



DEPARTMENT OF DEFENSE

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2014 CLIMATE CHANGE  
ADAPTATION ROADMAP



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## FOREWORD

The responsibility of the Department of Defense is the security of our country. That requires thinking ahead and planning for a wide range of contingencies.

Among the future trends that will impact our national security is climate change. Rising global temperatures, changing precipitation patterns, climbing sea levels, and more extreme weather events will intensify the challenges of global instability, hunger, poverty, and conflict. They will likely lead to food and water shortages, pandemic disease, disputes over refugees and resources, and destruction by natural disasters in regions across the globe.

In our defense strategy, we refer to climate change as a “threat multiplier” because it has the potential to exacerbate many of the challenges we are dealing with today – from infectious disease to terrorism. We are already beginning to see some of these impacts.

A changing climate will have real impacts on our military and the way it executes its missions. The military could be called upon more often to support civil authorities, and provide humanitarian assistance and disaster relief in the face of more frequent and more intense natural disasters. Our coastal installations are vulnerable to rising sea levels and increased flooding, while droughts, wildfires, and more extreme temperatures could threaten many of our training activities. Our supply chains could be impacted, and we will need to ensure our critical equipment works under more extreme weather conditions. Weather has always affected military operations, and as the climate changes, the way we execute operations may be altered or constrained.

While scientists are converging toward consensus on future climate projections, uncertainty remains. But this cannot be an excuse for delaying action. Every day, our military deals with global uncertainty. Our planners know that, as military strategist Carl von Clausewitz wrote, “all action must, to a certain extent, be planned in a mere twilight.”

It is in this context that DoD is releasing a Climate Change Adaptation Roadmap. Climate change is a long-term trend, but with wise planning and risk mitigation now, we can reduce adverse impacts downrange.

Our first step in planning for these challenges is to identify the effects of climate change on the Department with tangible and specific metrics, using the best available science. We are almost done with a baseline survey to assess the vulnerability of our military’s more than 7,000 bases, installations, and other facilities. In places like the Hampton Roads region in Virginia, which houses the largest concentration of US military sites in the world, we see recurrent flooding today, and we are beginning work to address a projected sea-level rise of 1.5 feet over the next 20 to 50 years.

Drawing on these assessments, we are integrating climate change considerations into our plans, operations, and training across the Department so that we can manage associated risks. We are considering the impacts of climate change in our war games and defense planning scenarios, and are working with our Combatant Commands to address impacts in their areas of responsibility.

At home, we are studying the implications of increased demand for our National Guard in the aftermath of extreme weather events. We are also assessing impacts on our global operations – for instance, how climate change may factor into our rebalance to the Asia-Pacific. Last year, I released the Department of Defense’s Arctic Strategy, which addresses the potential security implications of increased human activity in the Arctic – a consequence of rapidly melting sea ice.

We are also collaborating with relevant partners on climate change challenges. Domestically, this means working across our federal and local agencies and institutions to develop a comprehensive, whole-of-government approach to a challenge that reaches across traditional portfolios and jurisdictions. Within the U.S. Government, DoD stands ready to support other agencies that will take the lead in preparing for these challenges – such as the State Department, US Agency for International Development, and the Federal Emergency Management Agency.

We must also work with other nations to share tools for assessing and managing climate change impacts, and help build their capacity to respond. Climate change is a global problem. Its impacts do not respect national borders. No nation can deal with it alone. We must work together, building joint capabilities to deal with these emerging threats.

Politics or ideology must not get in the way of sound planning. Our armed forces must prepare for a future with a wide spectrum of possible threats, weighing risks and probabilities to ensure that we will continue to keep our country secure. By taking a proactive, flexible approach to assessment, analysis, and adaptation, the Defense Department will keep pace with a changing climate, minimize its impacts on our missions, and continue to protect our national security.

A handwritten signature in blue ink, reading "Chuck Hagel". The signature is stylized with a large, bold "C" and "H". Below the signature is a horizontal line.



## Department of Defense FY 2014 Climate Change Adaptation Roadmap

Climate change will affect the Department of Defense's ability to defend the Nation and poses immediate risks to U.S. national security. The Department is responding to climate change in two ways: adaptation, or efforts to plan for the changes that are occurring or expected to occur; and mitigation, or efforts that reduce greenhouse gas emissions. This Climate Change Adaptation Roadmap (Roadmap) focuses on the Department's climate change adaptation activities<sup>1</sup>.

The Strategic Sustainability Performance Plan (SSPP) articulates the Department's sustainability vision to maintain our ability to operate into the future without decline in the mission or the supporting natural and man-made systems. The actions set forth in this Roadmap will increase the Department's resilience to the impacts of climate change, which is a key part of fulfilling this vision.

The Department has established three broad adaptation goals:

**Goal 1:** Identify and assess the effects of climate change on the Department.

**Goal 2:** Integrate climate change considerations across the Department and manage associated risks.

**Goal 3:** Collaborate with internal and external stakeholders on climate change challenges.

These goals are supported by four lines of effort:

- **Plans and Operations** include the activities dedicated to preparing for and carrying out the full range of military operations. Also included are the operating environments in the air, on land, and at sea, at home and abroad, that shape the development of plans and execution of operations.
- **Training and Testing** are critical to maintaining a capable and ready Force in the face of a rapidly changing strategic setting. Access to land, air, and sea space that replicate the operational environment for training and testing is essential to readiness.
- **Built and Natural Infrastructure** are both necessary for successful mission preparedness and readiness. While built infrastructure serves as the staging platform for the Department's national defense and humanitarian missions, natural infrastructure also supports military combat readiness by providing realistic combat conditions and vital resources to personnel.

*"But the challenge of global climate change, while not new to history, is new to the modern world. Climate change does not directly cause conflict, but it can significantly add to the challenges of global instability, hunger, poverty, and conflict. Food and water shortages, pandemic disease, disputes over refugees and resources, more severe natural disasters – all place additional burdens on economies, societies, and institutions around the world."*

- Secretary Hagel

Halifax International Security Forum  
(DoD Arctic Strategy) Nov 2013

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<sup>1</sup> The Department's progress and strategies towards climate change mitigation, mainly through changes in our energy use, can be found in the main body of Strategic Sustainability Performance Plan (SSPP), Goals 1, 2, 3, 5 and 6.

