



U.S. ARMY CORPS OF ENGINEERS INSTALLATIONS, ENERGY AND ENVIRONMENT TECHNOLOGY INNOVATION STRATEGY



U.S. ARMY



US Army Corps
of Engineers

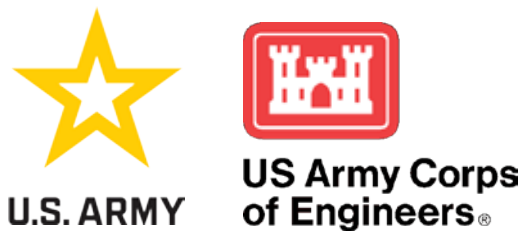
May 2025

ACKNOWLEDGEMENTS

The U.S. Army Corps of Engineers (USACE) expresses immense gratitude to the significant contributions made to inform this strategy by workshop participants and contributing authors* of:

- AFC
- AMC
- Army DEVCOM C5ISR Center
- ASA (ALT)
- ASA (IE&E)
- HQDA DCS G9
- IMCOM G4
- OASA IE&E
- OASA IE&E (SI)
- ODASA (E&S)
- ODASA (ESOH)
- ODASA (IH&P)
- ODASA (R&T)
- PEO CS&CSS
- PNNL
- USACE ERDC
- USACE HQ
- USACE OCE
- USA HNC
- USMA

The considerable knowledge and experience of this group on the missions, current and future challenges, and expression of actions needed to achieve desired outcomes greatly enabled the outstanding content embodied in this strategy.



Developed in partnership with
The Water Institute



www.usace.army.mil/



Front Page: Soldiers from the Old Guard test the second iteration of the Integrated Visual Augmentation System (IVAS) capability set during an exercise at Fort Belvoir, VA | Photo by Courtney Bacon

*Abbreviation expansions found on page 43.

This document is a revision to the originally published January 2024 version.



An M2 Bradley fighting vehicle and a group of M1 Abrams tanks secure an area during a Robotic Complex Breach Concept demonstration at Grafenwoehr Training Area, Germany, April 6, 2018. The Robotic Complex Breach Concept employs the use of Robotic and Autonomous Systems (RAS) for intelligence, suppression, obscuration, and reduction missions | Photo by Spc. Hubert D. Delany III, 22nd Mobile Public Affairs Detachment, U.S. Army

TOP 7 INSTALLATIONS, ENERGY & ENVIRONMENT (IE&E) CHALLENGES

As part of the effort to develop this Technology Innovation Strategy, partners were engaged to identify the greatest challenges currently facing the Army in the IE&E sector. These challenges, as follows, are addressed in this strategy:



READINESS: Scaling up Artificial Intelligence/Machine Learning (AI/ML) data analytics capacity to strengthen readiness.



ENERGY: Deliver safe and resilient solutions, including nuclear energy, that provide reliable electricity on demand at installations and in the field.



HAZARDS: Delivering technology innovations to address hazards such as flooding, drought, saltwater intrusion, extreme temperatures, wildfires, and other impacts of individually occurring and compound stressor events on installations and Army readiness.



ENERGY EFFICIENT BUILDINGS: Developing solutions for sustainable building materials, base camps, and improved energy efficiency.



QUALITY OF LIFE: Designing facilities to proactively prevent issues such as hazardous biological growth from occurring to ensure improved health and morale.



RELIABLE SUPPLY CHAINS: Ensuring reliable energy and potable water supplies in all conditions.



BRAC TRANSITIONS: Delivering technological solutions to support the transition of Base Realignment and Closure (BRAC) properties.

FOREWORD FROM DR. EDMOND J. RUSSO JR., S.E.S.

U.S. ARMY ENGINEER RESEARCH AND DEVELOPMENT CENTER

As Gen. Dan Caine, Chairman of the Joint Chiefs of Staff, wrote in his initial message to the Joint Force, “Our approaches to building and fighting the force must keep pace with changes to both the strategic environment and technology. Each of us, as a caretaker of the profession of arms, must be ready to adapt and strengthen the institution to meet the challenges before us.”

Indeed, the dynamically changing global state of affairs and trends in the rapid and often disruptive evolution of technology creates challenges for installations as the Army works to remain ready to ensure national security and stability. The increased frequency and extremity of natural hazards in the homeland and abroad are ever-present concerns for confident IE&E mission management. In advancing USACE support to the IE&E mission set, it is strategically necessary to adapt natural and built infrastructure networks at installations in ways that reduce the destructive and consequential impacts of such extreme, and potentially compound, stressors. These challenges inspire a need for more robust preparation in addressing future risks and uncertainties, with a view toward increased mission readiness for operational success. This requires improvements in customer, stakeholder and end-user engagements; industry partnerships; cross-R&D organization coordination; internal and external communications; staffing and acquisition management; and future facilities planning — all of which are necessary for generating the requisite extreme event response capabilities for long-term IE&E resilience and reliability.

The Army’s challenges and priorities for IE&E are additionally being experienced by other military branches and are most optimally addressed with interdisciplinary, multi-organization partnering solutions. The identification and application of broad competencies, with a strategic focus on both natural and built operational settings, will inform a suite of impacts for proactive management of installations as vital weapon systems to enhance warrior readiness and deliver maximum deterrence across the Joint Forces. The U.S. Army Engineer Research and Development Center (ERDC) aspires to deliver strategic R&D support in solving these challenges through an incremental to leap-ahead technology innovation spectrum (Office of the Under Secretary of Defense, 2022a). Leveraging the requisite R&D capabilities via a network of partners and in collaboration with industry will result in increased Army and Joint Force readiness for superior power projection against adversaries of the U.S. and its allies across the combat, combat service, and combat service support functions. We look toward this strategy to, in time, inspire “spirals of outreach and inclusion” for the broader Tri-Services community and collectively energize irreversible Joint Force momentum arising from a whole-of-community experience in its intent.





A U.S. Marine Corps High Mobility Multipurpose Wheeled Vehicles with a mounted beam director and radar, assigned to Naval Surface Warfare Center Dahlgren and Crane Division, participate in a high energy laser expeditionary exercise as part of Weapons and Tactics Instructor course 2-24, at Tactical Airfield, near Wellton, Arizona, April 4, 2024. WTI is an advanced graduate-level course that provides advanced tactical training to enhance and employ advanced aviation weapons and tactics. (U.S. Marine Corps photo by Cpl. Alejandro Fernandez)

Identification of future products as well as retrospective and forward-looking gap analyses have aided ERDC in shaping a coherent vision across its Installations and Operational Environments Research and Development Area. As a living document, this strategy will be evolved and updated to promote Tri-Services inclusivity through collaboration and knowledge sharing. Future iterations of the strategy will aspire to embrace proponents of the Program Objective Memorandum (POM) process for Operation and Maintenance, Planning and Design, and Military Construction. Accordingly, this strategy will present opportunities for investment in, and the delivery of, new, enabling technologies for IE&E mission advancement, such as real-time data analytics, reliable supply chains, advanced modernization tools, improved supply-chain resilience, and strengthened extreme stressor event management capabilities.

Some of these opportunities are presented in the strategy as “Innovation Vignettes,” which are intended to serve as examples of possible R&D to address many of the challenges outlined above. The Innovation Vignettes are not actions to be presently implemented, but rather meant to spark ideas for discussion as USACE draws upon collective expertise to develop implementation actions for technology innovation.

The intended end state is to support enhanced warrior readiness, improved lethality and maximum deterrence via these product transitions, which will arise across a rich spectrum of current and future required R&D capabilities. In this process, next steps include the development of an implementation plan with performance objectives and metrics to benchmark progress. The implementation plan will be informed by this strategy as a Call-to-Action across the ERDC “6Ps” (Portfolio, Products, People, Premier Facilities, Promote Communication, and Partnerships).

We thank you for your continued and future expanded engagement in these strategic and implementation initiatives.

A handwritten signature in black ink that reads "Edmond J. Russo, Jr." The signature is written in a cursive, flowing style.

