

“HOW THE ARMY DOES SMART”

Smart Cities and Installations of the Future

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By Alexander Braszko, Military Analyst, Center for Army Lessons Learned

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Army garrisons are very much like small municipalities, facing similar challenges in implementing security measures, providing services to Soldiers and their families, and sharing data for improved decision-making. Municipal governments around the world are doing exactly those things for their own residents by using integrated Smart City programs and Internet-of-Things (IoT) sensor systems. This article addresses the employment of smart technologies on U.S. Army installations.

Specifically, it highlights benefits that garrison commanders and staffs can gain by using smart technologies to monitor and manage facilities and services, collect data, and implement measures based on analysis of that data. Commanders and staffs that appreciate and learn from municipalities' skillful use of Smart City technologies can similarly position themselves for significant improvements in their own garrison operations.

Currently, the U.S. Army's Strategy to implement smart technologies on installations is in its infancy. Establishing the best lead proponent would facilitate the integration and eventual benefits these technologies offer. This needs to happen quickly if the Army hopes to develop, coordinate, and eventually realize the advantages emerging technologies bring with them into our rapidly changing world.

COVID-19 and Pandemic Implications

Over the past year, City governments witnessed first-hand the benefits smart technologies offer. In her blog on govlaunch.com, Lindsay Pica-Alfano describes COVID-19's effects on municipalities. Entitled, “What We Hope the Future Holds for Local Government,” she reveals three new lessons discovered in towns and cities across our country over the previous several months¹:

- Digital services should not be temporary.
- More local government innovation will be expected by citizens.
- It is critical to continue sharing information across local governments globally.

As self-quarantine measures forced many municipal governments to offer online means of paying taxes, registering for businesses, and signing up for city services, residents now realize the convenience of the new options. As public and private businesses witness how productive teleworking can be and how easily it is implemented, several companies, including Twitter, have decided to let employees continue to telework permanently even after COVID-19 protective measures subside.ⁱⁱ

The U.S. Army developed its own set of lessons learned during the COVID-19 pandemic. It, too, realized the criticality and practicality of teleworking, the importance of pre-pandemic preparation and coordination from an IT perspective, and the value of innovating to discover solutions to shared problems. The Army also realized the importance of resilient installation facilities, services, and operations in order to absorb disruptions and continue supporting readiness. Continuity of operations off-garrison became a priority. Given the uncertainty of the duration or frequency of the coronavirus, as well as future pandemics, these lessons will not be quickly forgotten.

Whether for detection, alerts and notification, contact tracing, or pushing out the latest relevant information, dozens of new digital solutions to the COVID-19 pandemic seem to come out in the press and social media almost daily. For example, Google and Apple recently, in rare form, joined forces to create a smartphone-tracking tool for CV-19 tracing.ⁱⁱⁱ Airports are testing the latest thermal cameras and other technologies to screen travelers for CV-19.^{iv} Even the CDC has published, on their Digital Tools link, evaluation criteria for digital contact tracing tools.^v While not every new digital tool created is worth its weight in salt, and several likely violate our expectations to privacy, many of those discoveries could, and probably should be considered for use in installation operations. Teleworking is a prime example.

Given all the above, a question arises: should military installations be looking to mimic innovative cities with respect to data collection and technology integration? If so, are the means and processes to do so currently in place? Another equally important question is who in the Army is exploring technologies from an installation perspective and who is leading the effort to better collect, share, and process data on Army installations? Before attempting to answer these questions, it is important to identify exactly what a Smart City is and why so many municipalities around the world are clamoring to gain recognition as a Smart City.

Smart City and Smart Installation Defined

While it has been used at least for a decade, the term “Smart City” can be somewhat difficult to comprehend, in part because of the lack of a clearly accepted definition of the term and in part due to multiple facets of Smart City initiatives. A doctrinal definition of “Smart” would be helpful for military leaders so they can better understand implications for “Smart Installations.” For the purposes of this article, a Smart City is an urban area with municipal government leaders who use technologies, including cameras, sensors, and Internet of Things (IoT) networks, to collect data for improved municipal decision making. Collected data can be used by various departments, including Water, Public Works, General Services, Information Technology, Health, Police, Fire to improve citizens’ quality of life and present ways to analyze efficiencies in citywide operations.^{vi} Similarly, a Smart Installation makes use of comparable data collection methods for predictive analysis and improved decision making on post.

