CLIMATE CHANGE LESSONS FROM THE US MILITARY

WHAT JAPANESE INDUSTRY CAN LEARN FROM ANOTHER GLOBAL ENTERPRISE

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THE CENTER FOR CLIMATE AND SECURITY

AUTHORS
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VICE ADMIRAL DENNIS MCGINN, U.S. NAVY (RETIRED)

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Cover Photo:
Port of Kobe from the sky in Kobe City, Hyogo prefecture, Japan. December 2015
663highland / WikiMedia

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FOREWORD

The US military and Japanese industry are both facing an operating environment that is being reshaped by climate change. These two seemingly disparate entities share many of the same concerns, such as business continuity; many of the same dependencies, including on municipal infrastructure to support their operations; and many of the same vulnerabilities to climate impacts, such as hazards to ports and coastal infrastructure exposed to sea level rise and extreme weather. The US military also has a physical presence in many of the same environments as Japanese industry, including in East and Southeast Asia, and so faces similar concerns in this particularly disaster-prone region.

For these reasons, Japan's business leaders may find useful lessons in how the global U.S. military has approached managing its climate-related hazards, in order to preserve long-term competitive advantage. By taking a frank and comprehensive approach to climate-related risk management, starting by acknowledging the risks and planning and resourcing to avoid them (and avoid making them worse), they can support achieving their missions.

This report presents examples of how the US military has dealt with key climate-related challenges, including physical exposure to sea level rise and extreme weather, along with the wider potential of climate change impacts to exacerbate instability. The key takeaway: it is in both entities' interests to manage the unavoidable and avoid the unmanageable climate change-related threats.

Vice Admiral Dennis McGinn, U.S. Navy (Retired)

Advisory Board, the Center for Climate and Security

Former Assistant Secretary of the Navy for Energy, Installations and Environment

INTRODUCTION

WHY ARE CLIMATE RESILIENCE LESSONS FROM THE US MILITARY APPLICABLE TO JAPANESE INDUSTRY?

The global environment is changing. Temperatures are rising, as are sea levels. Storms are becoming wetter and more intense as oceans warm. Food and water insecurity create new challenges for governments as they seek to protect their citizens. The Asia-Pacific is the most disaster-prone region of the world; since 1970 a person living in the region has been five times more likely to be affected by natural disasters than a person living outside it, and escalating disaster risk is outpacing resilience efforts.[1] According to the United Nations Economic and Social Council for Asia and the Pacific, annual economic losses in the region due to disasters could exceed USD$160bn by 2030,[2] and an estimated 40% of global economic losses from disasters from 2015-2030 will be in the Asia-Pacific.[3]

As these and other factors drive change, large global enterprises will need to adapt in order to minimize disruptions to their operations. One organization that has spent considerable time contemplating these changes has been the United States (US) military. While the US military may not be closely associated with environmental causes or agendas, it is very concerned with any factor that may impose constraints on its ability to perform its national defense missions. Thus, it is increasingly concerned about climate change.

The US military has approached climate change as a large organization seeking to adapt to impacts on operations and business continuity. This approach may be applicable to other large enterprises seeking to operate in similar environments, whether in copying successful approaches or avoiding missteps that put billions of dollars at risk.

From a climate preparedness standpoint, international Japanese firms and industries share many common characteristics with the US military. Each manages a vast array of infrastructure – including in Asia and the Pacific,[4] maintain a regional or global presence and operate extensive supply and logistics networks. Each is dependent on the local government and community for licensing, staffing, and a range of services essential to operational efficiency. And in times of natural disaster or other crisis, each may be called upon to make their assets and capabilities available to support the community which houses them. Thus, there is much that the US military and Japanese businesses in Asia can share and learn from each other in the realm of climate resiliency.

Each of these characteristics and dependencies is, in turn, vulnerable to climate impacts. Storms and floods can damage infrastructure and disrupt operations; sea level rise can increase the destructive power of storm surge and cause coastal flooding and inundation; and changes in water availability, temperatures and other climate extremes can disrupt operations, damage assets and imperil the health and safety of people. Climate impacts, when they strike, can destroy up to 100% of the value of the facility or operation.

While it is not possible to predict with precision when and where this will occur, predictive capabilities are enabling more high-confidence assessments of risk location and characterization.

Like the US military, Japanese industry has an interest in bolstering resilience and ensuring business continuity. The risk management approach used by the US military can offer important lessons for Japanese industry. Both also operate in a part of the world that is growing in international strategic significance. This paper discusses some of the similarities between military and industrial enterprises in terms of climate hazard exposure. It examines not only near-term and direct climate change impacts but also some of the higher-order impacts and repercussions of these changes, such as impacts on political stability. With an understanding of the US Department of Defense (DoD) response to climate change, Japanese companies will be better positioned to 'manage the unavoidable and avoid the unmanageable'.

LANGLEY AIR FORCE BASE, Va. -- This photo of Memorial Park was taken during Hurricane Isabel on Sept. 18, 2003. Isabel left 32 fatalities and $1.9 billion in damages throughout Virginia. U.S. Air Force photo/Tech. Sgt. Ben Bloker

THE COMMON THREAT:

PHYSICAL VULNERABILITIES TO CLIMATE CHANGE

Physical infrastructure is foundational to both military capabilities and business operations. Both the US military and Japanese industry rely on a significant international footprint, with complex physical infrastructure across multiple climate zones. The US Department of Defense maintains a global property portfolio consisting of 568,383 facilities, valued at approximately $1.05 trillion, at 4,793 sites worldwide.[5] DoD facilities are located in every US state, in multiple US Territories, and in 42 nations. Across the Pacific, more than 40,000 DoD buildings sit on installations and sites comprising more than 3,600 square kilometers (1,400 square miles); this infrastructure enables systems including force projection, training, equipping, Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), supply, humanitarian, and other critical missions.[6] In a January 2018 publication, around half of US-based installations reported having been affected by climate change impacts, from flooding and wind damage to extreme temperatures, drought and wildfires.[7]

Military bases are in essence small cities, with much of the same infrastructure and footprint found in urban areas. There are industrial facilities, office buildings, and warehouses; ports with piers and drydocks; air bases with hangars and runways; research labs, data centers, communications hubs and more. Consequently, the physical vulnerabilities of DoD infrastructure and installations are similar to those owned by private companies with such operations.