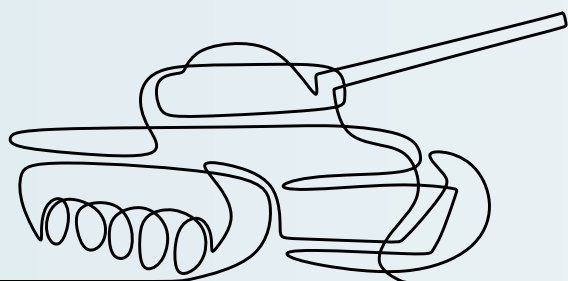
Dr. Edmond Russo
Director of the Environmental Laboratory
U.S. Army Engineer Research and Development Center



Field testing of drones at Project Convergence 2022 | Photo by Sgt. Woodylyne Escarne, U.S. Army

TABLE OF CONTENTS

8	CHAPTER 1 STRATEGY VISION, PURPOSE, AND INTENT
12	CHAPTER 2 PRIORITY INNOVATION FOCUS AREAS
14	FOCUS AREA 1: SUPPORT ARMY MODERNIZATION AND STRENGTHEN READINESS
18	FOCUS AREA 2: DELIVER MODERN AND RESILIENT FACILITIES AND SERVICES
24	FOCUS AREA 3: PROTECT SOLDIERS, COMMUNITIES, AND OPERATIONAL SETTINGS
30	FOCUS AREA 4: ENSURE RESILIENT AND RELIABLE RESOURCES
34	CHAPTER 3 STRATEGIES FOR DELIVERING R&D SOLUTIONS FOR TECHNOLOGY INNOVATION
40	CHAPTER 4 THE PATH FORWARD: STRATEGY IMPLEMENTATION
42	REFERENCES
43	ABBREVIATIONS



STRATEGY VISION, PURPOSE, AND INTENT



Military intelligence Soldiers with the 25th Infantry Division train on the One World Terrain (OWT) drone and mapping system at Schofield Barracks, Hawaii. The OWT's Tactical Handheld Automated Navigational Mapping and Observation System (THANOS) provides 3D terrain mapping with accuracy down to a two centimeter differential, allowing operators to virtually "move" through the battlespace using only a mouse and keyboard | Photo by Staff Sgt. Thomas Calvert, U.S. Army

STRATEGY VISION, PURPOSE, AND INTENT

Since its establishment, USACE has continuously delivered innovative solutions to meet the Army's toughest engineering challenges, both at home and abroad. This includes comprehensive support by USACE to the Army's missions related to IE&E. In a world dominated by near-peer threats and facing more frequent and extreme crises, conflicts and natural disasters, USACE and its partners must lead the development and delivery of technologies to ensure Army modernization, Warfighter readiness and installation resilience today and into the future.



A cybersecurity specialist working on securing computer systems. Photo by Master Sgt. David Eichaker, National Guard Bureau

VISION

The USACE IE&E vision is to help transform Army installations into a secure, integrated network of highly effective and efficient platforms that deliver Warrior readiness and enhanced lethality for conflict deterrence and a decisive winning advantage. As such, ERDC, in support of and in concert with the Army installations community—the Secretariat, Army Staff, Land Holding Commands and USACE—has developed this IE&E Technology Innovation Strategy to support the Army in meeting its Force Management objectives, including:



ENHANCED
WARRIOR
READINESS
AND MAXIMUM
DETERRENCE

ADVANCING
DATA DRIVEN
DECISIONS FOR
EFFICIENCY AND
EFFECTIVENESS

MAINTAINING
INSTALLATION
RESILIENCE IN
THE FACE OF
ACCELERATING AND
COMPLEX THREATS



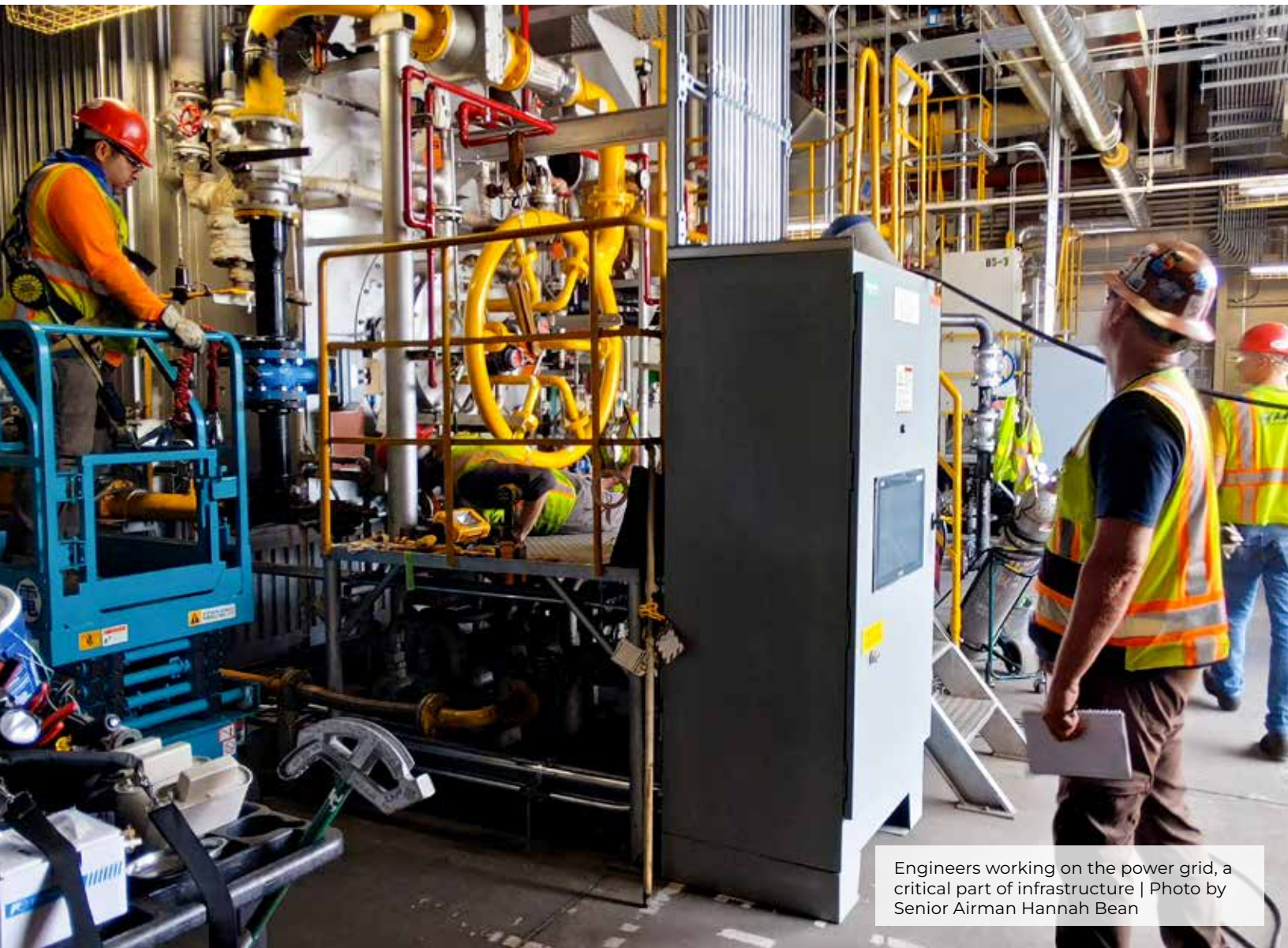
An attendee of a Department of Defense organized Arctic science and technology summit hosted by ERDC's Cold Regions Research and Engineering Laboratory (CRREL) tries out a simulation-based vehicle control training simulator designed by CRREL's mobility team | Photo by David Marquis

PURPOSE

The purpose of this strategy is to support the Army in achieving capacity overmatch and battlefield dominance by focusing on innovation and advancement of critical capabilities, infrastructure modernization, and the application of next generation design concepts and solutions to strategic support area needs and requirements. The overarching goal of this strategy is to advance the priorities of the Army and the nation it defends, and align strategic drivers with programming and budgeting decisions to support delivery of the Army of 2030 and design of the Army of 2040.

INTENT

The intent of this strategy is to ensure that cyber, physical, operational, energy, and water security measures leverage R&D innovation and resources to meet current and projected Army transformation requirements, and that installations and field operations can support and integrate the technologies necessary for winning modern and future wars. The homeland is no longer a sanctuary, and the 2022 National Defense Strategy warns that the “scope and scale of threats to the homeland have fundamentally changed” (U.S. Department of Defense, 2022). As the potential for physical and cyber-attacks on military bases and their surrounding communities grows, these facilities must be protected against kinetic and non-kinetic attacks. In addition to hostile attacks, energy systems, critical infrastructure, and supply chains face disruptive threats from natural disasters (U.S. Department of Homeland Security, 2019). Employing the capabilities described in this strategy is anticipated to preserve overmatch and dominance in these and other critical areas to provide the resilience and endurance needed for success.



Engineers working on the power grid, a critical part of infrastructure | Photo by Senior Airman Hannah Bean

PRIORITY INNOVATION FOCUS AREAS

Joint Base Lewis-McChord soldiers test new augmented reality tech integrated with Stryker vehicles | Photo by Spc. Chandler Coats

PRIORITY INNOVATION FOCUS AREAS

To ensure the Army is prepared to face the toughest challenges related to IE&E, four focus areas were identified as priorities for technology innovation. Each focus area also includes subordinate objectives consistent with the vision and goals outlined in this strategy. These focus areas and their associated objectives are based on requirements identified in Army strategies such as the Army Modernization Strategy (U.S. Army, 2019), and the Army Installation Strategy (U.S. Army, 2020). Understanding these objectives will help USACE direct and prioritize support efforts for the Army of 2030 and 2040.

