molnar	1967
Lt Col John A. Callahan, USAF, (R)	1945	COL William H. Nordin, USA, (R)	1949	Lt Col Robert M. Blocher, USAF, (R)	1956	LTC Arthur P. Ireland Jr., USA, (R)	1969
Mr. Woodbury Carter	1945	Mr. James H. Scholtz	1949	Mr. Robert G. Farris	1956	Mr. Larry K. Henderson	1970
LTC James H. Dallman, USA, (R)	1945	Mr. Dean M. Teece	1949	Mr. Robert E. Grassberger	1956	Mr. Clarence L. D. Miller	1972
CPT Frederick R. Einsidler, USA, (R)	1945	Col Edward Batchelor, USAF, (R)	1950	LTG Robert D. Hammond, USA, (R)	1956	Mr. Gerald J. Hayes Jr.	1975
COL Joseph H. Hoffman Jr., USA, (R)	1945	Dr. Frederick D. Hoham III	1950	COL Thomas P. Kehoe, USA, (R)	1957	Mr. Frank A. Mrak III	1975
BG Nikitas C. Manitsas, USA, (R)	1945	COL Martin J. Small, USA, (R)	1950	Mr. John W. Purdy	1957	Mr. Allen H. Stults	1979
Mr. Clair G. Whitney	1945	Mr. John H. Smith	1950	Col Benjamin E. Waller III, USAF, (R)	1957	Mr. David R. Brown	1981
RADM Delbert S. Barth, USPHS, (R)	1946	COL Nelson L. Thompson, USA, (R)	1950	MAJ Lorin B. Farr Jr., USA, (R)	1958	Mr. Christopher J. G. Cachero	1981
Mr. Jack T. Cairns	1946	COL Robert R. Werner, USA, (R)	1950	Mr. Roger C. Gietzen	1958	Mr. Michael Bertha	1986
LTC Jesse A. Fields Jr., USA, (R)	1946	LTC George L. Harman, USA, (R)	1951	LTC Robert H. Miller, USA, (R)	1958	Mr. David B. Mesick	1986
Mr. Thomas E. Gaines	1946	COL Robert A. Prehn, USA, (R)	1951	LTC Millard L. Pedersen, USA, (R)	1958	CPT James E. Chaffin III, USA	2009
COL J. Edward Houseworth III, USA, (R)	1946	Mr. William H. Dana	1952	LTC John W. Peters, USA, (R)	1958	1LT Bao Huy D. Vo, USA	2012
Mr. Daniel L. Levy Jr.	1946	COL Wayne H. Elliott, USA, (R)	1952	LTC Donald R. Williams, USA, (R)	1958		
LTC Clarence M. Mendenhall III, USA, (R)	1946	COL John V. Foley Jr., USA, (R)	1952	Mr. Joseph H. Coreth	1959		

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392 *total projects
presented*



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UNIVERSITY OF ARKANSAS | UNIVERSITY OF VIRGINIA

SIX



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Scott R. Clark '85 Innovation Award

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11-12 Grad Marchback 	6 <i>BEAT BUFFALO!</i> 2014 Football Season Home Opener	2-5 Homecoming Welcome Back to the Classes of 2009, 2004, 1999, 1994!
16 Acceptance Day	FALL REUNIONS SEP 4-7 Class of 1979 OCT 2-5 Homecoming (Classes of 2009, 2004, 1999, 1994) OCT 8-12 Class of 1969, Class of 1974 OCT 23-26 Class of 1959 OCT 30-NOV 2 Classes of 1984, 1989	

Upcoming events suggested by West Point staff & faculty.

Events for Nov 2014—Jan 2015 should be sent to editor@wpaog.org by Aug 15, 2014.

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FROM: John T. Carley '45

I have just finished reading the 2014 spring edition of *West Point* magazine. The avalanche of acronyms is overwhelming. They make some of your articles unreadable.

RESPONSE:

We understand your concern and, believe us, it is a concern with which we struggle in every issue. But you know how it is at the Academy and in the Army—so much to do in so little time. To counter this, these institutions use acronym after acronym to cover as much ground as possible quickly and efficiently. The same is true for many of West Point magazine's Academy-focused articles. However, if you don't dine on acronym soup regularly, it can be very difficult to digest. You may have noticed that for acronym-heavy articles, we offer an acronym guide at the end, but in the future we'll try to cut back on the acronyms to make our articles more readable.

FROM: Lorrin C. Peterson '45

The details described in the peer-to-peer coaching article from the recent issue of *West Point* magazine are a refreshing change from my days at the Academy. Then, the whole system seemed to be directed at impeding learning and encouraging dismissal. One Superintendent called it—correctly, I feel—an exclusionary instead of inclusionary process.

RESPONSE:

Sometimes “the Corps has...” can be a positive change. Thank you for reminding graduates of this fact.

FROM: Dr. Jay. W. Gould III '54

The 2014 spring issue of West Point magazine was about coaching, particularly how it is the responsibility of every cadet, graduate, and person assigned to or concerned about USMA worldwide to support the development of the Corps. Here's a letter showing how this was done more than 60 years ago. The 1951 Army Football Team lost most of its players to Honor Code violations. Several honor-abiding cadets filled lost positions, but they were sub-caliber players. Many losses ensued. Then, in 1953, some cadets formed a Cheerleading Squad bent on reestablishing the trust lost between the Corps and the Team, believing that if the players understood that the Corps was behind them, they would play with super-human efforts. A victory cannon was built and first fired before the intercollegiate Game of the Year against heavily favored Duke. The Corps responded to the blast roaring “Go! Go! Go!” and trumpets sounded “Charge” so loudly it deafened the radio broadcasters. Standing the entire game, the cadets never stopped chanting, and Army defeated Duke 14-13, claiming the Lambert Trophy as the best Northeast team in Division I-A college football. That same victory cannon still fires at all Army Football games.