Moreover, these installations rely on local communities for utilities (electricity, water and wastewater), transportation networks (such as roads and rail networks), civilian employees and some of their housing, whether a base is located within the US or in another nation. As such, the resiliency of neighboring communities and civilian populations is directly related to the resiliency of military installations to climate change impacts. Regardless of the location of the installation, the neighboring civilian and military communities are dependent on each other. They depend on extensive supply chains that may have vulnerabilities that primary infrastructure may not. In other words, each enterprise must assess not only its own vulnerabilities, but the vulnerabilities of the various municipal and state support and supply networks upon which it depends.

This paper explores how the DoD has begun to consider climate vulnerabilities in several key areas and draws out implications for Japanese industry which shares these vulnerabilities in its global operations.

SEA LEVEL RISE AND FLOODING

The most direct threat to DoD infrastructure around the world is sea level rise and the associated flooding, storm surge and increased impact from storms and high tides that come with a higher sea level baseline. In fact, the US military capability depends on "95,471 miles of coastline along which 1,774 US military sites reside across the globe."[8] In the Asia-Pacific region, this is particularly acute, as most installations are based around ports or on islands.[9]

As outlined in the Center for Climate and Security's Military Expert Panel Report on Sea Level Rise and the Military Mission, the impact of sea level rise on the US military could mean that "major transportation, command and control, intelligence and deployment hubs may face erratic outages, or operational disruptions, due to sea level rise and storm surge. In that context, the ability of US military forces to fulfill mission requirements will likely be hindered by greater costs, delays and insufficient assets at critical junctures."[10]

Furthermore, for the approximately 10 percent of US military installations and training grounds located along low-lying and exposed coastlines, the long-term effects of sea level rise in terms of flooding will be significant. Of the 292 US-based military sites within 2 kilometers of the coastline, 45% have reported that they were affected by flooding in recent years.[11]

However, the effects of sea level rise go well beyond slow-onset effects. As noted by The Strategic Environmental Research and Development Program (SERDP), the Department of Defense's (DoD) environmental research program, potential risks to installations include:

- Loss or damage to mission-essential infrastructure including coastal development; energy and water infrastructure;
- Loss or degradation of mission capabilities;
- Loss of training and testing lands, including beaches and barrier islands;
- Loss of transportation means, facilities and/or corridors;
- Loss of habitat and associated natural resources;
- Increased risk of storm damage and coastal erosion; and,
- Increased potential for loss of life.[12]

MV Delta Mariner docks at Meck Island with support equipment for use in the Missile Defense Agency's two-stage intermediate/long-range launch vehicle (LV-2) program. January 2009 U.S. Missile Defense Agency

Like the US military, Japanese industry relies on access to transportation networks such as ports to move quantities of goods and equipment rapidly. Because military bases and economic infrastructure often share a proximity to the sea for strategic reasons, climate change impacts such as higher sea levels and more frequent and powerful storms, mean both commercial infrastructure and installations along the coast face trade-offs in terms of increased vulnerability. The cost of protecting these assets can be enormous – for example, adapting the Asia-Pacific's biggest ports to operate with 21st century climate impacts is projected to cost up to $49bn.[13]

Many industrial facilities that provide components for Japan's automotive and electronics industries are located near the ports of Asia's delta megacities. These low-lying population centers arose and flourished due in part to ease of trade access via rivers and sea. These same attributes make them vulnerable to coastal climate change risks, including sea level rise, more destructive storm surges and coastal flooding and inundation. Where groundwater extraction contributes to land subsidence, such as in Jakarta and Bangkok, risks associated with sea level rise may be particularly acute.[14]

CASE STUDY: HAMPTON ROADS, VIRGINIA

While they are a significant distance from most Japanese industrial facilities, the military installations at Hampton Roads, Virginia, on the East Coast of the United States, face climate hazards similar to those of industrial facilities around Jakarta, Bangkok or the Pearl River Delta, due to being located in a low-lying delta. They also face difficult decisions around costs associated with adapting or relocating these facilities. The Hampton Roads area houses the highest concentration of military force in the world, with over 100,000 military and 40,000 civilian personnel serving in the area, and facilities from each branch of the military. It is home to NATO's Allied Command Transformation, US Fleet Forces Command, the US Air Force's Air Combat Command, the US Marine Corps Forces Command and the US Army Training and Doctrine Command. It also serves as, the home base of the US Navy's Atlantic Fleet.

Aerial view of Langley Air Force Base.
1st Fighter Wing Public Affairs Office / WikiMedia

With low-lying topography, Hampton Roads already experiences regular tidal flooding that disrupts base operations. For example, the main access road to Naval Station Norfolk floods multiple times a year, impeding even emergency access to the installation. Such interruptions to day-to-day base operations cost time, attention and budgetary resources. In 35 years, these areas are projected to be underwater for 10 percent of the year.[15] Studies project that by 2040, the main access road to Naval Station Norfolk will be inundated, and impassable, for 2-3 hours per day due to normal tide action.[16]

In addition to obstructing transportation, high tides and storm surge also periodically necessitate shutting off the electricity and steam lines that run underneath the piers that service the US Navy's ships. Piers built recently are several feet higher than those built in the mid-20th century, to accommodate higher seas. Flood walls are being constructed not only to protect the Hampton Roads area's coastal urban centers but also high-value military infrastructure such as dry docks.