- **Acquisition and Supply Chain** include the full range of developing, acquiring, fielding, and sustaining equipment and services and leveraging technologies and capabilities to meet the Department's current and future needs, including requirements analysis.

The Roadmap is divided into four sections: the policy framework for climate change adaptation planning and three goal sections. For each goal, the Roadmap provides an overview, and specific details on how the Department's adaptation will occur across the four lines of effort, as well as a description of ongoing efforts (where applicable).

## POLICY FRAMEWORK FOR CLIMATE CHANGE ADAPTATION PLANNING

The foundation for the Department's strategic policy on climate change adaptation began with the publication of the Quadrennial Defense Review (QDR) in 2010 by the Secretary of Defense. The QDR articulates the United States' national defense strategy and seeks to adapt, shape and rebalance our military to prepare for the strategic challenges and opportunities we face in the years ahead.

The 2010 QDR recognized that climate change was a threat to national security and the 2014 QDR reaffirms the Department's position: "The impacts of climate change may increase the frequency, scale, and complexity of future missions, including Defense Support to Civil Authorities (DSCA), while at the same time undermining the capacity of our domestic installations to support training activities."

The third National Climate Assessment notes that certain types of weather events have become more



Army National Guard rescues flooding victims after Hurricane Isaac  
August 30, 2012. Credit: US ARNG SGT Rashawn D. Price

frequent and/or intense, including heat waves, heavy downpours, and, in some regions, floods and droughts. Sea levels are rising, oceans are becoming more acidic, and glaciers and arctic sea ice are melting. Scientists predict that these changes will continue and even increase in frequency or duration over the next 100 years.

These climate-related effects are already being observed at installations throughout the U.S. and overseas and affect many of the Department's activities and decisions related

to future operating environments, military readiness, stationing, environmental compliance and stewardship, and infrastructure planning and maintenance.

Climate change also will interact with other stressors in ways that may affect the deployment of U.S. Forces overseas and here at home. As climate change affects the availability of food and water, human migration, and competition for natural resources, the Department's unique capability to provide logistical, material, and security assistance on a massive scale or in rapid fashion may be called upon with increasing frequency. As the incidence and severity of extreme weather events change, the Department will adapt to meet these dynamic operational realities.

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#### RESPONSIBLE SENIOR AGENCY OFFICIAL

The Deputy Under Secretary of Defense (Installations and Environment) is the Department's Climate Change Adaptation Planning Officer and is responsible for overseeing the implementation of the Department's climate change adaptation efforts.

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#### COORDINATING BODY

The Department's Senior Sustainability Council (SSC), established in 2010, comprises Department senior leaders, the military departments and components and is charged with developing strategy, recommending policy, and ensuring coordination on sustainability initiatives across the Department. The SSC is co-chaired by the Deputy Under Secretary of Defense (Installations and Environment) and the Assistant Secretary of Defense for Operational Energy Plans and Programs. The SSC directs, oversees, and supports development of the Department's annual integrated SSPP and has purview over mitigation – through greenhouse gas emissions reduction efforts – and climate change adaptation.

The SSC established a Climate Change Adaptation Working Group (CCAWG) in December 2012, to facilitate implementation of the climate change requirements found in EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, and EO 13653, *Preparing the United States for the Impacts of Climate Change*. The CCAWG takes direction from and provides advice to the SSC regarding the state of climate science, vulnerability and impact assessment, and adaptation practices, and they lead the development of the Department's Roadmap. The CCAWG has membership from all Services and multiple offices, including Policy, Operational Energy Plans & Programs, Personnel and Readiness, and the Joint Staff. The SSC and CCAWG fulfill the Department's original Goal 1, set forth in the 2012 Roadmap - "Define a coordinating body to address climate change." The SSC and CCAWG will continue to analyze climate change-related policy, guidance, and practice; ensure that the Department has access to the climate-related information necessary to make informed decisions; and engage with internal and external stakeholders.

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#### EXECUTIVE ORDER REQUIREMENTS

This 2014 update to the Roadmap fulfills the requirements of a Climate Change Adaptation Plan found in Executive Orders 13514 and 13653. Executive Order 13514 requires that all Federal Departments and Agencies evaluate climate change risks and vulnerabilities to manage both the short- and long-term effects of climate change on the agency's mission and operations, and include an adaptation planning document as an appendix to its annual SSPP. Executive Order 13653 notes that "building on these efforts, each agency shall develop or continue to develop, implement, and update comprehensive plans that integrate consideration of climate change into agency operations and overall mission objectives and submit those plans to CEQ and OMB for review." A table which cross references this Roadmap to the specific implementation requirements of EO 13653 is provided in Annex 1.

## GOAL 1 – IDENTIFY AND ASSESS THE EFFECTS OF CLIMATE CHANGE ON THE DEPARTMENT.

*Overview. Utilize an iterative assessment process to identify how climate change might shape the Department's plans and operations and what current and projected climate-related impacts might occur to its training and testing, built and natural infrastructure, and acquisition and supply chain.*

The effects of the changing climate will be felt across the full range of Department activities, including plans, operations, training, infrastructure, and acquisition. The direction, degree, and rates of the physical changes will differ by region, as will the effects to the Department's mission and operations. By taking a proactive, flexible approach to assessment and analysis, the Department can keep pace with changing climate patterns and minimize effects on the Department.

Initial analysis indicates that four primary climate change phenomena are likely to affect the Department's activities:

- Rising global temperatures
- Changing precipitation patterns
- Increasing frequency or intensity of extreme weather events
- Rising sea levels and associated storm surge

A high-level summary of potential impacts to the four lines of efforts - plans and operations, training and testing, built and natural infrastructure, and acquisition and supply chain

- is provided in Annex 2. For convenience to the reader, excerpts from Annex 2 are provided in relevant sections of the Roadmap.