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Although most new or emerging technologies are not necessarily labeled a “smart technology,” when used for municipal government operations, many can be and are often marketed under the category. Autonomous vehicles, sewer sensors, traffic management, and road construction technologies can all fall into the smart technology context, again when used by cities to conduct day-to-day operations. The spectrum of technologies that fall under Smart City initiatives is very broad.

A Smart Installation is similar to a Smart City in that it could use similar technologies collecting similar data for its own improved decision-making, improved efficiencies, and improved services provided to military members. Additionally, Smart Army Installations would ideally share data internally with service providers on post, and externally with other Army installations. Finally, in addition to being collected, processed, and analyzed, all data shared would have to be stored and protected just as it is within cities, from a cybersecurity and data privacy perspective.

The Benefits of Being “Smart”

Naturally, no city considers itself a dumb city, and the term Smart City can actually be a misnomer. Nevertheless, it is the term of choice for many technologically advanced and innovative cities around the world. The name conveys what they have been doing, often through an Office of Innovation or through a Chief Technology Officer (CTO), Chief Innovation/Information Officer (CIO), or Chief Data Officer (CDO) in City Hall. It conveys the idea that they are data driven, forward thinking, and innovative, integrating emerging technologies to improve quality of life for residents.

When City Hall leadership appreciates technology and invests in integrating technologies into citywide operations, improvements typically follow: road repair times decrease, streets do not flood as frequently, and garbage is picked up on time. Thanks to improved understanding and use of big data, IoT networks, and Smart City technology integration, efficiencies in water departments, public works departments, and police departments are improving municipal support and thereby quality of life in cities around the country.

Army installations stand to benefit from watching and imitating these Smart Cities, providing Garrison Commanders greater datasets for understanding trends, being proactive rather than reactive through predictive analysis, increasing resiliency and thereby improving quality of life for those that live and work on Army installations.

Fad or the Future?

CISCO, hereto a major player in the Smart City arena, recently announced its intent to move away from Smart City initiatives. Nationwide, COVID-19 negatively impacted city revenues collected due to lockdowns. As a result, many Smart City pilots and programs were negatively impacted by the pandemic.

Still, studies indicate we will still see an explosion in both the number and the percentage of the world's population living in urban areas in the future. There are currently 29 cities in the world with a population of more than 10 million people. That number is expected to climb to 43 by 2030.^{vii} According to the World Water Council, by 2030, 70 percent of the world's population will live in cities.^{viii} Municipal governments are well aware of these facts. Many are in fact still trying to use Smart City initiatives to accommodate that growth and the associated demands on public infrastructure. It will be interesting to note how COVID-19 and the subsequent move toward teleworking ultimately influences these trends.

Some additional truth in advertising is prudent. A few cities that made the mistake of focusing on flashy tech versus hard data in their Smart City efforts had notorious failures primarily because 1. They could not point to any significant impacts resulting from integrating those technologies and 2. They did not sufficiently engage communities where they installed controversial technologies. A lack of transparency in their Smart City programs and not taking data privacy issues into consideration with respect to controversial tech, like AI or facial recognition, brought about friction and mistrust by residents. Eventually, massive Smart City efforts failed, such as the notorious example of Sidewalk Labs in Toronto^{ix}. Done right, integrating emerging technologies into cities to gather more data for improved decision making can prove to be extremely beneficial. Moreover, the narrative of being on the cutting edge of technology and providing services to citizens in new and innovative ways has its own rewards.