SEA LEVEL RISE AND SALTWATER INTRUSION

While sea level rise may conjure up images of infrastructure sinking below the water, multiple effects manifest before such a dramatic outcome. In addition to coastal flooding and storm surge, which will impact infrastructure long before sea levels rise above current ground elevation, rising sea levels salinize the groundwater and soil in coastal regions. This has been an issue of particular interest to the US Department of Defense because of its sprawling footprint in the region. The DoD has presence in Japan, Australia, Republic of Korea, Hong Kong, Singapore, Cambodia, and Diego Garcia; on Hawaii and Guam; and in the Commonwealth of the Northern Marianas Islands and the Marshall Islands.[17] Coastal and small-island installations are critical for US military presence in the region, providing important operational, logistics, and training functions.

While most of the industrial facilities that Japanese industry rely on may not face freshwater scarcity due to aquifer salination, this hazard presents a lesson-learned about the merits of conducting thorough climate risk assessments before making strategic investments in infrastructure that impacts strategic competitiveness. Specifically, the DoD, through its Strategic Environmental Research and Development Program (SERDP), determined that Kwajalein – home to the Ronald Reagan Ballistic Missile Test Site – would be unable to support human habitation due to the lack of available drinking water as early as 2030.

CASE STUDY: KWAJALEIN ATOLL

Kwajalein Atoll, in the Marshall Islands, hosts the Ronald Reagan Ballistic Missile Test Site, as well as 1300 Americans, including military service members, Department of Defense civilians and contractors. Of particular note, the DoD has continued to make investments at this location, including more than a billion dollars for new radar capabilities to track objects in space.[18]

However, recent DoD research shows that this strategic location is at serious risk due to sea level rise. In 2018, a report titled "The Impact of Sea Level Rise and Climate Change on Department of Defense Installations on Atolls in the Pacific Ocean,"[19] concluded that the combination of sea level rise-driven

Composite "true color" multispectral satellite image of Kwajalein Atoll, Republic of Marshall Islands.
NASA/USGS

inundation, combined with annual wave-driven flooding, will be of sufficient volume to make the groundwater non-potable year-round. Additionally, at 0.4 meters of sea-level rise, much of the isthmus that connects Roi and Namur will be flooded annually, negatively impacting the facilities in those locations. The report assessed several scenarios. Under the scenario that reflects current rates of increase of carbon emissions, potable groundwater will be unavailable as early as 2030.

This provides a key lesson: that infrastructure investments require a sound understanding of future climate change risks, in order to avoid becoming stranded assets.

EXTREME WEATHER

While sea level rise and coastal flooding are day-to-day challenges that will proceed at a predictable pace (within a bounded range of uncertainty), the biggest threat of damage to both industrial and military facilities comes from extreme weather. In the last year alone, the DoD has endured billions of dollars of damage from extreme weather. Tyndall Air Force Base in Florida was nearly wiped out by Hurricane Michael in October 2018, while record flooding from Hurricane Florence inundated Camp Lejeune, a US Marine Corps base, a month earlier. At Tyndall, the winds not only damaged the buildings, but also expensive F-22 aircraft stowed within hangars to ride out the storm. Record flooding in Nebraska in March 2019 swept through Offutt Air Force Base, home of US Strategic Command. The recovery costs for these three bases alone are reportedly over $8 billion. Looking to the Pacific, typhoons have buffeted military bases in Guam and the Northern Marianas, though imposing much less recovery costs.[20] Storm surge, high winds and power disruptions can halt operations and damage structures and property, draining both human and financial resources diverted for recovery.

An aerial view of Offutt Air Force Base and the surrounding areas affected by flood waters March 17, 2019. An increase in water levels of surrounding rivers and waterways caused by record-setting snowfall over the winter in addition to a large drop in air pressure caused widespread flooding across the state of Nebraska. U.S. Air Force photo by TSgt. Rachelle Blake

Whether or not facilities can withstand climate shocks and stressors, and how quickly and completely they are able to bounce back after disruption, will increasingly determine mission assurance for the military as well as business continuity for the private sector. The US military relies in part on diesel generators during electricity disruptions. However, given that diesel is an inefficient response for medium- to long-term outages, the DoD is pursuing a more comprehensive energy resilience strategy including more on-site energy production, microgrids and a diversified energy portfolio.

Admiral Philip Davidson, the Commander of Indo-Pacific Command, the US military entity in the Asia-Pacific, was asked about the impact of climate change in the Pacific region when testifying before the Senate Armed Services Committee in early 2019. He highlighted the recovery efforts on Tinian and Saipan, noting "A contribution of Title X forces in significant numbers, to help clear debris, to help fix roofs, to help restore the infrastructure there… Our assistance in terms of humanitarian assistance and disaster relief, our ability to command and control, to marshal troops, to deliver logistics is important training for the region".[21] General Joseph Dunford, the Chairman of the Joint Chiefs of Staff, separately observed, "I can't think of a year since I've been on active duty that we haven't conducted at least one operation in the Pacific… due to extreme weather."[22] Warmer waters caused by climate change are provoking high-energy storms with strong winds and intense precipitation, wreaking havoc on both infrastructure and recovery capabilities.