1

SUPPORT ARMY MODERNIZATION AND STRENGTHEN READINESS

- Operationalize Installations
- Expand Protection
- Support the Army Modernization Strategy (AMS)
- Advance Acquisition and Logistics



2

DELIVER MODERN AND RESILIENT FACILITIES AND SERVICES

- Plan, Adapt, and Build Quality, Functional Facilities
- Deliver Modern Services
- Adopt Resilient Systems
- Modernize and Innovate Installations
- Develop Trusted AI/ML in Installations-Related Data Systems
- Transform Installation Operations



3

PROTECT SOLDIERS, COMMUNITIES, AND OPERATIONAL SETTINGS

- Conduct Safe Operations
- Sustain Mission Resources
- Remediate Contaminants
- Develop Risk-Informed Metrics
- Implement Smart and Forward-Looking Land Management
- Transform Operational Training Lands Management



4

ENSURE RESILIENT AND RELIABLE RESOURCES

- Develop Resilient Energy and Water Supply
- Improve Supply Chain Resilience for Army Energy Systems and Materials
- Develop Efficient, Directed Energy Storage and Release Systems
- Work with Industry to Improve Energy Efficiency



1

SUPPORT ARMY MODERNIZATION AND STRENGTHEN READINESS



Support Army transformation and strategic readiness to ensure the Army's ability to accomplish its mission to deploy, fight, and win our nation's wars.

As the Army focuses on fielding the next generation of combat vehicles, aerial platforms, and weapons systems, innovation that looks beyond current 2028 development targets will seek to upgrade these technologies with robotics, AI, and other advanced technologies as they become available.

Effective and rapid data acquisition and analysis are crucial to providing military advantage. As a result, the Army will increasingly rely on real-time data and integrated decision-driven, analytic capabilities. Modernization is a continuous process, and the Army must keep pace with meeting the requirements for training, sustaining, projecting, and maintaining its force.

To support the Army with modernizing and strengthening readiness, USACE will focus on addressing objectives outlined in the following pages.

INNOVATION VIGNETTE

STRENGTHEN READINESS & RESILIENCE

CONTEXT

Identify, assess, and address vulnerabilities in the installation through planning, exercising, and utilizing installation systems and operations infrastructure. Our current ability to assess our vulnerabilities is slow and manual.

CHALLENGE

Adversarial actions and evolving natural hazards, along with lack of maintenance, operational training, and synergies across systems, and other factors, may put installations at risk in ways we do not fully understand.

R&D ACTIONS

Develop exercises and tools to reveal the specifics of vulnerabilities and operationalize the installation.

RESULT

Create a mitigation strategy for future and ongoing threats and develop a system to operationalize the strategy.



A soldier wears virtual reality glasses and experiences virtual reality war games | Illustration by NIWC Pacific



Kwajalein Atoll, part of the Republic of the Marshall Islands, where researchers address needs for resilient infrastructure. | Photo by DigitalGlobe, Inc., Creative Commons Attribution 4.0 International Public License

OPERATIONALIZE INSTALLATIONS



Turning data into actions for installations requires developing technologies that support the secure collection and use of data generated on Army installations to inform decisions and optimize performance, thereby turning data into actionable knowledge. Collection, management, analysis, visualization, and other advanced methods for interrogating data will enable decisions at all levels of installation management. Many aspects of modern Army installations can be supported by the collection and use of data and the speed at which modern data analytics assists with decision making. Just as the private sector has increasingly leveraged data as a commodity, the Army is turning to data, data management, and data analytics as outlined in the Army Data Plan (U.S. Army, 2022b) for a competitive advantage and to mitigate risk.



Soldiers update maintenance record data after performing an engine wash on a CH-47 Chinook helicopter | Photo by Sgt. 1st Class Shane Hamann, U.S. Army National Guard

EXPAND PROTECTION

Our military's global presence increases vulnerability to cyber and physical attacks, as well as potential attacks by transnational criminal organizations, and elevates the need for innovative solutions to address threats quickly. Stronger and more frequent natural disasters are increasing threats to Soldiers and military infrastructure. The Army requires technology and innovations that can prevent, detect, mitigate, and remediate threats to mission execution that can result from a wide range of factors, from natural-disaster-related vulnerabilities to deliberate disruptions.



U.S. Army Sgt. James Stranchina, assigned to 2nd Cavalry Regiment, uses virtual reality to simulate operation on the Dronebuster Block 3B handheld electronic jammer at Rose Barracks, U.S. Army Garrison Bavaria, Vilseck, Germany, Feb. 12, 2025. The counter-unmanned aerial systems course trains Soldiers in enemy small drone threat detection and defense. (U.S. Army photo by Pfc. Brent Lee)

INNOVATION VIGNETTE

EXPAND PROTECTION

CONTEXT

Installations and their surrounding communities in the continental U.S. (CONUS) and overseas have become increasingly vulnerable to cyber and physical attacks, criminal and social activity, and more frequent, extreme, and compounded natural hazards. They also rely on digitalized infrastructure, which elevates their vulnerability to cyber warfare.

CHALLENGE

Installations exist in all operational settings (e.g., tropical, arid, temperate, continental, and polar regions) and must have functioning infrastructure at all times. However, foreign and domestic adversaries, aging facilities, deferred maintenance, and increasingly dangerous natural hazards put our installations at risk in ways not yet fully understood, and our current ability to assess vulnerabilities is slow and manual.

R&D ACTIONS

- Create enterprise-wide installation systems and infrastructure to find, assess, and address vulnerabilities quickly, then develop innovative integrated solutions to those liabilities.
- Identify modernization requirements and priorities for installations.

RESULT

All Army installations are equipped to protect their residents and infrastructure, train future forces, project power, maintain resilient energy and water systems, and mitigate the impacts of more frequent and extreme natural hazards.

SUPPORT THE ARMY MODERNIZATION STRATEGY (AMS)



Competition and conflict can occur as multiple threats and span all domains (land, air, sea, cyber, and space). To address these threats in current and future operating environments, the Army is focusing on advancements in the following six Army modernization priorities (U.S. Army, 2019):



long-range
precision fires



future vertical lift



soldier lethality



next generation
combat vehicles



network



air and missile
defense

Each of these priorities inherently relies on the advancement of underlying technology and deployment capacity to advance their goals. Current and future force advancements in weapon systems, for example, will require advancements in support (e.g., with robotics, facility layout/design) and coordination of infrastructure resources. Congruently, installations are also challenged by recent, ongoing, and future force structure changes associated with the AMS. For the Army to operate across multiple domains in contested space, installations and facilities must transform at pace with ongoing modernization efforts. USACE will therefore focus on developing advancements to address these challenges to support distributed forces and all domain operations.

ADVANCE ACQUISITION AND LOGISTICS

Effective Warfighter operations depend on reliable and efficient access to necessary infrastructure and supplies. These needs include power and energy generation and transmission that are resilient or impervious to threats, alongside robust supply chains for material production and transport. Necessary advancements in this arena will include intelligent and standardized transmission and management of energy and water, as well as modernization of the supply chain to responsibly, reliably, and strategically source and transport materials. Also needed are adaptable and readily deployable base camp solutions, with underlying advancements in energy and water generation and storage, shelters and base equipment, and rapidly deployable Domain Awareness digital solutions.



The M142 High Mobility Artillery Rocket System, a mobile rocket system that provides lethal close and long-range missile fire support to the Arctic region, prepares for launch | Photo by Lance Cpl. Eric Dmochowski, U.S. Marines

2

DELIVER MODERN AND RESILIENT FACILITIES AND SERVICES



Modernize Army installations at home and abroad with facilities, infrastructure, and services to support the mission and the people who live and work there.

Transformation of installations is required to meet the capability needs of the Army of 2030 and 2040 to maintain the nation's competitive advantage. Threats to installations and surrounding communities continue to grow in complexity, from natural hazards to adversarial actions and increased risk of disruption or attack. To combat these threats and provide continued, reliable support, modern innovations must be developed and constructed or deployed to installations, services, and systems.