*"And because we know that climate change is taking place, we are assessing our coastal and desert installations to help ensure they will be resilient to its effects. Planning for climate change and smarter energy investments not only make us a stronger military, they have many additional benefits – saving us money, reducing demand, and helping protect the environment. These initiatives all support President Obama's Climate Action Plan..."*

- Secretary Hagel

Halifax International Security Forum (DoD Arctic Strategy) Nov 2013

## PLANS AND OPERATIONS

The changing climate will affect operating environments and may aggravate existing or trigger new risks to U.S. interests. For example, sea level rise may impact the execution of amphibious landings; changing temperatures and lengthened seasons could impact operation timing windows; and increased frequency of extreme weather could impact overflight possibility as well as intelligence, surveillance and reconnaissance capability. The opening of formerly-frozen Arctic sea lanes will increase the need for the Department to monitor events, safeguard freedom of navigation, and ensure stability in this resource-rich area. Maintaining stability within and among other nations is an important means of avoiding full-scale military conflicts. The impacts of climate change may cause instability in other countries by impairing access to food and water, damaging infrastructure, spreading disease, uprooting and displacing large numbers of people, compelling mass migration, interrupting commercial activity, or restricting electricity availability. These developments could undermine already-fragile governments that are unable to respond effectively or challenge currently-stable governments, as well as increasing competition and tension between countries vying for limited resources. These gaps in governance can create an avenue for extremist ideologies and conditions that foster terrorism. Here in the U.S., state

and local governments responding to the effects of extreme weather may seek increased DSCA. These potential effects are summarized in Table 1.

| <b>Table 1: Potential Effects of Climate Change on Department Plans &amp; Operations</b>                                                                                                                                                                                                                                                                                                                     |
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| <ul style="list-style-type: none"> <li>• Increased demand for DSCA.</li> <li>• Increased demand for disaster relief and humanitarian assistance overseas.</li> <li>• Increased need for air, sea, and land capabilities and capacity in the Arctic region.</li> <li>• Altered, limited or constrained environment for military operations.</li> <li>• Instability within and among other nations.</li> </ul> |

As a Department, we need to better understand how the changing climate will affect plans and operations in the U.S. and abroad. The Department will need to monitor these developments and decide which situations will require intervention based on U.S. security interests – either preemptively through security cooperation and capacity building, or with stability measures once conditions escalate.

Specifically, the Department must assess how the projected effects of climate change may:

- Alter operating environments. As these operating environments change, so may the need for adjustments to Department capabilities and capacity.
- Impact Department planning assumptions.
- Interact with other stressors—poverty, environmental degradation, political instability and social tensions—to accelerate conflict and instability detrimental to U.S. interests.
- Impact capacity building projects, stability operations, and construction of military and civilian infrastructure.
- Affect the demand for Department capabilities and prioritization of engagement across the range of military operations, with special attention to overseas humanitarian assistance and disaster response missions.
- Influence demands on the Department, including the Reserve Component, to support DSCA and other emergency operations in the U.S.



Hospital ship USNS Comfort and fleet replenishment oiler USNS Leroy Gumman provide support in Haiti, February, 2010. Credit: US Navy, Petty Officer 3rd Class Matthew Jackson

## TRAINING AND TESTING

Maintaining a capable and ready Force in the face of a rapidly changing strategic setting requires agility and preparedness. The Department must be able to train our Forces to meet the evolving nature of the operational environment. The Department executes training in the field environment to achieve and sustain proficiency in mission requirements. Similarly, the Department conducts testing in the field environment in anticipation of the military's use of weapons, equipment, munitions, systems, or their components. As such, access to the land, air, and sea space that replicate the operational environment for training and testing is critical to the readiness of the Force. Potential effects to the Department's training and testing are summarized in Table 2.



**Table 2. Potential Effects of Climate Change on Department Training & Testing**

- Increased number of ‘black flag’ (suspended outdoor training) or fire hazard days.
- Decreased training/testing land carrying capacity to support current testing and training rotation types or levels. Some training/testing lands may lose their carrying capacity altogether.
- Increased dust generation during training activities, which may interfere with sensitive equipment, resulting in greater repairs, or may require more extensive dust control measures to meet environmental compliance requirements.
- Stressed threatened and endangered species and related ecosystems, on and adjacent to DoD installations, resulting in increased endangered species and land management requirements.
- Increased operational health surveillance and health and safety risks to the Department’s personnel.
- Increased maintenance/repair requirements for training/testing lands and associated infrastructure and equipment (e.g., training roads, targets)

The Department must assess the effects of projected climate change on its:

- Ability to carry out training and testing activities in the field environment.
- Access to existing training lands. Diminished access may increase the demand for acquisition/development of new training lands or alternative training to maintain unit readiness.
- Readiness of an individual unit or an individual weapons system’s testing regime from ‘lost days’ at an individual training/testing location. The Department must assess these impacts at local training/testing assets and quantify the cumulative effects across all the Department’s training and testing.
- Health and safety risks to the Department’s personnel, and the extent to which demand for operational health surveillance programs and health services might increase.

## **BUILT AND NATURAL INFRASTRUCTURE**

The Department manages a diverse mixture of built and natural infrastructure to support testing, training and other mission and readiness requirements. For example an installation may need a forest



Amphibious assault training. Credit: Petty Officer 3rd Class Amanda S. Kitchner

or desert landscape for maneuvers, coastal waters for amphibious assault training, or wetlands to prevent flooding and erosion. Climate change will have serious implications for the Department’s ability to maintain both its built and natural infrastructure, and to ensure military readiness in the future. Potential effects to the Department’s built and natural infrastructure are summarized in Table 3.

**Table 3. Potential Effects of Climate Change on Department Built & Natural Infrastructure**

- Increased inundation, erosion, and flooding damage.
- Changing building heating and cooling demand, impacting installation energy intensity and operating costs.
- Disruption to and competition for reliable energy and fresh water supplies.
- Damage from thawing permafrost and sea ice in Alaska and the Arctic region.
- Increased ecosystem, wetland, sensitive species, and non-native invasive species management challenges.
- Increased maintenance requirements for runways or roads to remain operable during extreme hot days.
- Changed disease vector distribution, increasing the complexity and cost of on-going disease management efforts.