This raises key risk management questions for both the US military and Japanese industry. Should a facility located in a climate-vulnerable area be "hardened" for resilience, or relocated? What standards and calculations should guide these decisions? And what constitutes a "climate-ready" operation?

The nominee for Commandant of the United States Marine Corps, Lieutenant General Michael Berger, told a Senate committee in May, 2019 that these issues have been brought into sharp focus as they wrestle with rebuilding Camp Lejeune in North Carolina, which was damaged significantly in 2018's hurricane season. He noted that "the new standards for… military construction are absolutely critical. When we recover from a storm like we are now in North Carolina, we need to look at the location of the buildings. We need to look at the construction standards of the buildings to make sure that they'll survive what the climate is going to throw at them."[23] This is not only true when one rebuilds after a storm has damaged facilities, but when investments are being considered in the first place.

Some of these standards have been imposed by Congress, as is the case for requirements to build higher in floodplains,[24] and others are being developed as the military considers how to rebuild after increasingly difficult hurricane seasons.[25] These are live issues for the US military,[26] and should be treated as such by Japanese industry as well.

TAKING RISK ON BOARD

This message is starting to resonate within the financial community. Firms seeking to secure insurance, either to hedge business risk or to access bank funding, can expect costs to rise with extreme weather projections. Thus risk departments should start taking steps to incorporate climate resilience into investment, rebuilding and refurbishment, operational planning and location costs after storms and decisions – before external parties start asking difficult questions.

This leads to the question of where to start. A myriad of climate data has been generated by the UNFCCC process, with different modeling assumptions based on different warming, or "climate-forcing," scenarios. The challenge is how to localize this data for its impact on specific geography or facility; and how to translate a range of risk levels into business impact, to inform executive decision making.

Tools for accomplishing this localization and translation are under development by a number of private firms, as well as reinsurance companies. One notable initiative is underway at the World Bank. As many major investors are aware, the World Bank has already established the gold standard for assessing and managing social and environmental risk in investments with their eight International Finance Corporation (IFC) Performance Standards.[27] But while climate change and adaptation are mentioned in IFC Performance Standards 1 and 5, the level of detail needed for a high-confidence decision has grown more rapidly than the ability of companies to project and interpret this risk.

The World Bank Group, led by the IFC Climate Business office, is working on a fix. They are developing a set of sector-specific models populated with data from the US National Center for Atmospheric Research, one of the most advanced climate data collection and modeling agencies in the world. Using these tools, businesses in different industries can project different climate scenarios on a site-specific basis, entering

enterprise-specific data on asset costs, logistics dependencies, and such. The output will be a set of outcomes, and costs, that can be expected over time. Based on models such as these, business executives, as well as their financial partners, will be able to make more informed decisions and set boundaries for future investment.

Ultimately, the decision whether to raise the level of a port or airport, relocate a supply chain cluster, or close a long-standing military installation, rests with executive management. Business decision-makers and military decision-makers alike will need to weigh the magnitude and probability of risk to people and operations versus the benefits of maintaining or extending the status quo. In doing so, investment in proper modeling in the short term can save lives and costs in the medium term and beyond.

A Chemical plant in Keihin industrial area. The Keihin Industrial Zone encompasses the metropolis of Tokyo and includes part of Kanagawa ken (prefecture). The heart of the zone is the Kawasaki and Yokohama harbour area, a large industrial belt along the northwestern shore of Tokyo Bay. Tomo Yun / Yun Stock Photos

CLIMATE AND STABILITY

In addition to its concern over the physical risks that climate change presents, the Department of Defense seriously considers the strategic risks of climate change, in particular its effect as a "threat multiplier." Climate change can exponentially increase the threat of insecurity and instability by worsening existing crises, adding stress to fragile nations and overwhelming the coping capacities of currently stable societies and countries. This risk has been acknowledged at the very highest levels of the Department and across multiple Administrations.

The DoD's Quadrennial Defense Review – its foundational strategy document – cited the threat multiplier dynamic in 2010 and 2014. Former Secretary of Defense, James Mattis, noted in 2016 that "Climate change is impacting stability in areas of the world where our troops are operating today… [T]he effects of a changing climate — such as increased maritime access to the Arctic, rising sea levels, desertification, among others — impact our security situation."[28] The US military's current highest-ranking officer, Chairman of the Joint Chiefs of Staff General Joseph Dunford, stated, "When we look at… climate change, it's in the category of sources of conflict around the world and things we have to respond to… [W]hen you look at a source of conflict – shortages of water and those kind of things – those are all sources of conflict. So it is very much something that we take into account in our planning as we anticipate when, where and how we may be engaged in the future and what capabilities we should have."[29] Former commander of US Indo-Pacific Command, Admiral Samuel J. Locklear, called climate change the biggest long-term security threat in the Asia-Pacific region.[30]

As climate change impacts become stronger, they exacerbate the drivers of instability by, for example, changing resource distribution dynamics, affecting power balances, driving economic crises and placing additional strain on struggling governments. For example, this could mean that a country's elites are able to monopolize or distribute disaster relief supplies or recovery funds to consolidate their power, which can exacerbate existing tensions and political fault lines within societies, which in turn could increase grievances that find expression in political unrest or violence. These crises can overwhelm the ability of developing or unstable governments to manage conflicts nonviolently.

In these ways, climatic changes multiply existing environmental, social, political and economic risks. A recent Stanford University study demonstrated what social scientists and military experts have observed for years: climate change has a disproportionately negative effect on the economies of warm countries.[31] The broader consequences of a changing climate could increase the prevalence of negative outcomes including more widespread food and water insecurity; forced displacement and rapid, unplanned migration; increasing vulnerable, under-served populations with limited livelihood options contributing to the expansion and strengthening of violent extremist organizations and other impacts which are debilitating to civil society. Such outcomes not only affect human security, but also endanger a reliable and stable business environment.