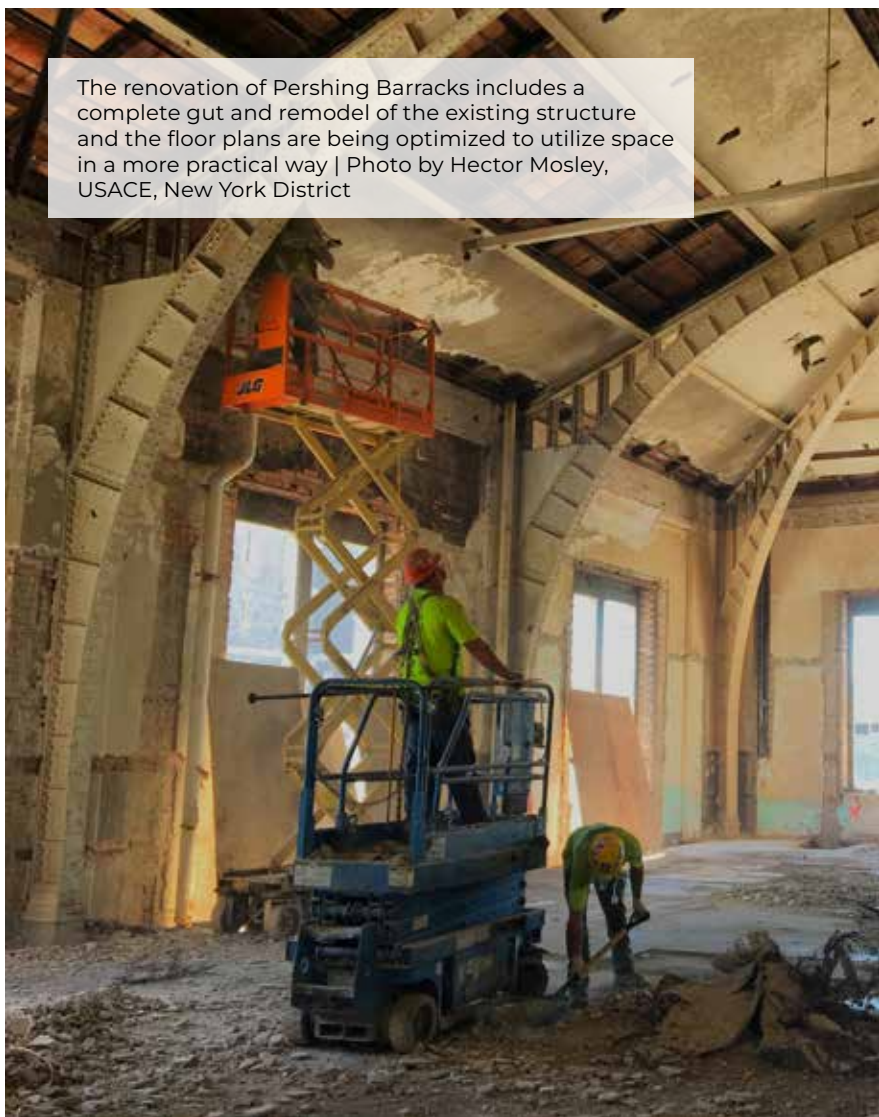
To support the Army in delivering modern and resilient installations, USACE will focus on addressing these objectives, outlined in the following pages.

PLAN, ADAPT, AND BUILD QUALITY, FUNCTIONAL FACILITIES



Over time and as installations age, the buildings and structures associated with them require updating, even as new and innovative technologies are developed for new construction. One focus will be on developing and deploying reliable building alternatives for existing and new facilities and remediating issues like hazardous biological growth where needed. Another priority is designing and/or renovating facilities to provide co-benefits (e.g., improved aesthetics that can also improve mental health), as well as standardizing control systems to ensure facilities are well-maintained and meet modern health and safety standards.

The renovation of Pershing Barracks includes a complete gut and remodel of the existing structure and the floor plans are being optimized to utilize space in a more practical way | Photo by Hector Mosley, USACE, New York District



TAKE CARE OF PEOPLE

CONTEXT

Hazardous biological growth (HBG), such as mold, bacteria, and viruses, in Army facilities can degrade conditions and quality of life, which impacts health and safety, as well as recruitment, readiness, and ability to deploy. This issue may require substantial resources and ultimately detract from the mission when other housing or workplaces must be found.

CHALLENGE

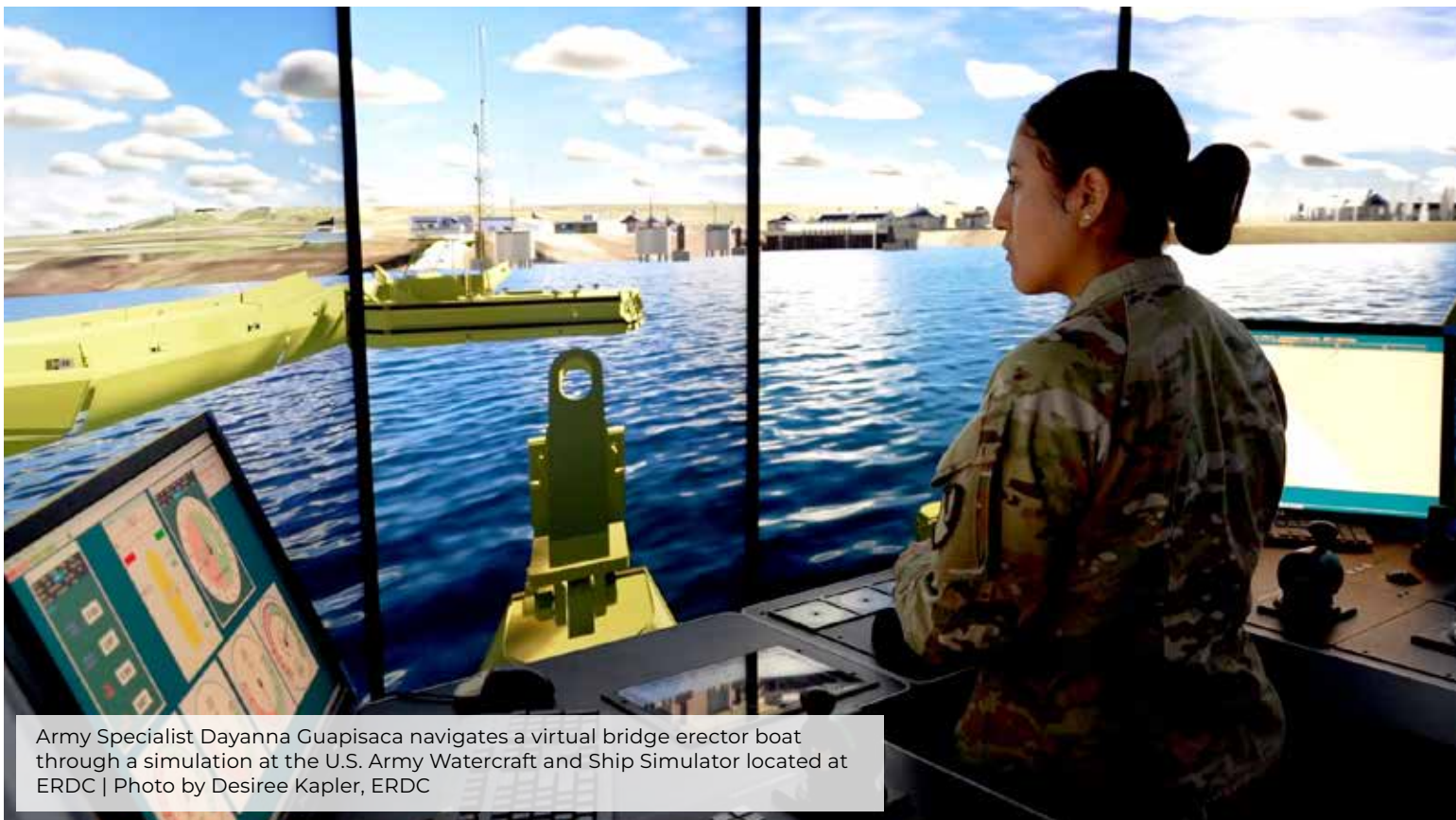
- a. Data are lacking on the prevalence of unwanted biological species, their associated etiology, and the environmental factors influencing both growth and virulence. This gap exacerbates uncertainty in how changing operational conditions may be influencing the spread and persistence of HBG.
- b. There are currently no acceptable limits for exposure to all types of HBG.
- c. Although technology exists to quantify HBG, additional innovations (e.g., remote sampling and real-time analyses) are needed to improve upon current technological capacity. Other potential contributors to HBG (e.g., building envelope issues) are overlooked.
- d. HBG in existing facilities is often hidden (e.g., behind walls or under floors) and can therefore be difficult to detect.

R&D ACTIONS

- a. Develop and implement technologies that can detect and identify when conditions are favorable for HBG and automatically report and control/correct the issue for actionable results. These technologies must also be reliable and maintainable with current and future conditions.
- b. Incorporate holistic design principles, modeling, and smart tools into design processes to detect humidity in facilities to prevent HBG.
- c. Develop mitigation and prevention technologies.
- d. Develop performance metrics for identifying a threshold for safe occupancy.
- e. Conduct studies on design implications of implementing reliably sourced materials, new policies, new systems, etc.

RESULT

Safe facilities, improved quality of life, reduced life cycle costs for operations, expanded lifespan of facilities, and increased production, morale, and retention.



Army Specialist Dayanna Guapisaca navigates a virtual bridge erector boat through a simulation at the U.S. Army Watercraft and Ship Simulator located at ERDC | Photo by Desiree Kapler, ERDC

DELIVER MODERN SERVICES



Providing modern services supports the Army's greatest strength and most valuable asset—its people. Adopting and providing the most capable and current infrastructure to support modern technology is critical to achieving the Army's priorities of delivering ready combat formations and strengthening the profession of armed services (Wormuth, George, and Weimer, 2023) through attracting and maintaining a competitive workforce. Long-term, "futures" planning is needed to continually update installations with technology support capacity for future Soldiers, their families, and civilians as expectations shift, allowing the Army to be good stewards of taxpayer dollars.