The Department must assess the effects of projected climate change on the:

- Design, operation, maintenance and repair of buildings and transportation assets.
- Management of natural infrastructure assets, including unique landscapes, ecosystems and habitats, particularly those supporting sensitive species.
- Energy, fuel, water supply, and utility services, including electrical grid, drinking water, wastewater, and steam systems.
- Adequacy of existing stormwater management systems to accommodate more frequent and intense precipitation events.
- Emergency preparedness and response.
- Distribution of disease vectors, including exposure to diseases in regions not routinely encountered, that may have acute and long-term impacts on personnel health and safety.



Flooding at Keesler Air Force Base. Credit: SSgt Kimberly Rae

## ACQUISITION AND SUPPLY CHAIN

The Department's acquisition and supply chain include the full range of developing, acquiring, fielding, and sustaining equipment and services and leveraging technologies and capabilities to meet the Department's current and future needs, including requirements analysis. Climate change impacts may affect the supplies, equipment, vehicles, and weapons systems the Department buys, where and from whom we buy them, how they are transported and distributed, and how and where they are stockpiled and stored. Potential effects to the Department's acquisition and supply chain services are summarized in Table 4.

**Table 4. Potential Effects of Climate Change on Department Acquisition & Supply Chain**

- Changed operational parameters for current and planned weapons and equipment, resulting in increased associated maintenance requirements or requirements for new equipment.
- Reduced availability of or access to the materials, resources, and industrial infrastructure needed to manufacture the Department's weapon systems and supplies.
- Interrupted shipment, delivery or storage/stockpile of materials or manufactured equipment and supplies.
- Alterations in storage and stockpile activities.
- Reduced or changed availability and access to food and water sources to support personnel.

The Department must assess the effects of projected climate change on its:

- Wide array of weapons systems, both in terms of operating range and associated maintenance requirements, and determine if new equipment is required to operate in new environments.
- Individual critical supplier, as well as the cumulative effects across all Department acquisition and supply activities, to identify critical component acquisition and supply chain vulnerabilities and associated cost increases.
- Key transportation modes and routes.
- Storage and stockpile activities, both at the individual site and cumulatively across the Department.

## ONGOING EFFORTS

The Department has initiated several research and survey efforts to more fully identify and characterize vulnerabilities, impacts, and risks posed by climate change. The Department is implementing a phased installation-level vulnerability assessment approach to: develop methodologies for conducting consistent screening-level vulnerability assessments of military installations world-wide (starting with coastal and tidal installations); leverage recent scientific advancements regarding coastal assessment; and provide a platform to build upon prior to conducting more comprehensive and detailed assessments, whether coastal installations or otherwise.

A screening level survey assessment tool was piloted in the Fall of 2013 and was deployed in 2014 to assess current installation-specific vulnerability to climate impacts. Data from these screening-level assessments will be used to identify areas and installations where more detailed vulnerability assessments may be needed. The Department is using a whole-of-government approach to develop recommendations on regional sea level rise for use in more detailed coastal vulnerability and impact assessments of military installations worldwide, to ensure consistency in conducting these assessments.

As climate science advances, the Department will regularly reevaluate climate change risks and opportunities in order to develop policies and plans to manage its effects on the Department's operating environment, missions, and facilities. Research organizations within the Department, including the Strategic Environmental Research and Development Program (SERDP), are planning and completing studies to characterize climate change impacts in specific regions of the world and develop and pilot vulnerability assessment and adaptation methodologies and strategies.

Research involving coastal assessment method development is scheduled for completion during 2014. As a synthesis of this work, SERDP prepared a report in 2013 - *Assessing Impacts of Climate Change on Coastal Military Installations: Policy Implications* - that drew on the lessons learned from the SERDP-funded research efforts in the context of coastal installations and on the expertise of individuals within the DoD community and other Federal agencies. Work in other regions is still underway, including research designed to understand how: increased temperature trends and changes in the fire regime in the interior of Alaska will impact the dynamics of thawing permafrost and the subsequent effects on hydrology, access to training lands, and infrastructure; and changes in storm patterns and sea levels will impact the Department's Pacific Island installations, including their water supplies.

## GOAL 2 – INTEGRATE CLIMATE CHANGE CONSIDERATIONS ACROSS THE DEPARTMENT AND MANAGE ASSOCIATED RISKS

*Overview. Continue efforts to integrate climate considerations into programs, operations, plans and processes. Develop and implement adaptation strategies to address risks identified through the iterative assessment process in Goal 1.*

Adaptation to climate change cannot be a separate decision-making process, but rather integrated into the Department's existing management processes. Therefore, the Department will review and, as needed, make changes to existing plans, policies, programs, and operations to incorporate climate change considerations. Some additional policy and guidance may be needed to support specific activities and adaptation implementation; however, by and large, the Department will use existing mechanisms to implement policy and guidance that ensure mission resilience.

*"Climate change shapes the operating environment and the missions that DoD must undertake."*

- John Conger, Acting Deputy Undersecretary of Defense for Installations and Environment

March/April 2014,  
Environmental Law Institute Forum

### PLANS AND OPERATIONS

Dynamic environmental conditions, climate-aggravated flashpoints, and increasingly severe natural disasters may require adaptations to how the Department plans and executes operations around the globe. As appropriate, the Department will seek refinements to existing processes and develop new climate-specific plans and guidance.

Specifically, the Department will review and, as needed, modify:

- Plans and guidance unique to climate change related challenges, such as the Department's Arctic Strategy and the Navy's Arctic Roadmap.
- Overarching Department-wide plans and guidance to Combatant Commanders.
- Combatant Command deliberate planning, including Theater Campaign Plans, Operation Plans, Contingency Plans, and Theater Security Cooperation Plans.
- Country-specific cooperation and engagement.
- Department-wide Force planning analyses and processes, including Defense Planning Scenarios and war games.
- Internal policy guidance provided to the Components for the preparation and review of program and budget submissions.
- Total Force capacity and capabilities for DSCA, disaster relief, and humanitarian assistance, to include specific focus on the Reserve Component.