While this article focuses on the Army's novel efforts in creating Smart Installations, sister services have already embraced integrating smart technologies, collecting data for decision making via IoT sensors, and building smart buildings on their installations. For example, AT&T recently announced a Smart Base initiative with the United States Air Force at Maxwell AFB. Additional Smart Base initiatives are taking place at Los Angeles Air Force Base, CA, and Tinker Air Force Base, OK.^x According to a July 2020 article in defensesystems.com, the Marine Corps is partnering with the smart community nonprofit, U.S. Ignite, in a project to "leverage the facility's investments in both autonomous vehicle testing and micro grid technology."^{xi}

For a glimpse into futuristic possibilities, an interesting scenario, "a day in the life of a garrison commander with access to smart technologies," click here: <https://smallwarsjournal.com/jml/art/mad-scientist-initiative-installations-future-day-life-garrison-commander>.

Truth be told, Army installations are still in the industrial age and need to be led into the digital age.

The Benefit of More Data

More important than the “dazzle” that comes with integrating cutting edge technologies, having access to data for decision-making and predictive analysis is what truly makes becoming “Smart” worthwhile. Larger municipalities, such as New York, Paris, and Shanghai have grown familiar with the value of accumulating large data sets and digitized information, and their recorded improvements validate their efforts. CDOs, CTOs, and CIOs are grappling with how best to use newly acquired data to improve municipal processes, share data over Internet of Things (IoT) networks, and store it.^{xii} Similar positions of responsibility will likely need to be created within garrison staffs should they adopt similar initiatives.

Here is just one example where collected and analyzed data has impacts on infrastructure: consider weather and its effects on a barracks roof. Precipitation, extreme heat, extreme cold, hail all impact the longevity of roof materials. With smart sensors integrated into a roof, that weather data can be collected and analyzed with respect to the physical impacts on roof materials. With the right algorithms and a better understanding of the damage inflicted on a roof, engineers can decide exactly when a roof should be replaced. Whether a roof has a few more years left on it before replacing it, or whether or not it would be more cost effective to replace it earlier, can make a big difference in dollars spent on overall maintenance costs across post over time. With data in a region collected on multiple roofs over time, garrisons could eventually more accurately predict, and budget for, roof replacements on an installation. This is just one example showing how data collected and predictive analysis can save Smart Installations money.

The Benefit of Sharing

As mentioned, military installations and cities share many of the same challenges and responsibilities. However, they do not always share their best practices and lessons learned with each other. Over the last several months, Army installations have had to shift gears and determine how best to innovate and overcome challenges to prevent the spread of COVID-19. Cities are making conscious efforts to find ways technology can help them better understand, map, and isolate this virus. Unfortunately, the innovative solutions they developed may not necessarily be shared with nearby Army installations and vice versa. Army installations are still in the industrial age and need to be led into the digital age. It will take creative Army leaders comfortable with experimenting and innovating to get the installation of the future up and running. Those leaders stand to benefit from communicating closely with and possibly cooperating with their civilian counterparts off-post.

Just like cities, Army installations collect large volumes of data and must try to share it with service providers on post, commercial service providers off post, and private providers on and off post. According to a June 2019 article from Army AL&T magazine, "Army data is housed in hundreds, if not thousands, of disparate systems that typically don't communicate with one another. Sometimes the single, authoritative source for one type of data is a spreadsheet on a supply sergeant's desk."^{xiii}

Take for example, a garrison like Fort Leavenworth, KS. The movement of over a thousand students, families and their household goods (HHG) occurs every year during the PCS cycle. Students often require childcare; some have special medical requirements or spouses that need assistance with finding employment. Ideally, to ensure efficient and hassle-free transitions onto new posts, all that data should be transmitted to the corresponding organizations associated with providing the required service. When Soldiers and their families arrive at a new post, they should not have to wait long for housing, their HHGs, a space for their child in childcare, and a meeting with a spouse employment representative. In reality, daily coordination among U.S. Army Garrison Fort Leavenworth, Army University and the Command and General Staff School (CGSS), Housing Oversight Office (HOO), Logistics Readiness Center (LRC), Army Community Service (ACS), and Child and Youth Services (CYS) is a difficult and laborious manual reconciliation. Oftentimes it is disjointed with seams and filled with data inaccuracies and gaps. Before Move.mil, soldiers would visit a post's Transportation Office and fill out pages of information on a clipboard. Today, we have a digital tool to assist with PCSs in Move.mil, but that does not mean it is an effective communication or data sharing platform among services like housing, temporary lodging, ACS and CYS. Unexpected changes for service members, such as arriving earlier or later, can have a significant impact on getting his/her home ready following maintenance, followed by shifts in transportation delivery and reservations in temporary lodging. If not carefully managed and shared across installation service providers, families can have an overall negative PCS experience.