Soldiers program Spot, a robot dog that can perform autonomous missions | Photo by Steven Stover, 780th Military Intelligence Brigade (Cyber)

ADOPT RESILIENT SYSTEMS



The first step to addressing risks is understanding and mitigating vulnerabilities before the threat itself is actualized. Technological and system advancements will be undertaken that can identify vulnerabilities in systems efficiently and effectively through, for example, automated testing techniques. In addition, investments will be undertaken in upgrading facility inventory tools to generate resilience-improving projects. These investments may not only result in improved systems and tools, but also earn higher return on investment and increase overall resilience.

MODERNIZE AND INNOVATE INSTALLATIONS



Installations are vital tools for advancing the military mission and ensuring Warrior readiness, and as such are being conceptualized as weapons systems for the modern Warfighter. Just as modern weaponry is needed to advance the Army mission, installations require advancements including modernizing and updating information technology (IT) systems and requirements; providing training and governance for personnel; integrating sensors and automating data collection and analysis for interoperability; advancing and deploying modern systems such as next generation metadata, data lakes, cyber switches, and digital twins; enhancing data security; evaluating and, where needed, advancing criteria and standards; and conforming to the Army Data Plan (U.S. Army, 2022b).

INNOVATION VIGNETTE

MODERNIZE AND INNOVATE

CONTEXT

Installations will require modernization at a pace to support a future modernized Army to train, sustain, and enable force projection.

CHALLENGE

Future systems that will need to be implemented will not work with current, aging installations.

R&D ACTIONS

Leverage existing life cycle information on installation assets to identify interoperability capabilities and any associated data gaps to provide actionable planning recommendations.

RESULT

A minimum set of criteria/standardized design and tools to enable new adaptable and flexible design. Mechanisms (i.e., tools or processes) are developed and implemented to identify interoperability gaps.



MG Kimberly Colloton, USACE Deputy Commanding General, and researchers, Heather Lloyd and Madeline Shunk, from ERDC's Construction Engineering Research Lab (CERL) show efficient installations in CERL's Control Systems Technology Lab | Photo by Jared Eastman, U.S. Army ERDC Public Affairs



DEVELOP TRUSTED AI/ML IN INSTALLATIONS-RELATED DATA SYSTEMS

AI and ML are revolutionizing the 21st century, allowing data-driven solutions to be developed and used rapidly across numerous applications. This acceleration must occur in the Army through close relationships between technology developers and end users, with assurance of responsible AI usage and insightful analytics and metrics founded on quality data and data stewardship (U.S. Department of Defense, 2023). To support the Army, there will be a focus in bridging the gap between AI theory and practical military installation applications, as well as to develop AI technologies for installations that are becoming increasingly connected and reliant on data-driven decisions. The deployment of AI and ML systems in military contexts necessitates reliability, security, transparency, and accountability throughout their lifecycle. To address these challenges, it is crucial to focus on mitigating algorithmic biases, enabling explainable AI, bolstering security measures, safeguarding privacy, establishing accountability and governance structures, upholding ethical data practices, facilitating human-AI cooperation, ensuring compliance with regulations, and implementing continuous monitoring.

Thanks to advances in AI, human-agent teaming and machine learning, Soldiers will provide commanders with real-time information about the enemy gathered from a variety of different sources, including possible courses of action, which will help them to make better decisions in battle | Photo from Army Research Laboratory





CCAD leverages Digital Twin Scan Data from 8360 Scanbox to automate measurement | Photo by Ervey Martinez

TRANSFORM INSTALLATION OPERATIONS



AI/ML and other emergent technologies have high potential and value for improving the day-to-day operations of Army installations. Because of the number and diversity of installations within the Army force, however, plans must be developed for deploying and maintaining these technologies in an efficient and cost-effective way. To support that target, lifecycle costs to meet requirements through emerging methods and uses for AI/ML for predictive analytics (e.g., in facility maintenance) will be identified. As part of an enterprise-wide redevelopment of installation-specific IT and to provide visibility among installations, Installation Management Command (IMCOM) and ASA IE&E, the Army must also develop an installation Common Operating Picture (COP) system to provide installation commanders real-time visibility of all critical infrastructure. System requirements for the installation COP will be developed as part of the first step of realizing this vision.

3

PROTECT SOLDIERS, COMMUNITIES, AND OPERATIONAL SETTINGS



Ensure the safety, health, and well-being of Soldiers, their families, Army Civilians, and the surrounding communities, as well as the protection of operational settings.

Compounding natural hazards, aging infrastructure, outdated technologies, and adversarial actions will continue to pose threats in the years leading up to the Army of 2030, 2040, and beyond. The safety of Soldiers, civilians, families, and communities is paramount, and the Army is charged with providing clean and healthy environments for living and working. This assurance will come from innovations that minimize, mitigate, and restore negative impacts to the installation operational settings of our Warfighters. To support the Army in protecting Soldiers, communities, and operational settings, USACE will emphasize the following objectives outlined in the following pages.



Children of the U.S. Army Southern European Task Force, Africa (SETAF-AF) Soldiers, and civilians participate in preparation drills during the Lion Cub to Work Day | Photo by Sgt. Bobbi-Jo McGinley, U.S. Army

CONDUCT SAFE OPERATIONS



The foundation of safe installation operations is a shift to more functional and adaptive facilities. Without advancements toward that approach, issues that arise for one installation will recur there and at others throughout the Army, decreasing efficiency and increasing risk. Lessons that have been learned in recent years to improve safety, such as using robotics for hazardous jobs, will be catalogued and used to improve operations at all installations. In addition, new building security and safety concepts will be developed and used to protect civilians and Soldiers alike during emergencies.

SUSTAIN MISSION RESOURCES

A ready Army requires secure and sustainable natural resources at installations and beyond. Proactive steps in natural-resource-management innovation are needed to ensure that clean water and air are readily available into the future, as well as to maintain the trust and confidence of communities that neighbor military installations. Under this objective, Army operations will be evaluated and improved to ensure compliance with statutory requirements to protect and preserve water, air and soil in the most efficient manner possible.

REMEDIATE CONTAMINANTS

 Decades of operations at Army installations have left a legacy of materials now classified as contaminants or hazardous. Advanced technologies can identify alternatives for phased out materials that are environmentally sound, low risk to human health, and compatible with mission operations. In addition, Base Realignment and Closure (BRAC) properties can be transitioned to enable more efficient use of available resources to support forces and increase operational readiness.



A U.S. Army Corps of Engineers geophysicist operates equipment used to detect and classify metal objects in the subsurface as potentially a target of interest, such as a munition | Photo by William Farrow



Daniel Vasconcelos, a regulator from USACE New England District and member of the National Technical Committee for Ordinary High Watermarks (OHWM), stands along a river in Vermont while field testing an interim OHWM identification data sheet | Photo by David Marquis

INNOVATION VIGNETTE

CONTAMINATION MITIGATION

CONTEXT

Ongoing and past activities at installations can and have contributed to the contamination of water, air, and soil. Although there may be awareness of activities that can lead to environmental contamination, suitable alternatives to these critical activities do not currently exist.

CHALLENGE

The types of contamination, location, and requirements for regulatory compliance may be unknown. Some existing tools can be used, but this largely depends on the contaminant. Furthermore, regulatory requirements may often change and there may be uncertainty surrounding compliance and enforcement.

R&D ACTIONS

Develop sensing technologies to identify where contamination exists and how to mitigate it to speed the remediation process and reduce Army liabilities. Identify and develop alternative materials for use and/or technologies to mitigate environmental contamination in a cost-effective manner.

RESULT

Net reduction in contamination levels, increased ability to use land and infrastructure, and potential increase in quality of life.

DEVELOP RISK-INFORMED METRICS



An important, cross-cutting component of effectively modernizing and protecting the complex network of Army installations is the capacity to prioritize advancement of objectives in the face of evolving physical, cyber, operational and extreme-weather hazards. Well-crafted, risk-informed metrics benchmark the outcome and likelihood of potential attacks, or of risks the environment may hold for installations now and into the future. Key performance indicators will be established for assessing vulnerabilities of crucial military components related to extreme-weather events, critical infrastructure, and essential services.

IMPLEMENT SMART AND FORWARD-LOOKING LAND MANAGEMENT



Innovative land management practices can increase the safety and security of Army installations by, for example, reducing vulnerability to wildfires, storms, and other natural threats. Innovative land management techniques to enhance base security and ensure efficient compliance with statutory requirements while preserving the mission will be developed, identified, and deployed through information dissemination and training. Examples include incorporating natural and nature-based features (NNBF) in training lands and in land management to reduce wildfire risks, as well as the development of predictive land management capabilities and decision support tools that establish baseline and forecast future conditions.

INNOVATION VIGNETTE

INSTALLATIONS - LAND MANAGEMENT CONTEXT

Senior Commanders rely on land management to preserve local operational settings in compliance with laws and regulations while maintaining access for training, testing, and mission requirements.