### TRAINING AND TESTING

The Department's long-standing stewardship of its training and testing lands is articulated through its sustainable range program, installation-level Range Complex Master Plans (RCMPs), and the Readiness and Environmental Protection Initiative (REPI). As appropriate, the Department will seek refinements to existing processes and develop new climate-specific plans and guidance.



Specifically, the Department will review and, as needed, modify:

- The sustainable range program, RCMPs, and the REPI program.
- Training and testing plans, including the location, frequency, and duration of training and testing rotations.
- Future Base Realignment and Closure (BRAC) and stationing decisions.
- Health surveillance programs, including increased frequency of health monitoring, and adequacy of personnel protective equipment.



U.S. Marines and Navy sailors range training in the Middle East in 2009 under dry conditions. Credit: USMC Cpl Robert C. Medina

## **BUILT AND NATURAL INFRASTRUCTURE**

DoD installations are in essence “power projection platforms” from which the Department employs Forces across the full spectrum of military operations. As such, adapting to changing climate conditions is critical to the ability of the Department to address current and future threats, and sustain its mission. Effective adaptation planning will ensure the continued availability of the land, air, and water resources at our installations and ranges so the Department can train and operate today and into the future. As appropriate, the Department will seek refinements to existing processes and develop new climate-specific plans and guidance. Specifically, the Department will review and, as needed, modify:

- Installation Master Plans to guide development activities.
- Integrated Natural Resource Management Plans (INRMPs), Integrated Cultural Resource Management Plans (ICRMPs), and Integrated Pest Management Plans (INMPs).
- Design and construction standards.
- Encroachment management plans and programs.
- Stormwater management and other utility systems.
- Facility maintenance and repair cost models.
- Installation-level water resource management plans.
- Emergency preparedness and response planning.

## **ACQUISITION AND SUPPLY CHAIN**

The Department depends upon the private sector for the manufacture of its weapons systems and replacement parts. Many major corporations have recognized the potential effects of climate change on their operations and are aggressively pursuing manufacturing/supply resiliency efforts. As appropriate, the Department will seek refinements to existing processes and develop new climate-specific plans and guidance.

Specifically, the Department will review and, as needed, modify:

- Requirements analysis and acquisition strategies, including strategic reserves and stockpiles for critical components.

- New and existing weapons systems and their associated maintenance plans.
- Storage, distribution, and transportation activities, including transportation modes and routes.

## ONGOING EFFORTS

In 2013, the Department initiated a review of existing directives, policies, manuals, and associated guidance documents and criteria to identify which ones should incorporate considerations of a changing climate. The initial screen identified 58 documents for review, primarily associated with mission assurance, plus those having the potential to adversely impact the Department's mission if climate change risks were not addressed. During 2014, the Department will work within the existing review and update cycle to establish a plan for incorporating consideration of climate change into the appropriate documents.

Many infrastructure managers are already adapting to changing climate factors. Reported rebuilding efforts after extreme storms include upgrading to more wind-resistant structures, burying utility lines underground, changing storage locations for chemicals used in low-lying wastewater treatment plants, protecting water supply wells, and removing vulnerable trees. In preparation for the possibility of more wildfires, installations reported preparing better firebreaks and making timber stand improvements to reduce fire fuel loads.

*"[DoD] needs to consider all aspects of the global security environment and plan appropriately for potential contingencies and the possibility of unexpected developments both in the near and the longer terms. It is in this context that the Department of Defense must consider the effects of climate change ... and how these effects could impact our national security."*

- Dr. Daniel Chiu

Deputy Assistant Secretary of Defense for Strategy and Force Development, Testimony to the Senate Defense Appropriations Subcommittee, May 21, 2014

The 2012 Unified Facilities Criteria for Installation Master Planning (UFC 2-100-01) requires the consideration of climatic conditions along with other variables already being assessed (e.g., changes in mission requirements, surrounding land use and population density, and infrastructure assets and configurations beyond and linking to the installation). The 2013 UFC for High Performance and Sustainable Building Requirements (UFC 1-200-02), mandates the consideration of changing climate conditions when designing buildings, including potential increased heating or cooling requirements. The Department issued a Floodplain Management Policy in February 2014 that establishes requirements to minimize risks when military assets must be located within flood plains.

The Department is exploring the expansion of applications of risk management schemes already in use, primarily within the Defense Critical Infrastructure Program. Decisions on where and how to locate future infrastructure will become increasingly reliant on robust risk management processes that account for dynamic factors associated with climate change. While the initial modifications to risk management methodologies are focused on critical infrastructure, it is anticipated that the Department will utilize them across all decision making in the future.

Similarly, the Department already takes many actions addressing its natural infrastructure. The Natural Resources Conservation Program policy (DoDI 4715.03) was updated in 2011 to incorporate consideration of potential climate change impacts in the management of installation natural resources.

These considerations are documented in the INRMPs which are coordinated with the appropriate fish and wildlife management agencies. The INRMP Implementation Guide (DoDM 4715.03) was issued in November 2013 and provides specific direction for how INRMPs should incorporate climate change. Adaptive management approaches are the foundation for sustainable use of natural resources to support mission needs, meet stewardship requirements, and contribute to ecosystem resilience in the face of climate change. Maintaining ecosystem resilience is a key adaptation strategy given the uncertainty of potential impacts.

The Department is actively conducting research that will support further integration of climate change. This includes projects that: assess potential changes in the intensity, duration, and frequency of extreme precipitation events, including changes in the timing and intensity of snowmelt and subsequent run-off events; include development of adaptive decision frameworks; and address understanding the characteristics of species that are either conservation (management) reliant or adaptable to potential changes in climate and human activities.

### GOAL 3: COLLABORATE WITH INTERNAL AND EXTERNAL STAKEHOLDERS ON CLIMATE CHANGE CHALLENGES

*Overview. Promote deliberate collaboration with stakeholders – across the Department and with other Federal, State, local, tribal and international agencies and organizations - in addressing climate change considerations. This collaboration may include expanded operations, adaptation strategies and research.*

Partnerships are needed to fully ensure the Department's mission is sustainable under climate change. The Department cannot effectively assess its vulnerabilities and implement adaptive responses at its installations if neighbors and stakeholders are not part of the process. The Department's decisions and those of neighboring communities are intrinsically interconnected. Aspects of our mission, such as Force deployment, may be affected by assets outside our control, such as transportation infrastructure.