RESPONSE:

What an inspiring story, Dr. Gould. Hopefully all Army fans will remember it come Saturday, December 13, 2014!



IT'S TAILGATE TIME

Go to WestPointAOG.org to register for tailgates held at West Point or hosted by a Society near you.

Past in Review

George Washington Goethals: Engineer of the Panama Canal

By **Sherman L. Fleek**, Guest Writer

This August will mark the 100th anniversary of the opening of the Panama Canal, perhaps the most legendary engineering feat involving West Point and its graduates. This monumental project was led by George Washington Goethals, Class of 1880.

Goethals, number two in his class, graduated without a demerit and went on to an outstanding and productive career for nearly thirty years up to his appointment in 1907 as the head of the Panama Canal project. Arriving at the Academy in 1876, his real name was George Williams Goethals, and much like Hiram Ulysses Grant in 1839, who adopted the name "Ulysses S." after his nominating congressman mistakenly submitted it as such to West Point, young Goethals decided to accept the accidental change of Williams to Washington when the Honorable S.S.

Cox changed Goethals' middle name on his nomination. Commissioned an engineer officer, Goethals excelled in his duties, including his first independent project in 1882-83—building a bridge over the Spokane River in Washington State. He later said this bridge was "the hardest job I ever tackled," having never built a bridge before and learning as he went.

President Theodore Roosevelt appointed then-Major Goethals to manage and supervise the Panama Canal project. The French government, through a sponsored public company, first worked on the project in 1881. From the beginning the French suffered setbacks. Floods and mudslides hampered the project constantly. But perhaps their worst enemy was disease: yellow fever and malaria caused the death of some 22,000 French workers by 1889. The French company collapsed in ruin and financial scandal by 1890. After stifled progress under the French, the project was becoming an embarrassing international failure. When the United States helped Panama gain its

independence in November 1903 and then assumed control of the Canal Zone, that embarrassment was transferred to America. Two Americans, both railroad men, improved the railroad system and some of the infrastructure to support such a mammoth undertaking, but still the project languished, and both of these men, troubled and frustrated, resigned as governors of the Isthmian Canal Commission. Roosevelt then reorganized the Commission, abolishing



the position of governor, and designated Goethals as chairman and chief engineer of the Canal Commission and president of the Panama Railroad Company in 1907. When Goethals arrived, much had been completed on the canal but the task was still daunting, the terrain of the canal and the railroad system alone were major obstacles. During his seven years in Panama, Goethals

was on detached duty from the Army, wore civilian clothes, and received a civilian salary; even though he was promoted steadily through the rank of colonel during those years.

For years graduates of the United States Military Academy had an active role in planning a canal to connect the oceans. For example, Henry L. Abbot, Class of 1854, had served as a consultant to the French and advocated for the lock canal system that Goethals ended up building rather than a sea-level canal. When Goethals received the canal assignment, he appointed three members of the Long Gray Line to key posts: Harry F. Hodges, Class of 1881, became Goethals assistant chief engineer and supervised the construction of the canal's three sets of locks; William Sibert, Class of 1884, was put in charge of building the Atlantic Division of the canal; and David Gaillard, Class of 1884, led all dredging and excavation operations, including the Culebra Cut, a third-of-a-mile-wide channel through the mountains of Panama's continental divide that was started by the French. The

Panama Canal was a gargantuan task for Goethals and his team. Though the cause and eradication of yellow fever and malaria had been scientifically discovered by U.S. Army Major Walter Reed by this time, the work to prevent the diseases remained. None of the locks were finished, the Culebra Cut was only about 20 percent complete, and all the other technical challenges loomed large.

One of Goethals' first battles is what he called the "Human Element," securing the best people and keeping them happy and healthy. On Sundays he held "Sunday Court" where he personally heard grievances and complaints. He improved living conditions, sanitation, food and water, and through the outstanding services of U.S. Army physician Dr. William Gorgas, the diseases were mastered. Goethals at times had some 44,000 people involved in the project. He hired some of the best engineers possible, military and civilian, and allowed them autonomy on the technical issues, while he supervised the governance problems. The "Yellow Peril," as his famously yellow-painted automobile was known, raced about on inspections and visits. Thanks to Goethals' determination and professional standards, work began to accelerate and eventually the entire project was completed two years ahead of schedule. The first official transit was on August 15, 1914. The cost to the United States: \$375,000,000.

Goethals was promoted to major general, and later he was recalled from military retirement during World War I. He was responsible for combining feuding Army supply and logistical bureaus into a better managed and less bureaucratic Services of Supplies; again, a gargantuan task. Perhaps Goethals' greatest legacy is what his Soldiers thought of him as an officer, engineer, and leader. Said one of them, an old veteran engineer worker, "He's the squarest boss I ever worked for and I've worked for them all."

Sherman L. Fleek is the United States Military Academy's Command Historian. Retired from active duty as a lieutenant colonel in 2002, Fleek served twenty-five years in the Army as an enlisted tanker, aviator, and finally chief historian of the National Guard Bureau. Prior to serving in his present position, he also served as command historian of Walter Reed Army Medical Center, 2007-09, and published five historical books.



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