When Fort Leavenworth Garrison Commander, COL Harry Hung, speaks of an ideal day in the future where data is shared across the Army with respect to soldiers and families, he refers to the "Ritz Carlton effect." When you first decide to stay in a Ritz Carlton hotel, he explains, you provide information about your preferences. Your likes and dislikes on your hotel preferences (location by floor, views, amenities desired in the rooms, service requests, etc...) are recorded and shared with all hotels. During your stay, every hotel contact is recorded and they deliberately seek to find ways to surprise and delight you during your stay. This

may include cooking something not on the menu or a uniquely curated hard to find gift waiting in your room as a surprise that elevates your stay all without any added charge. This example of Ritz Carlton providing outstanding customer service is enabled by a high level of detailed client information shared across every staff member from the housekeeper to front bellhop. The Army can use the same approach to "tailor services" to the specific needs of each Soldier and their family. Having the ability to access and extract that information about our soldiers and families shared among organizations and services on post is extremely valuable. We can reduce the lag between providers and focus on delivering a better overall PCS experience. This information also enables the Army to focus resources where they are specifically needed rather than performing the industrial-aged approach where everyone has to get a brief and visit every service provider before they move on, only to wonder why they were there if they did not need the service. Transitioning to the information-age allows us to be efficient with our limited personnel resources and more effective by focusing on providing increased services for a smaller population.

Smart Installation Risks

The threat from near peer and peer adversaries, criminal and hacker organizations, asymmetric and terrorist organizations pose to IoT networks and Smart Installation technologies is significant. RAND recently released a study addressing those risks in detail: https://www.rand.org/pubs/research_reports/RRA107-1.html As cities have discovered, placing a firewall between IT networks and those smart sensors, cameras, technologies collecting data is not sufficient to prevent them from being exploited.

In 2015, the Department of Homeland Security's Office of Cyber and Infrastructure Analysis published a thorough assessment called, "The Future of Smart Cities: Cyber-Physical Infrastructure Risk"^{xiv} The document discusses the risks to transportation systems, electricity subsectors, water and wastewater treatment systems when adopting or increasing reliance on smart technologies.

Sector	Cyber-Physical Technologies Examined
Transportation Systems Sector	Autonomous Vehicles Positive Train Control Intelligent Transportation Systems Vehicle-to-Vehicle and Vehicle-to-Infrastructure
Electricity Subsector	Smart Power-Generation Plants Smart Distribution and Transmission Advanced Metering Infrastructure
Water and Wastewater Systems Sector	Smart Water Treatment Smart Water Distribution Smart Water Storage

Figure 1. Smart technologies, DHS Office of Cyber and Infrastructure Analysis

Additionally, with all data collected, including that with Personally Identifiable Information (PII), HIPAA compliance requirements and privacy concerns abound when it comes to big data, especially data collected on a population within a city or installation. Municipal leaders have learned the value of community engagement when it comes to implementing potentially controversial technologies like smartphone data collecting devices, beacons, facial recognition, cameras, etc. While the same level of concern may not exist on a military installation, informing Soldiers and their families before putting out controversial technologies, would certainly be prudent and is highly recommended for garrison commanders.

Additional Challenges

The Army lacks individuals with extensive experience in Smart Cities and smart technologies. TRADOC's Mad Scientist Forum regularly covers Smart City technologies and has several blogs where Soldiers and DA Civilians can learn about and discuss Smart City technologies on installations. From one Mad Scientist Blog: "Installations of the Future is a microcosm of overarching Army Modernization challenges. We are simultaneously invested in legacy infrastructure that we need to upgrade, and making decisions to build new smart facilities. Striking an effective and efficient balance will start with public-private partnerships to capture the expertise that exists in our universities and in industry. *The expertise needed to succeed in this modernization effort does not exist in the Army.*"^{xv}