The complexities and uncertainties of climate change require a whole-of-government approach. The Department already participates in nationwide efforts such as the U.S. Global Change Research Program and the National Climate Assessment sustained assessment process. It also partners with individual agencies such as the National Oceanic and Atmospheric Administration on, for example, the development and operational implementation of a national Earth System Prediction Capability.

The Department is also represented on all of the councils and working groups established under EO 13653 and will continue to participate in federal climate partnerships and other interagency processes. The Department, through the Air Force Weather Agency, contributes earth-space environmental data, receiving nearly 500,000 weather observations and satellite-derived wind profiles each day and sharing these data with the National Climatic Data Center and the Navy's Fleet Numerical Meteorological and Oceanographic Center.

*"Climate change also creates both a need and an opportunity for nations to work together, which the Department will seize through a range of initiatives. We are developing new policies, strategies, and plans, including the Department's Arctic Strategy and our work in building humanitarian assistance and disaster response capabilities, both within the Department and with our allies and partners."*

- 2014 Quadrennial Defense Review

## PLANS AND OPERATIONS

Collaboration is essential to effectively adapting Department plans and operations, and the Department will enhance collaboration within the Department itself, across the Federal Government, and with external entities that include partner nations, non-government organizations, and the private sector. Focus areas include:

- Cooperation with the Coast Guard, other agencies, and other Arctic nations to ensure that the increasingly accessible Arctic region remains peaceful and open to all nations.
- Continued collaboration with the State Department and foreign militaries to improve vulnerability assessments and adaptation efforts.
- Collaboration with interagency, state, and local officials to streamline and integrate responses to extreme weather events in the U.S.
- Cooperation with partner nations to enhance planning, responses, and resilience to the effects of climate change.

## TRAINING AND TESTING

The anticipated effects of climate change on the Department's ability to train and test will drive the need for creative collaboration at multiple levels. Focus areas include:

- Shared use of training and testing assets within the Department and with our Allies.
- Collaboration with maritime and land management agencies.
- Collaboration with the medical and research communities to address health surveillance and disease treatment programs.

## BUILT AND NATURAL INFRASTRUCTURE

Effective collaboration with internal and external stakeholders will be required to address myriad built and natural infrastructure challenges. Focus areas include:

- Collaboration on design, construction, and operation of high-performance sustainable buildings and construction standards.
- Collaboration with surrounding communities for planning climate change adaptation and emergency preparedness and response.
- Collaboration with other land/resource management agencies with regard to encroachment challenges.
- Expansion of partnerships with external, non-federal government land and resource stewardship organizations.
- For overseas installations, coordination with host nation military and other appropriate organizations.



Secretary Hagel hosted 10 defense ministers of the Association of Southeast Asian Nations on April 2, 2014. One topic was collaboration on non-traditional security challenges, such as climate change and natural disasters. Credit: DoD Photo by Erin A. Kirk-Cuomo

## ACQUISITION AND SUPPLY CHAIN

Collaboration with the private sector, including major manufacturing, supply, and transportation corporations, may enable the Department to leverage best practices and adaptation strategies to increase resiliency in the Department's acquisition and supply enterprises. Focus areas include:

- Collaboration with external producers and suppliers, transportation networks, and inventory management entities.
- Collaboration with industry as part of the acquisition and procurement process.
- Collaboration within the Department to increase shared use of supply/resupply networks and maintenance facilities.
- Collaboration with other Federal Agencies to leverage best practices and adaptation strategies.



## Annex 1. Cross Reference: EO 13653 Implementation Requirements vs. Roadmap

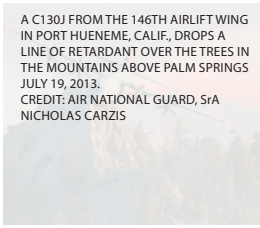
| Preparing Federal Agency Climate Change Adaptation Plans in Accordance with Executive Order 13653 (12/19/13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Department of Defense FY 2014 Climate Change Adaptation Roadmap                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>Planning Requirements</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | NA                                                                                                |
| <b>Affirming Agency Commitment – Policy Framework for Climate Change Adaptation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Policy Framework for Climate Change Adaptation                                                    |
| <b>Planning for Climate Change Related Risk:</b> Section 5(a) of E.O. 13653 states that, “each agency shall develop or continue to develop, implement, and update comprehensive plans that integrate consideration of climate change into agency operations and overall mission objectives...”                                                                                                                                                                                                                                                                                                                                                                                                                           | NA                                                                                                |
| i. identification and assessment of climate change related impacts on and risks to the agency’s ability to accomplish its missions, operations, and programs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Goal 1: Identify and assess the effects of climate change on the Department                       |
| ii. description of programs, policies, and plans the agency has already put in place, as well as additional actions the agency will take, to manage climate risks in the near term and build resilience in the short and long term                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Goal 2: Integrate climate change considerations across the Department and manage associated risks |
| iii. a description of how any climate change related risk identified pursuant to paragraph (i) of this subsection that is deemed so significant that it impairs an agency’s statutory mission or operation will be addressed, including through the agency’s existing reporting requirements                                                                                                                                                                                                                                                                                                                                                                                                                             | Goal 1: Identify and assess the effects of climate change on the Department                       |
| iv. a description of how the agency will consider the need to improve climate adaptation and resilience, including the costs and benefits of such improvement, with respect to agency suppliers, supply chain, real property investments, and capital equipment purchases such as updating agency policies for leasing, building upgrades, relocation of existing facilities and equipment, and construction of new facilities                                                                                                                                                                                                                                                                                           | Goal 2: Integrate climate change considerations across the Department and manage associated risks |
| v. a description of how the agency will contribute to coordinated interagency efforts to support climate preparedness and resilience at all levels of government, including collaborative work across agencies’ regional offices and hubs, and through coordinated development of information, data, and tools, consistent with section 4 of this order. [Note: section 4 is ‘providing information, data, and tools....’]                                                                                                                                                                                                                                                                                               | Goal 3: Collaborate with internal and external stakeholders on climate change challenges          |
| <b>Modernizing Federal Programs and Policies to Support Climate Resilient Investment:</b> Section 2(a) of E.O. 13653 states that Federal agencies shall address efforts to modernize Federal programs and policies “(To) support the efforts of regions, States, local communities, and tribes, ... consistent with their missions and in coordination with the Council on Climate Preparedness and Resilience (Council) established in section 6 of this order...” That section also states that agencies shall “report on their progress in achieving the requirements identified above, including accomplished and planned milestones, in the Agency Adaptation Plans developed pursuant to section 5 of this order.” | NA                                                                                                |
| IV.i. identify and seek to remove or reform barriers that discourage investments or other actions to increase the Nation’s resilience to climate change while ensuring continued protection of public health and the environment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Goal 1: Identify and assess the effects of climate change on the Department                       |
| IV.ii. reform policies and Federal funding programs that may, perhaps unintentionally, increase the vulnerability of natural or built systems, economic sectors, natural resources, or communities to climate change related risks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Goal 2: Integrate climate change considerations across the Department and manage associated risks |
| IV.iii. identify opportunities to support and encourage smarter, more climate-resilient investments by States, local communities, and tribes, including by providing incentives through agency guidance, grants, technical assistance, performance measures, safety considerations, and other programs.                                                                                                                                                                                                                                                                                                                                                                                                                  | Goal 3: Collaborate with internal and external stakeholders on climate change challenges          |
| <b>Senior Level Commitment...</b> updated Plans must be reviewed and signed by the agency representative to the Council.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Policy Framework for Climate Change Adaptation                                                    |