CHALLENGE

Insufficient tools for utilizing existing data that can support decisions advancing the mission while also minimizing negative impacts to operational settings. Land management decisions must balance and advance multiple requirements, including:

- a. BRAC remediation
- b. Training adaptation
- c. Integrated natural resource management



R&D ACTIONS

Enable predictive land management through development of decision support tools that establish baseline conditions and forecast future scenarios. Tools developed will be coupled with integration of multiple searchable databases (i.e., biological, political, geospatial, and hydrological) to improve institutional knowledge as well as advancements in data acquisition and analysis. Potential decision support tools to support predictive land management may include:

- a. Data analysis
- b. Robotics
- c. AI/ML
- d. Geospatial
- e. Sensor development and data acquisition
- f. Gap analysis and scenario planning

RESULT

Army lands are managed to preserve operational settings in compliance with laws and regulations while maintaining access for training, testing, and mission requirements. Training is adaptive, planned, coordinated, and executed in such a way as to mitigate environmental threats using the most up-to-date tools and technology available. Finally, undivested BRAC properties are remediated, meet current clean-up requirements, and can be transferred without liabilities.



U.S. Army Soldiers and NATO troops train with drones to simulate modern weapon systems which help their militaries update doctrine and training to combat against developing and future threats | Photo by 1st Sgt. Michel Sauret, U.S. Army

TRANSFORM OPERATIONAL TRAINING LANDS MANAGEMENT



The modern Army requires modern training facilities for emerging weapons systems to ensure Soldiers are skilled and ready for next generation Warfighter technology. Training facilities will be proactively planned, designed, and built to prepare the force and support on-demand capacity in the field. At the same time, these training areas will be designed, developed and modified to predict and mitigate the impacts of extreme-weather events and enhance Soldier safety during training by reducing the risk of training accidents due to flash flooding, extreme heat, etc.



Soliders during exercise Verboom, where U.S. engineers supported eFP Latvia by constructing an improvised door handle charge to demonstrate how to infiltrate a locked door | Photo by Capt. H Howey, U.S. Army



U.S. Army Lt. Col. Ari Martyn, left, commander of 1st Squadron, 91st Cavalry Regiment, 173rd Airborne Brigade, leads his officers through the Bayonet Assault Course at the 7th Army Training Command's Grafenwoehr Training Area, Germany Photo by Markus Rauchenberger, U.S. Army

4

ENSURE RESILIENT AND RELIABLE RESOURCES



Deliver shock-resistant energy, water, and materials to installations to ensure seamless mission execution.

Recognizing and understanding the face of evolving threats to critical lifelines of installation energy, water, and materials is key to maintaining and carrying out the Army mission. The Army must build resilient structures to ensure continuity of operations. In addition, installations should have the flexibility to share space and resources with local communities but also be capable of fully autonomous operations.

To support the Army by ensuring resilient and reliable installation energy, water, and materials, USACE will emphasize the following objectives in subsequent pages.

DEVELOP RESILIENT ENERGY AND WATER SUPPLY



Army installations are located across a wide variety of climates, with different threats facing each location. Extreme weather events—from larger and more frequent precipitation and coastal storm events to more prolonged and intense heat waves and droughts—have impacted and will continue to impact operations now and into the future. Innovation throughout the energy and water life cycles provides opportunities to build resilient systems. It is critical to understand how the Army and local surrounding communities allocate their resources (e.g., energy, water).

To maintain installation resilience, the Army must effectively deliver energy and distribute water in every location at all times. R&D is needed for developing and deploying solutions for installations and in the field on alternatives for nuclear energy. Operational energy and contingency operations are also needed for minimizing threats against stationary and mobile nuclear power plants.



Water pipe system | Photo by Eduardo Martinez

FUTURE BASE CAMPS

CONTEXT

Next-generation base camps must enhance Army force projection and persistence in austere environments. Reliable energy is a key component of base camps. The Army is already working with its commercial partners to revolutionize deployable power generation and storage. However, to reach their full potential, these generators must be deployed as part of a microgrid system paired with battery storage. The battery technology required for deployment at this scale exists and is improving every year, and the Army will move to acquire, implement, and help advance this technology. To minimize base fuel demands, the Army will enact a new policy, setting standards for using the most energy-efficient systems available for base camps, including renewable generation and battery storage where possible, decreasing logistical burdens and enabling resilient operations. To ensure protection and sustainment during Multi-Domain Operations (MDO), future base camps must employ the latest capabilities informed by the best available planning tools. As systems become more complicated, the Army increasingly relies on automated and computer-enabled planning.

CHALLENGE

The deployment and sustainment of base camps requires an awareness of the domain to inform the design of efficient shelters and equipment, and construction that is energy, water, and food resilient.

R&D ACTIONS

Develop a holistic view of the operational environments to support base camps via the use of network science (i.e., decision support tools, AI/ML, geospatial analysis), advanced materials (i.e., hardened structures), and risk/data analysis.

RESULT

Through careful planning and execution, the Army will significantly reduce operational energy and water use by 2035 to lighten logistical burdens and enable more resilient operations.

- a. Environment-specific, energy efficient base camp equipment has been developed, tested, and fielded. Systems for deployable water generation have been developed and fielded.
- b. Reliable supply chains are established using circular technology and redundant systems to create structural resilience and to decrease supply burdens.

The Army has the capability and capacity to sustain a competitive presence in regions of operational interest.



The Army's first hydrogen-powered nanogrid at White Sands Missile Range in New Mexico (U.S. Army photo by Sophia Espinosa)

IMPROVE SUPPLY CHAIN RESILIENCE FOR ARMY ENERGY SYSTEMS AND MATERIALS



The recent COVID-19 pandemic brought the issue of supply chain resilience to the forefront. To maintain operational readiness and adapt to rapidly changing circumstances, supply chain resilience is critical (Office of the Under Secretary of Defense, 2022b). The Army must assess and quantify risks to supply chains, including impacts to neighboring communities and external partners should food and water insecurity issues arise because of supply chain disruptions. To address these issues, technologies are needed for managing product life cycle data, evaluating material quality and performance, and promoting recycling and reuse to reduce reliance on foreign markets as well as minimize transportation vulnerabilities. Technologies that focus on Army construction, energy systems, water systems, materials source reliability, rare earth element reuse, supply chain analysis, and logistics optimization are also critical.



U.S. Army Soldiers from the 331st Transportation Company (Causeway), 11th Transportation Battalion, 7th Transportation Brigade (Expeditionary) construct a causeway in Antarctica | Photo by U.S. Army Col. Eddie Gray

DEVELOP EFFICIENT, DIRECTED ENERGY STORAGE AND DISPATCH SYSTEMS



United States and Allied forces operating in hostile territories and environments are reliant on innovative, nimble solutions for robust power delivery. Technologies for lightweight and high-performance energy storage and discharge will be developed, along with advanced solutions for energy generation, distribution, and life cycle management. Directed Energy Systems such as high-energy lasers and high-power microwaves will be explored and advanced for rapid recharge of installation and field-deployed technology, counter-unmanned aerial surveillance, and other operations.



Energy Exchange, one of the largest energy-focused training and trade show events in the United States, was held in Pittsburgh on March 25-28, 2024. Among the 2,600 participants were over 300 Army attendees, representing almost all installations and components. (Photo: U.S. Army)

WORK WITH INDUSTRY TO IMPROVE ENERGY EFFICIENCY



To improve energy efficiency, R&D must examine new energy system approaches that optimize power generation, distribution, storage, and management. Trends include digitization (including the power system itself), decentralization, integration (e.g., electrical, thermal, chemical processes), system operation, safety, and planning.

Working with industry to deliver these energy-efficiency solutions will result in cost savings and better stewardship of taxpayer dollars



▶ CHAPTER 3

STRATEGIES FOR DELIVERING R&D SOLUTIONS FOR TECHNOLOGY INNOVATION

U.S. Army Spc. Tanner Hartman conducts operations on a Mimir™ Onboard Forward Overwatch (MOFO) Mission Kit, an unmanned ground vehicle, during Project Convergence-Capstone 5 (PC-C5) on Fort Irwin, Calif., in March 2025. PC-C5 is the premier Joint, Combined experiment hosted by Army Futures Command to demonstrate how technology enhances cross-domain military operations. (U.S. Army photo by Sgt. Marita Schwab)

STRATEGIES FOR DELIVERING R&D SOLUTIONS FOR TECHNOLOGY INNOVATION

The Army must innovate to keep pace with technological advancements and modernization efforts in order to maintain the overmatch dominance advantage. Significant advancements requiring a more rapid cadence of innovation are needed to support delivery of the Army of 2030 and design of the Army of 2040.