APRA HARBOR, Guam (April 12, 2013) - Japan Maritime Self-Defense Force (JMSDF) submarine Hakuryu (SS-503) visits Guam for a scheduled port visit. U.S. Navy photo by Mass Communication Specialist 1st Class Jeffrey Jay Price.

Clearly, instability is not good for business. Transport, operations and production will not function effectively or efficiency when employees are not safe at home or commuting to work. Markets are significantly disrupted when the people have no faith that the government will ensure their basic safety.

For this reason, industry should closely monitor both the stability of nations that comprise either key trading partners or critical elements of their supply chain, and their national capacity to respond to climate impacts. Countries with lower costs of labor often also have lower institutional capabilities for implementing climate resilience measures. This renders them more likely to be disrupted by climate impacts and likely to take longer to recover after shocks.

The Center for Climate and Security's recent report 'Japanese Industry in an Unstable Climate: Reducing Exposure to the Security Implications of Climate Change' indicates that Japan is vulnerable to climate security risks in southeast Asia.[32] With 17% of its imports and key elements of its automotive and electronics supply chains located in nations with medium or high climate security risks, Japanese industries are not immune from the climate vulnerabilities of neighboring nations.

LESSONS FROM THE US DEPARTMENT OF DEFENSE RESPONSE

Given the similarities between the US military enterprise and Japanese industry's footprint throughout the Pacific, and given the assessments that DoD has made as to the risk that climate change poses to its global operations, what lessons can industry learn from the DoD response?

1) Acknowledge the Risk

Military recognition of climate threats reaches back across decades, including through both Republican and Democratic administrations in the US.[33] Multiple DoD reports and assessments by the US Intelligence Community have confirmed that security experts within the government recognize the threat of climate change.[34] For the US military and Intelligence Community, these matters are simply about risk management.

This view extends from leaders such as Former Secretary of Defense James Mattis and Chairman of the Joint Chiefs General Joseph Dunford to include twenty-eight senior DoD officials in public statements and testimony before Congress.[35] This public leadership on climate security has enabled pragmatic policymakers throughout the Department to develop policy and projects to mitigate the threat and build resiliency.

To the DoD, climate change is not a problem they will solve single-handedly – although it has spent millions on energy efficiency and renewable energy. Instead climate change is a risk to current operations which must be foreseen, modeled and adequately adapted to in terms of both facilities and operations. Given its roughly $1 trillion of infrastructure at risk around the globe, the impacts of extreme weather, sea level rise, drought and wildfire will be costly. And given an employee base of more than 2 million military and civilian personnel around the world, climate change puts lives at risk – both directly with extreme weather and indirectly by feeding instability and conflict.

At a basic level, the most important step for Japanese industry to take to protect its interests is to acknowledge the problem. Corporate leaders could help reduce and prepare for risks by signaling that their operational teams can and should incorporate these risks into strategic investments and decision-making.

It is also in the interest of Japanese corporate leaders to acknowledge that operations in certain regions or nations are riskier than others. Key actions could include identifying, measuring and taking steps to manage the risks to their investments which may be impacted by climate change. It is in a firm's interest and their stockholders' interest to incorporate all risks as they make strategic decisions. This is not limited to climate risks, but as the risks from climate change increase, it is also increasingly important to better integrate and prepare for them.

2) Plan and Resource for Avoiding Climate Risk

At the Department of Defense, the annual construction budget is roughly $10 billion. While this is generally considered to be an inadequate recapitalization budget for the $1 trillion worth of infrastructure under management, it remains a substantial amount of money. DoD's first step in adapting to climate change, therefore, was to incorporate climate risks into new construction projects. For example, in 2014, the Department issued guidance directing the military departments (Army, Navy, Marines, Air Force) to minimize new construction in floodplains, under the assumption that floods would be occurring more frequently. In those cases where mission requirements necessitated construction in such a location, they were asked to incorporate design features that would minimize the damage from expected flooding.

Whether because of this guidance or not, the catastrophic flooding at Offutt Air Force Base in 2019 did not damage the new billion-dollar Strategic Command headquarters,[36] as it had been sited on higher ground than much of the base. On the other hand, the new billion-dollar radar facility on Kwajalein Atoll, mentioned earlier, is now jeopardized by the fact that sea-level rise may eliminate the island's drinking water as early as 2030.[37] The first step in advance planning, therefore, is protecting future investments.

The US Congress has been particularly active in encouraging the military to manage climate risks, directing DoD to incorporate climate data into installation planning and mandating vulnerability assessments. This has been seen as a way to protect future investments and facilities.

In addition, the Department has been increasing its emphasis on resilience, particularly in the wake of Hurricanes Michael and Florence and the repair work at Tyndall Air Force Base and Marine Corps Base Camp Lejeune. In these locations, the Department has taken a deliberate approach of rebuilding in a way that will reduce damage should similar storms strike again. Energy resilience planning is being prioritized, based on the assumption that storms will knock out transmission infrastructure more often.