## Annex 2. High-Level Summary of Potential Impacts

| Potential Effects of Climate Change on the Department                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Plans and Operations</b> <ul style="list-style-type: none"> <li>Increased demand for DSCA.</li> <li>Increased demand for disaster relief and humanitarian assistance overseas.</li> <li>Increased need for air, sea, and land capabilities and capacity in the Arctic region.</li> <li>Altered, limited or constrained environment for military operations.</li> <li>Instability within and among other nations.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Training &amp; Testing</b> <ul style="list-style-type: none"> <li>Increased number of 'black flag' (suspended outdoor training) or fire hazard days.</li> <li>Decreased training/testing land carrying capacity to support current testing and training rotation types or levels. Some training/testing lands may lose their carrying capacity altogether.</li> <li>Increased dust generation during training activities, which may interfere with sensitive equipment, resulting in greater repairs, or may require more extensive dust control measures to meet environmental compliance requirements.</li> <li>Stressed threatened and endangered species and related ecosystems, on and adjacent to DoD installations, resulting in increased endangered species and land management requirements.</li> <li>Increased operational health surveillance and health and safety risks to the Department's personnel.</li> <li>Increased maintenance/repair requirements for training/testing lands and associated infrastructure and equipment (e.g., training roads, targets)</li> </ul> |
| <b>Built &amp; Natural Infrastructure</b> <ul style="list-style-type: none"> <li>Increased inundation, erosion, and flooding damage.</li> <li>Changing building heating and cooling demand, impacting installation energy intensity and operating costs.</li> <li>Disruption to and competition for reliable energy and fresh water supplies.</li> <li>Damage from thawing permafrost and sea ice in Alaska and the Arctic region.</li> <li>Increased ecosystem, wetland, sensitive species, and non-native invasive species management challenges.</li> <li>Increased maintenance requirements for runways or roads to remain operable during extreme hot days.</li> <li>Changed disease vector distribution, increasing the complexity and cost of on-going disease management efforts.</li> </ul>                                                                                                                                                                                                                                                                                         |
| <b>Acquisition &amp; Supply Chain</b> <ul style="list-style-type: none"> <li>Changed operational parameters for current and planned weapons and equipment, resulting in increased associated maintenance requirements or requirements for new equipment.</li> <li>Reduced availability of or access to the materials, resources, and industrial infrastructure needed to manufacture the Department's weapon systems and supplies.</li> <li>Interrupted shipment, delivery or storage/stockpile of materials or manufactured equipment and supplies.</li> <li>Alterations in storage and stockpile activities.</li> <li>Reduced or changed availability and access to food and water sources to support personnel.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                |

## ON THE FRONT COVER

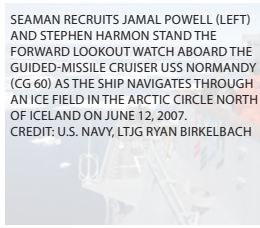
A C130J FROM THE 146TH AIRLIFT WING IN PORT HUENEME, CALIF., DROPS A LINE OF RETARDANT OVER THE TREES IN THE MOUNTAINS ABOVE PALM SPRINGS JULY 19, 2013.  
CREDIT: AIR NATIONAL GUARD, SrA NICHOLAS CARZIS



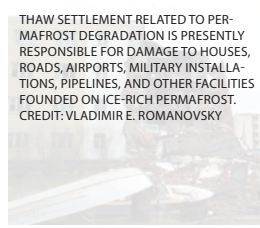
DAMAGE FROM SEVERE PRECIPITATION AND FLASH FLOODING AT FT. IRWIN, CALIFORNIA, AUGUST 2013.  
CREDIT: U.S. ARMY