Effective delivery of R&D solutions to the IE&E domain requires a continuous analysis of national, defense, and Army-level strategic priorities and policies, informed by mission requirements, to define relevant priority innovation focus areas that guide research and development. Priority innovation focus areas will evolve over time and must continue to be developed by key stakeholders in the Secretariat, Army Staff, Land Holding Commands, and USACE. A governance process is needed for prioritizing programming and budgeting decisions and to direct resource research and development, as well as training for effective implementation. R&D performing organizations will deliver impactful R&D in these priority innovation focus areas and ensure transition to stakeholders and end-users through appropriate industry partnering and technology transfer mechanisms and agreements. Finally, cross-function engagement of decision- and policy makers, resource managers, installation practitioners, and technical/innovation teams is needed to exchange expert knowledge. These efforts must span across and beyond the Army for maximal efficiency and outcomes, including Tri-Services involvement, industry partnering, and engagement from the Strategic Environmental Research and Development Program, Environmental Security Technology Certification Program, and similar innovation engines. This effort forms a cornerstone in execution of a proposed practical strategy map for technology development and innovation to address installation gaps and needs (see figure on following page).



The U.S. Army took a giant leap into the future of military construction with the debut of its first-ever additively constructed (3D-printed) Army barracks in Fort Bliss, Texas, with help from ERDC subject matter experts | Photo courtesy of ICON

STRATEGIC PRIORITIES AND DRIVERS



POLICY

FUTURE-FOCUSED
POLICY IN ALIGNMENT
WITH ADMINISTRATION
AND CONGRESSIONAL
PRIORITIES

REQUIREMENTS

COMMAND AND
MISSION AND
REQUIREMENTS

PRIORITY INNOVATION FOCUS AREAS

1

**SUPPORT ARMY
MODERNIZATION
AND
STRENGTHEN
READINESS**



3

**PROTECT
SOLDIERS,
COMMUNITIES,
AND OPERATIONAL
SETTINGS**



2

**DELIVER
MODERN AND
RESILIENT
INSTALLATIONS**



4

**ENSURE RESILIENT
AND RELIABLE
RESOURCES**



R&D EXECUTION

GOVERNMENT, INDUSTRY,
AND ACADEMIC EXPERTS
EXECUTE IMPACTFUL R&D

TRANSITION

TECHNOLOGY IS
TRANSITIONED TO
APPROPRIATE PARTNERS AND
STAKEHOLDERS: MATERIAL,
KNOWLEDGE, DOCTRINE, ETC.



U.S. Soldiers maneuver an M2 Bradley Fighting Vehicle during exercise
Photo by Sgt. John Schoebel, U.S. Army



A floating solar microgrid at Camp Mackall on July 28, 2023. With one-tenth of the Army housed at Fort Bragg, including Special Operations, Airborne and Global Response Force forces, energy generated will deliver imperative energy security and improvements to the installation's utility infrastructure. This supports mission readiness by maintaining a continuous power supply at this critical installation.
Photo by Jason Ragucci, Fort Bragg Garrison Public Affairs Office



Susan Bailey (right), ERDC's EL, demonstrates the effects of an oil spill on a body of water to fourth grade students in Vicksburg, Mississippi | Photo by Jared Eastman, U.S. Army Corps of Engineers

The following actions will provide the framework necessary to tackle this strategy's priority innovation focus areas—support Army modernization and strengthen readiness, deliver modern and resilient facilities and services, protect Soldiers, communities, and operational settings, and ensure resilient and reliable resources—and deliver effective R&D solutions.

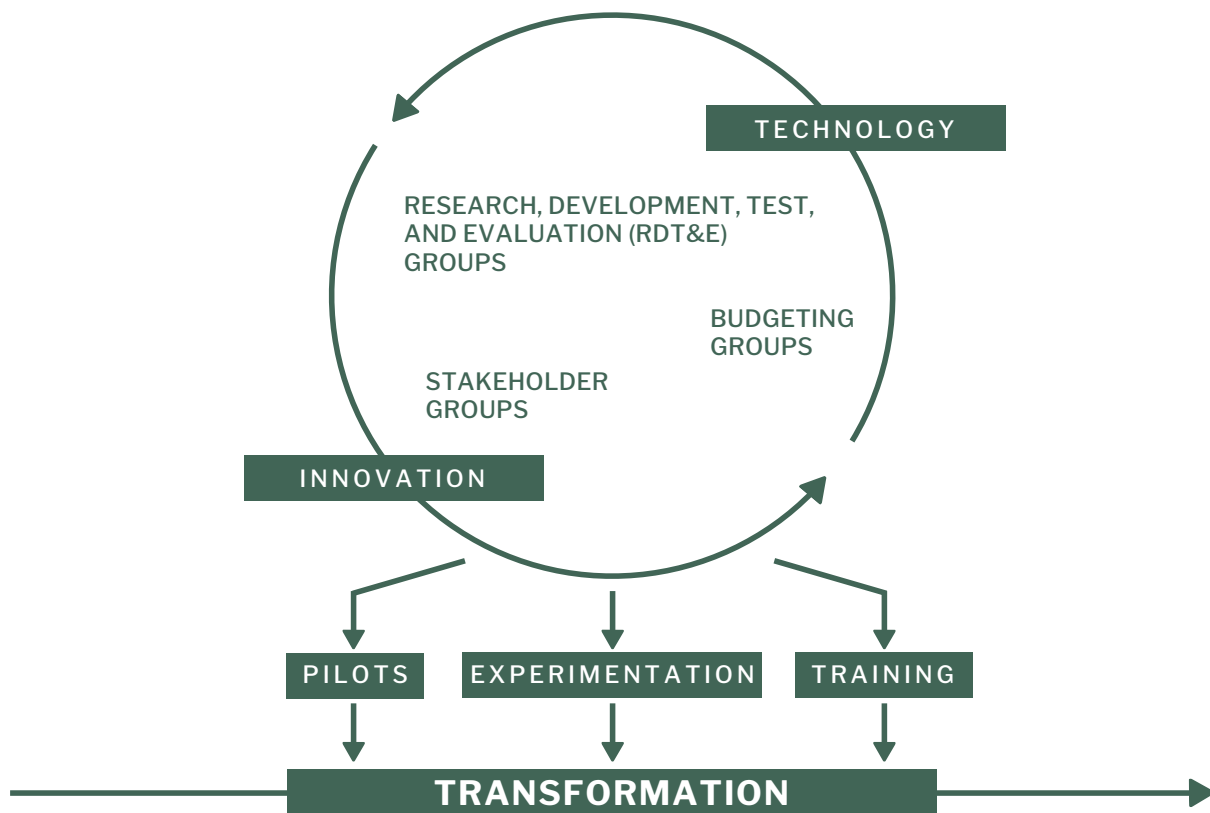
1 COMMUNICATE AND COLLABORATE

Communication and collaboration are not only critical for supporting delivery of the Army of 2030 and design of the Army of 2040, but also for meeting current and ongoing Army priorities, such as building and preparing cohesive teams for warfighting missions and strengthening the profession through exchange of ideas and lessons learned. Increased multidisciplinary communication and collaboration aids in leveraging the collective resources and capabilities needed to “embrace innovation to prepare for tomorrow” (USACE, 2023).

Communicating with and nurturing stronger collaborations across stakeholder groups also increases awareness and visibility of Army installation challenges as well as problem spaces to which innovative solutions may be applied. Investing in strategic messaging vertically and horizontally at all levels within installations and the broader community while working together to address challenges will improve understanding and solutions. Such activities are also important to gain buy-in from local communities surrounding installations.



Mr. David P. Jensen, Division Chief of U.S. INDO-PACOM, speaks at Defense Industry Day during CAPEX 2024. The Defense Industry Day at CAPEX 2024 provided an opportunity to build relationships supporting future regional security initiatives | Photo by U.S. Army Staff Sgt. Carolina Sierra



2 CONTINUOUSLY TRANSFORM

In addition to increasing communication and collaboration across stakeholder groups, USACE must continuously transform to develop solutions that meet the needs of Army installations. This requires consistent review of technology and innovation efforts to assess and address any capability gaps. USACE can then develop strategies for rapidly advancing solutions and approaches to:

- Promote awareness of common capability gaps and anticipate future challenges across the military installations community.
- Identify possible technology and innovative solutions.
- Support the Army with testing, adopting, and integrating new technologies.
- Leverage capabilities across the RDT&E performing organizations.
- Work with external RDT&E partners to predict the next generation of state-of-the-art technologies and equipment.
- Shape pilot programs and other experimentation priorities.
- Bring awareness to RDT&E resourcing needs.

Continuous, coordinated review of technology gaps would produce the desired outcome of bringing to the forefront problem set awareness, the art of the possible, resourcing, RDT&E execution and project transition, as well as linking critical partners needed to meet the goals of modern installations and Army priorities.

▶ CHAPTER 4

THE PATH FORWARD: STRATEGY IMPLEMENTATION

This strategy is intended to proactively inform USACE resourcing requirements that enable integration and advancement of the R&D program in support of Army modernization initiatives, as well as to communicate those priorities to enable effective and innovative collaboration across R&D organizations and with industry. It identifies near-, mid-, and long-range known and potential new obstacles that could impact the effort. Awareness and identification of the evolution of policies and procedures over time as well as the knowledge gaps relevant to rapidly developing innovative solutions for USACE mission areas is necessary to meet life cycle resourcing needs across R&D investment areas.