The 55th Wing's Recovery Operations Center staff works 16-hour shifts disseminating pertinent information to the base populous regarding the flooding caused by the Missouri River on March 19, 2019. The Missouri River breached the levee system which widened the river's footprint - covering one third of the base. U.S. Air Force Photo by Josh Plueger

New construction designed to protect existing facilities is rarer, but projects are beginning to emerge. For example, the Norfolk Naval Shipyard in Virginia is the location at which the US Navy performs maintenance of nuclear submarines. Its vulnerability to flooding with even moderate storms could put billions of dollars of invaluable equipment at risk. In 2017, the US General Accountability Office found the dry docks were not designed to withstand higher seas and stronger storms anticipated from climate change. Recognizing the risk, Navy included higher floodwalls in a shipyard modernization plan submitted to Congress last year.

The DoD has a disadvantage in that the US Government is currently subject to budget caps that limit spending. This creates a disincentive to invest today's funds in lowering future costs, and introduces a dynamic in which recovery costs are easier to secure from Congress than preventative investments. In theory, industry should not have the same impediment, provided a strong business case can be made. In reality, however, the psychological impediment of not wanting to spend money today to prevent a risk that may or may not appear in the future, is common to many organizations. Corporate boards remain more likely to fund geographic expansion, R&D, or shareholder returns than climate resilience measures they are not familiar with (due to their being a relatively new phenomenon) or are unable to assess the value of (due to lack of experience). Nonetheless, there are disincentives to adequately assessing and pricing climate risk in the private sector.[38]

Fundamentally, adaptation and resilience investments aim to protect DoD infrastructure, operations and assets from the changes in climate that they broadly acknowledge. Japanese industry shares these concerns. A key lesson is that any significant investment in infrastructure should include an assessment of vulnerability to changing climate conditions in the proposed location. Moreover, particularly valuable infrastructure should be assessed for possible relocation, business model change or resilience investments. Insurance is also an important tool available to industry. However, the insurance industry is beginning to understand these very same risks and to incorporate them into pricing. It is in industry's interest to address these issues proactively.

3) Energy Efficiency and Renewable Energy Benefit both Mission Accomplishment and Cost Savings

In addition to its adaptation efforts, the Department of Defense has pursued initiatives on energy efficiency and renewable energy for many years.

The DoD, for example, spends nearly $4 billion to power its installations annually. Energy efficiency results in significant savings. Moreover, recent efforts to host utility-scale solar farms on DoD bases were premised on the concept that developers would pay for the construction of the projects and DoD would agree to a long-term power purchase agreement at lower rates than it had historically paid. The DoD is working to ensure that these projects are able to provide power directly to critical facilities in the event of a power outage, thus improving mission resilience. Moreover, renewable energy at remote bases is seen as a good business decision compared to the cost – and the risk – of delivering diesel fuel for generators.

Each of these efforts has improved the DoD's reputation as an environmentally progressive actor, even though it was largely mission assurance and business case that drove the decisions. Similarly, as investors have given preference to natural gas and, in some cases, renewables, over domestic coal plants, DoD has seen its carbon footprint reduced without having had to take action.

In the same way, Japanese firms could incorporate increased energy efficiency and renewable energy into their business plans. Some of these systems, as has been seen with on-site renewable generation, provide not only the opportunity to lower costs but also operational benefits should there be a disruption in the electrical grid. Structured correctly, these investments make business sense and deliver positive reputational value for their environmental stewardship. Moreover, Japanese utilities which emphasize low carbon solutions, will allow firms to claim credit for reducing their carbon impact.

Dr. Elizabeth Sherwood-Randall, Deputy Secretary of Energy, center, poses with Solar Ready Vets participants at Hill Air Force Base's solar array field. U.S. Air Force photo by R. Nial Bradshaw

CONCLUSION:

MANAGING THE UNAVOIDABLE AND AVOIDING THE UNMANAGEABLE

The first and most fundamental lesson from the US military's experience with climate change is that it is in an organization's own interest to address the risks posed by climate change. Climate impacts are already occurring and will accelerate. Some risks are predictable – or at least foreseeable: in fact, some have become sufficiently tangible that they are informing military investments and planning. In this way, the military is clearly focused on managing the unavoidable implications of climate change.

There is another facet of the problem, however. The extreme scenarios projected for later this century will inevitably reach a level that is simply unmanageable. Some low-lying locations and entire island nations may be forced to shut down and relocate. Climate stresses may boil over in fragile contexts and manifest themselves in violent conflict, destruction of infrastructure and economic catastrophe. Any entity with long-term prospects would be well advised to consider how to avoid these extreme futures.

Given the extreme vulnerability to climate impacts in the Asia-Pacific and the growing economy of the region, it makes sense to take a long-term view of climate hazards. Part of assessing this risk involves acknowledging the different risk landscape presented by different emissions scenarios and their implications for Japan's long-term business interests – just as the US military is doing. Ultimately, the benefits of low carbon strategies and deployment of low-carbon technologies could provide a more stable and profitable environment for security and for business.

A Sunset Over Naval Base Coronado, San Diego. Derrick Neill

SUMMARY:

LESSONS FOR JAPANESE BUSINESS FROM THE US MILITARY RESPONSE TO CLIMATE CHANGE

1. **Acknowledge the risks.** Climate impacts are real, predictable and will materially affect business operations and supply chains. Recognize that while impacts are physical they can also damage social infrastructure and political stability. All such risks should be identified and assessed so they can be properly managed.

2. **Plan and resource to manage climate risk.** Any significant investment in infrastructure should include a thorough climate vulnerability assessment. Risks specific to construction, transportation, outdoor work and other operations should be identified and addressed.