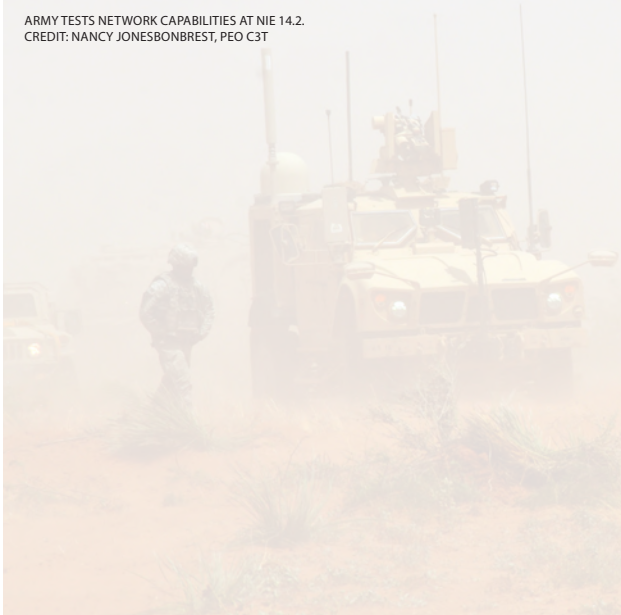
SEAMAN RECRUITS JAMAL POWELL (LEFT) AND STEPHEN HARMON STAND THE FORWARD LOOKOUT WATCH ABOARD THE GUIDED-MISSILE CRUISER USS NORMANDY (CG 60) AS THE SHIP NAVIGATES THROUGH AN ICE FIELD IN THE ARCTIC CIRCLE NORTH OF ICELAND ON JUNE 12, 2007.  
CREDIT: U.S. NAVY, LTJG RYAN BIRKELBACH



THAW SETTLEMENT RELATED TO PERMAFROST DEGRADATION IS PRESENTLY RESPONSIBLE FOR DAMAGE TO HOUSES, ROADS, AIRPORTS, MILITARY INSTALLATIONS, PIPELINES, AND OTHER FACILITIES FOUNDED ON ICE-RICH PERMAFROST.  
CREDIT: VLADIMIR E. ROMANOVSKY



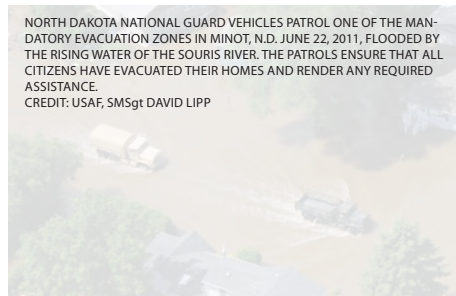
ARMY TESTS NETWORK CAPABILITIES AT NIE 14.2.  
CREDIT: NANCY JONESBONBREST, PEO C3T



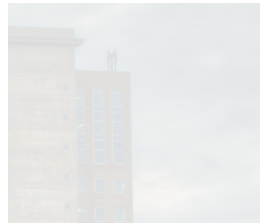
HATCHLINGS FROM ENDANGERED SEA TURTLES ARE RELEASED INTO THE ATLANTIC OCEAN NEAR KENNEDY SPACE CENTER/CAPE CANAVERAL.  
CREDIT: NASA, KIM SHIFLETT



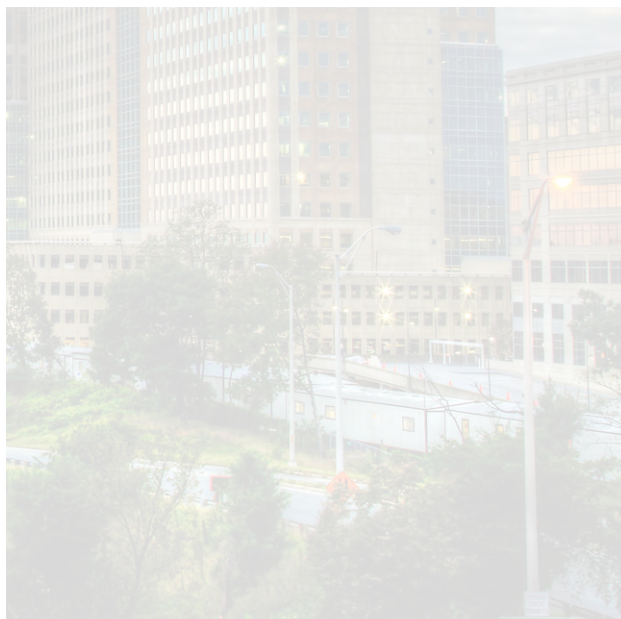
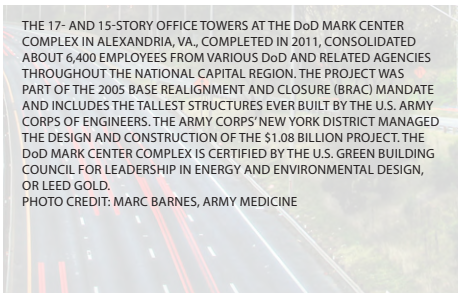
NORTH DAKOTA NATIONAL GUARD VEHICLES PATROL ONE OF THE MANDATORY EVACUATION ZONES IN MINOT, N.D. JUNE 22, 2011, FLOODED BY THE RISING WATER OF THE SOURIS RIVER. THE PATROLS ENSURE THAT ALL CITIZENS HAVE EVACUATED THEIR HOMES AND RENDER ANY REQUIRED ASSISTANCE.  
CREDIT: USAF, SMSgt DAVID LIPP



## ON THE BACK COVER



THE 17- AND 15-STORY OFFICE TOWERS AT THE DoD MARK CENTER COMPLEX IN ALEXANDRIA, VA., COMPLETED IN 2011, CONSOLIDATED ABOUT 6,400 EMPLOYEES FROM VARIOUS DoD AND RELATED AGENCIES THROUGHOUT THE NATIONAL CAPITAL REGION. THE PROJECT WAS PART OF THE 2005 BASE REALIGNMENT AND CLOSURE (BRAC) MANDATE AND INCLUDES THE TALLEST STRUCTURES EVER BUILT BY THE U.S. ARMY CORPS OF ENGINEERS. THE ARMY CORPS' NEW YORK DISTRICT MANAGED THE DESIGN AND CONSTRUCTION OF THE \$1.08 BILLION PROJECT. THE DoD MARK CENTER COMPLEX IS CERTIFIED BY THE U.S. GREEN BUILDING COUNCIL FOR LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN, OR LEED GOLD.  
PHOTO CREDIT: MARC BARNES, ARMY MEDICINE







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