An implementation plan will be developed pursuant to this strategy to provide internal guidance within ERDC, metrics for benchmarking progress, and other specifics of action. The implementation plan will be informed by this IE&E strategy as a Call-to-Action across the ERDC “6Ps” (Portfolio, Products, People, Premier Facilities, Promote Understanding, and Partnerships). Together, the strategy and implementation plan will engender shared understanding and unity of purpose across USACE while communicating the organization’s trajectory to stakeholders.

This strategy and the implementation plan will be shared with IE&E interested and affected parties, which include, but are not limited to: ASA (IE&E), ASA Acquisitions, Logistics, and Technology (ALT), IMCOM, Army G-9, Army G-3/5/7, Army G-4, Army Futures Command (AFC), and Army Materiel Command (AMC). The intent will be to elicit interactive feedback of the implementation plan as a response to the strategy, in a future IE&E Shared Visioning Workshop. The goal will be to evolve the implementation plan into a final version that achieves “6P” synergies and efficiencies in a high impact value proposition that would not otherwise be possible.

American Soldiers ruck march with the flag during the 1st Annual Bataan Memorial Death March
Photo by Master Sgt. Ryan Matson, 652nd Regional Support Group, U.S. Army Reserve



CONCLUSION

The development of the strategy and implementation plan documents entail defining value-laden opportunities for research and identifying how initiatives/priorities fit into and support the vision, goals, and objectives of Army installation stakeholders. These actions will be foundational towards identifying a road map of R&D initiatives and resourcing as a collective means to close stakeholder-informed technology innovation gaps in the near-, mid-, and long-term. To sustain the momentum generated via these early foundational actions, USACE envisions holding recurring whole-of-installation community summits for continuously cultivating shared understanding and unity of purpose, through changing conditions and mission priorities.

REFERENCES

Office of the Under Secretary of Defense. (2022a, February 1). USD(R&E) Technology Vision for an Era of Competition. https://www.cto.mil/wp-content/uploads/2022/02/usdre_strategic_vision_critical_tech_areas.pdf

USACE. (2023). USACE Engineering and Construction Strategic Plan, FY 2024-2026.

U.S. Army. (2019). 2019 Army Modernization Strategy: Investing in the future. https://www.army.mil/e2/downloads/rv7/2019_army_modernization_strategy_final.pdf

U.S. Army. (2020). Army Installations Strategy: Supporting the Army in multiple domains. https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN32810-SD_07_STRATEGY_NOTE_2020-01-000-WEB-1.pdf

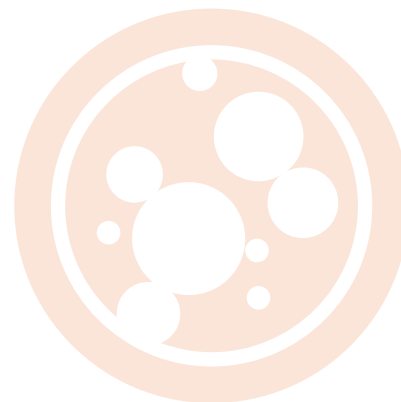
U.S. Army. (2022b). Army Data Plan. <https://api.army.mil/e2/c/downloads/2022/10/13/16061cab/army-data-plan-final.pdf>

U.S. Department of Defense. (2022). 2022 National Defense Strategy of the United States of America. <https://media.defense.gov/2022/Oct/27/2003103845/-1/-1/1/2022-NATIONAL-DEFENSE-STRATEGY-NPR-MDR.PDF>

U.S. Department of Defense. (2023, June 27). Data, Analytics, and Artificial Intelligence Adoption Strategy – Accelerating Decision Advantage. https://media.defense.gov/2023/Nov/02/2003333300/-1/-1/1/DOD_DATA_ANALYTICS_AI_ADOPTION_STRATEGY.PDF

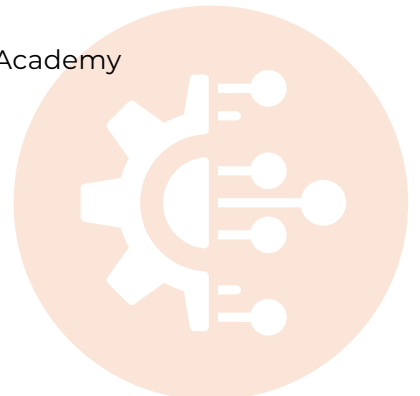
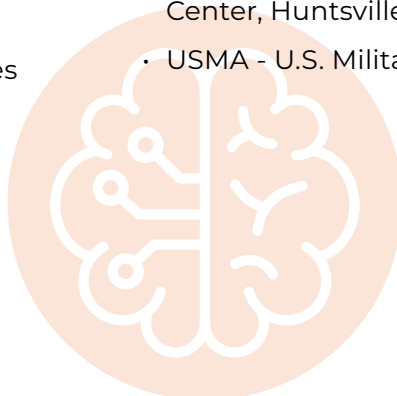
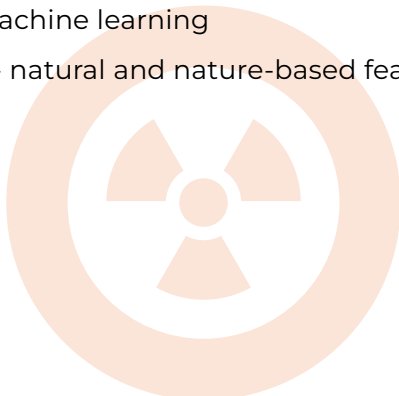
U.S. Department of Homeland Security. (2019, November). A Guide to Critical Infrastructure Security and Resilience. <https://www.cisa.gov/sites/default/files/publications/Guide-Critical-Infrastructure-Security-Resilience-110819-508v2.pdf>

Wormuth, Christine E., Randy A. George, and Michael R. Weimer. “Message to the Army Team.” Email message to the U.S. Army Workforce, October 27, 2023. <https://api.army.mil/e2/c/downloads/2023/10/27/48ce3005/message-to-the-army-team-tri-sign.pdf>



ABBREVIATIONS

- ADIM - Automated Direct/Indirect Mortar
- AFC - U.S. Army Futures Command
- AI - artificial intelligence
- AI/ML - artificial intelligence/machine learning
- AMC - Army Materiel Command
- AMS - Army Modernization Strategy
- Army DEVCOM C5ISR Center - Combat Capabilities Development Command, Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance and Reconnaissance Center
- ASA (ALT) - Assistant Secretary of the Army for Acquisitions, Logistics and Technology
- ASA (IE&E) - Assistant Secretary of the Army for Installations, Energy and the Environment
- BRAC - Base Realignment and Closure
- CONUS - Continental United States
- COP - Common Operating Picture
- DIU - Defense Innovation Unit
- DOE - Department of Energy
- ERDC - U.S. Army Engineer Research and Development Center
- EPA - Environmental Protection Agency
- HBG - hazardous biological growth
- HQDA DCS, G9 - Headquarters, Department of the Army, Deputy Chief of Staff, G-9 (Installations)
- IE&E - installations, energy and environment
- IMCOM G4 - U.S. Army Installation Management Command, G4 (Facilities and Logistics)
- IT - information technology
- MDO - Multi-Domain Operations
- ML - machine learning
- NNBF - natural and nature-based features
- OASA IE&E - Office of the Assistant Secretary of the Army for Installations, Energy and Environment
- OASA IE&E (SI) - Office of the Assistant Secretary of the Army for Installations, Energy and Environment, Strategic Integration Directorate
- ODASA (E&S) - Office of the Deputy Assistant Secretary of the Army for Energy and Sustainability
- ODASA (ESOH) - Office of the Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health
- ODASA (IH&P) - Office of the Deputy Assistant Secretary of the Army for Installations, Housing and Partnerships
- ODASA (R&T) - Office of the Deputy Assistant Secretary of the Army for Acquisitions, Logistics and Technology, Research and Technology
- OHWM - Ordinary High Watermarks
- OWT - One World Terrain
- PEO CS&CSS - U.S. Army Program Executive Office, Combat Support & Combat Service Support
- PNNL - Pacific Northwest National Laboratories
- POM - Program Objective Memorandum
- R&D - research and development
- RDT&E - Research, Development, Test and Evaluation
- USACE HQ - U.S. Army Corps of Engineers, Headquarters
- USACE OCE - U.S. Army Corps of Engineers, Office of the Chief of Engineers
- USA HNC - U.S. Army Engineering and Support Center, Huntsville
- USMA - U.S. Military Academy





INSTALLATIONS, ENERGY AND ENVIRONMENT TECHNOLOGY INNOVATION STRATEGY



U.S. ARMY



US Army Corps
of Engineers

U.S. ARMY CORPS OF ENGINEERS