3. **Energy efficiency and renewable energy can save costs, contribute to risk reduction and yield reputational dividends.** Companies that invest in products and technologies that enable climate mitigation or adaptation can benefit from a financial upside from the market and environmental stability that will grow from inevitable climate risk

NOTES

1 United Nations Economic and Social Council for Asia and the Pacific, *Asia-Pacific Disaster Report 2017*, October 2017, https://www.unescap.org/sites/default/files/1_Disaster%20Report%202017%20Low%20res.pdf

2 UN News, 'Disasters could cost Asia-Pacific region $160 billion per year by 2030, UN warns', 24 April 2018, https://news.un.org/en/story/2018/04/1008182

3 United Nations Economic and Social Council for Asia and the Pacific, 2017, *Ibid.*

4 The US Department of Defense has presence in Japan, Australia, South Korea, Hong Kong, Singapore, Cambodia, and Diego Garcia; on Hawaii and Guam; and in the Commonwealth of the Northern Marianas Islands and the Marshall Islands.

5 U.S. Department of Defense, Real Property Assets Database (RPAD), "Department of Defense Real Property Portfolio: 2016 Real Property Fast Facts," February 21, 2017, https://www.acq.osd.mil/eie/Downloads/Fast_Facts_2016.pdf, as cited in John Conger, 'An Overview of the DOD Installations Enterprise', The Heritage Foundation, Oct 4 2018, accessed at: https://www.heritage.org/military-strength/topical-essays/overview-the-dod-installations-enterprise

6 Constantine Samaras, 'U.S. Military Basing Considerations during a Rebalance to Asia: Maintaining Capabilities under Climate Change Impact', in *The US Asia-Pacific Rebalance, National Security and Climate Change*, The Center for Climate and Security, 2015.

7 US Department of Defense, Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, *Climate -related Risk to DOD Infrastructure: Initial Vulnerability Assessment Survey (SLVAS) Report*, January 2018, accessed at: https://www.acq.osd.mil/eie/Downloads/Congress/Climate-Related%20Risk%20to%20DoD%20Infrastructure%20(SLVAS)%20Report.pdf

8 Hall, J.A., S. Gill, J. Obeysekera, W. Sweet, K. Knuuti, and J. Marburger. 2016. *Regional Sea Level Scenarios for Coastal Risk Management: Managing the Uncertainty of Future Sea Level Change and Extreme Water Levels for Department of Defense Coastal Sites Worldwide.* United States Department of Defense, 2016.

9 U.S. Department of Defense, *Base Structure Report, Fiscal Year 2015 Baseline*, as cited in Constantine Samaras, 'U.S. Military Basing Considerations during a Rebalance to Asia: Maintaining Capabilities under Climate Change Impact', in 'The US Asia-Pacific Rebalance, National Security and Climate Change', The Center for Climate and Security, 2015. Includes total number of DoD buildings that are owned, leased or "other"(e.g. privatized or private entities in direct support of DoD) in Japan, the Republic of Korea, Diego Garcia,Singapore, Australia, Cambodia, Hong Kong, Guam, Marshall Islands, Wake Islands, American Samoa, Johnston Atoll, Northern Mariana Islands, Alaska and Hawaii.

10 The Center for Climate and Security, *Military Expert Panel Report: Sea Level Rise and the US Military's Mission, 2nd Edition*, February 2018, accessed at: https://climateandsecurity.files.wordpress.com/2018/02/military-expert-panel-report_sea-level-rise-and-the-us-militarys-mission_2nd-edition_02_2018.pdf

11 Department of Defense, *Climate-Related Risk to DoD Infrastructure Initial Vulnerability Assessment Survey (SLVAS) Report* (DoD: January, 2018), 17-18.

12 Strategic Environmental Research and Development Program, *Assessing Impacts of Climate Change on Coastal Military Installations: Policy Implications*, US Department of Defense, 2013, 5.

13 Ben McCarron, 'Climate Costs for Asia Pacific Ports', Asia Research and Engagement, https://www.asiareengage.com/s/APAC-ports-climate-costs.pdf

14 Shiloh Fetzek, Rachel Fleishman and John Conger, *Japanese Industry in an Unstable Climate: Reducing exposure to the security implications of climate change*, The Center for Climate and Security, May 2019.

15 The Center for Climate and Security, *Military Expert Panel Report: Sea Level Rise and the US Military's Mission, 2nd Edition*, February 2018, accessed at: https://climateandsecurity.files.wordpress.com/2018/02/military-expert-panel-report_sea-level-rise-and-the-us-militarys-mission_2nd-edition_02_2018.pdf

16 Washington Post. "In Norfolk, evidence of climate change is in the streets at high tide." May 31, 2014. http://www.washingtonpost.com/business/economy/in-norfolk-evidence-of-climate-change-is-in-the-streets-athigh-tide/2014/05/31/fe3ae860-e71f-11e3-8f90-73e071f3d637_story.html

17 U.S. Department of Defense, *Base Structure Report, Fiscal Year 2015 Baseline*.

18 US Government Accountability Office (GAO), 'Space Situational Awareness: Status of Efforts and Planned Budgets', October 8 2015, accessed at: https://www.gao.gov/assets/680/672987.pdf. See also Lockheed Martin, 'Space Fence', accessed at: https://www.lockheedmartin.com/en-us/products/space-fence.html

19 Curt D. Storlazzi, Stephen Gingerich, Peter Swarzenski, Olivia Cheriton, Clifford Voss, Ferdinand Oberle, Joshua Logan, Kurt Rosenberger, Theresa Fregoso, Sara Rosa, Adam Johnson, and Li Erikson (U.S. Geological Survey); Don Field, Greg Piniak, Amit Malhotra, and Mark Finkbeiner (National Oceanic and Atmospheric Administration); Ap van Dongeran, Ellen Quataert, Arnold van Rooijen, Edwin Elias, and Mattijs Gawehn (Deltares); and Annamalai Hariharasubramanian, Matthew Widlansky, Jan Hafner, and Chunxi Zhang (University of Hawaii), *The Impact of Sea-Level Rise and Climate Change on Department of Defense Installations on Atolls in the Pacific Ocean (RC-2334), Report to the U.S. Department of Defense Strategic Environmental Research and Development Program*, August 31, 2017, accessed at: https://www.serdp-estcp.org/content/download/46677/436373/file/RC-2334%20Final%20Report.pdf

20 Seth Robson, 'Northern Marianas military bases survive Super Typhoon Yutu', Stars and Stripes, October 25 2018, https://www.stripes.com/news/northern-marianas-military-bases-survive-super-typhoon-yutu-1.553438

21 John Conger, 'Commander of US Forces in the Indo-Asia Pacific Affirms Climate Change Threat', The Center for Climate and Security, Feb 14 2019, https://climateandsecurity.org/2019/02/14/commander-of-us-forces-in-the-indo-asia-pacific-affirms-climate-change-threat/

22 The Center for Climate and Security, 'Chairman of the Joint Chiefs: Climate Change a Source of Conflict Around the World', November 6, 2018, accessed at: https://climateandsecurity.org/2018/11/06/chairman-of-the-joint-chiefs-climate-change-a-source-of-conflict-around-the-world/

23 John Conger, 'U.S. Navy and Marine Corps Nominees Highlight the Threat from Climate Change', The Center for Climate and Security, May 2 2019, https://climateandsecurity.org/2019/05/02/u-s-navy-and-marine-corps-nominees-highlight-the-threat-from-climate-change/

24 Forbes Tompkins, 'President Signs Legislation Directing Military to Include Flood Preparation Standards for Military Bases', August 13 2018, https://www.pewtrusts.org/en/research-and-analysis/articles/2018/08/13/president-signs-legislation-directing-military-to-include-flood-preparation-standards-for-military-bases

25 Courtney Columbus, 'Hurricane-Damaged Air Force Base Has an Opportunity to Rebuild for Resilience', E&E News, November 9 2018, https://www.scientificamerican.com/article/hurricane-damaged-air-force-base-has-an-opportunity-to-rebuild-for-resilience/

26 Caitlin M Kenney, 'House lawmakers question whether Tyndall Air Force Base, Camp Lejeune should be rebuilt', Stars and Stripes, March 13, 2019, accessed at: https://www.stripes.com/news/us/house-lawmakers-question-whether-tyndall-air-force-base-camp-lejeune-should-be-rebuilt-1.572537

27 Available at https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards

28 Sec.US Secretary of Defense James Mattis, unpublished written remarks submitted to the Senate Armed Services Committee, as reported in Andrew Revkin, 'Trump's Defense Secretary Cites Climate Change as National Security Challenge', ProPublica, March 14 2017, accessed at: https://www.propublica.org/article/trumps-defense-secretary-cites-climate-change-national-security-challenge

29 Gen. Joseph F Dunford Jr, 'The US Military in a Time of Geopolitical Strain', Duke University Department of Political Science, November 5 2018, presentation available at https://www.youtube.com/watch?v=hKvpHtLs7sY&feature=youtu.be, as reported in 'Chairman of the Joint Chiefs: Climate Change a Source of Conflict Around the World', The Center for Climate and Security, November 6 2018, accessed at: https://climateandsecurity.org/2018/11/06/chairman-of-the-joint-chiefs-climate-change-a-source-of-conflict-around-the-world/

30 Bryan Bender, 'Chief of US Pacific forces calls climate biggest worry', The Boston Globe, March 9 2013, https://www.bostonglobe.com/news/nation/2013/03/09/admiral-samuel-locklear-commander-pacific-forces-warns-that-climate-change-top-threat/BHdPVCLrWEMxRe9IXJZcHL/story.html

31 Simply stated, climate change is better for cool economies and worse for warm ones. The gap in economic output between climate zones – e.g., countries such as Norway and Sweden vs. countries such as India and Nigeria – is 25% greater than it would have been absent climate change, all other factors being equal. Noah S. Diffenbaugh and Marshall Burke, 'Global Warming has increased economic inequality,' Proceedings of the National Academy of Sciences of the United States of America, April 22nd, 2019, at https://www.pnas.org/content/early/2019/04/16/1816020116

32 Conger, Fetzek and Fleishman, "Japanese Industry in an Unstable Climate: Reducing Exposure to the Security Implications of Climate Change," *The Center for Climate and Security*, May 2019

33 See more at The Center for Climate and Security, 'Resource Hub – Defense', https://climateandsecurity.org/resources/u-s-government/defense/

34 See more at The Center for Climate and Security, 'Resource Hub – Intelligence', https://climateandsecurity.org/resources/u-s-government/intelligence/

35 The Center for Climate and Security, 'Chronology of US Military Statements and Actions on Climate Change and Security', https://climateandsecurity.org/2019/05/03/update-chronology-of-u-s-military-statements-and-actions-on-climate-change-and-security-jan-2017-april-2019

36 Patrick Martin, 'Critical Air Force Base flooded in Nebraska', The Washington Post, March 18 2019, accessed at: https://www.washingtonpost.com/national-security/2019/03/18/critical-air-force-base-flooded-nebraska/?utm_term=.bffc4c8f7178

37 Hall et al, op. cit.

38 For a more thorough examination of this issue, please see Shiloh Fetzek, Rachel Fleishman and John Conger, *Japanese Industry in an Unstable Climate: Reducing exposure to the security implications of climate change*, The Center for Climate and Security, May 2019

THE CENTER FOR CLIMATE AND SECURITY

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FOREWORD

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