The Army lacks an ability to rapidly pilot prototypes. In June 2018, TRADOC cohosted, along with the Office of the Assistant Secretary of the Army for Installations, Energy and Environment (ASA (IE&E)), the Army's Installations of the Future Conference. One of the top 10 takeaways from the conference stated, "A common suite of tools is needed to integrate smart technologies onto installations. While Garrison Commanders need

mission command to take advantage of the specific cultures of their installations and surrounding communities, the Army cannot afford to have installations going in different direction on modernization efforts. A method is needed to rapidly pilot prototypes and then determine whether and how to scale the technologies across Army installations.”^{xvi}

Leading the Strategy Charge; ASA (IE&E)

There has been a bit of work done with respect to exploring Smart City technologies within the Army. However, only a handful of individuals within Army organizations are actually attempting to provide a way ahead for Smart Installation-related changes on posts. With a few individuals’ career changes and/or retirements, that knowledge base may altogether disappear.

The good news is there is a small organization currently leading the Strategy Development charge to integrate smart technologies into Army installations. The very few, but very capable, folks at the Assistant Secretary of the Army Installations Energy and Environment have years of experience in Smart Cities and are definitely using it for the good of the Army. ASA (IE&E), led by Mr. Richard Kidd and Mr. John Thompson, Strategic Integration, created an Installations of the Future initiative that fully recognizes what municipalities in the U.S. and around the world are doing to adapt to growing populations and to effectively integrate data collection and new technologies into Army installation operations.

In March 2020, ASA (IE&E) responded to a House Armed Services Committee request to determine if Smart City technologies should be integrated into installations, and if so, what the risks of doing it are. As part of a more thorough answer, ASA (IE&E) commissioned the Rand study, mentioned earlier, on threats to installations, and it did an extensive cost benefit analysis to determine potential benefits and return on investment for smart technology integration. Not surprisingly, it highlighted that installations cannot remain analog in a digital age when peer nations are advancing so quickly.

The 12-page “Army Report on Creating an Army Installations Test and Demonstration Program Using Commercial Technologies” response, put together by ASA (IE&E), expertly answers the HASC’s questions and shows the office has been paying close attention to what cities are doing. Through leading several of their own pilots, specific organizations within the Army have learned the value of asking the hard questions up front. It also highlights the fact that, according to the 2018 National Defense Strategy, installations are no longer sanctuaries or safe havens free from retribution if the United States does enter a war with a peer nation. As a part of the response, ASA (IE&E) provided a thorough section on risks from adversaries, as well as a cost benefit analysis of emerging tech for Army Installations.

Click here: <https://www.asaie.army.mil/Public/SI/doc/7%20-%20Report%20to%20Congress%20Army%20Installation%20T&D.pdf> for more information on the initial findings, including the following:

- “Technology is pivotal to supporting readiness and modernization, increasing resilience, promoting safety, increasing efficiency, lowering costs, and improving the quality of life for service members and their families.

- The Army spends over \$17B per year to sustain and improve Army installations.
- Past, incremental approaches to modernizing Army facilities are increasingly inadequate given the pace of technological change and specifically the deployment of ‘Internet of things’ (IOT) devices that are integrated into ‘smart’ buildings, resilient micro-grids and connected infrastructure.
- The Army would benefit from a dedicated, data-driven innovation effort for installation modernization, keeping pace with broader Army modernization efforts, and modeled on similar efforts elsewhere in the Department of Defense.”^{xvii}

While the document is a great start, the handful of individuals at ASA (IE&E) who put together that response face an uphill battle. Neither ASA (IE&E) nor the Army are structured, aligned, or resourced to integrate these technologies and data-collecting solutions effectively into installations today or in the near future. They have begun an excellent strategy, but not the means to implement it. The Army is behind, and needs to catch up as soon as possible to benefit from the advantages offered by smart technologies.

ASA’s (IE&E) 16 Promising Technologies Identified by

The following 16 technologies were listed in ASA’s report to the HASC as relevant and promising from a Smart Installation perspective:

- Perimeter access control, linear sensing – enhances security, reduces manpower and need for physical barriers
- Smart Child Development Centers – provides visibility for safety, security, building operations, and human interactions
- Modernized master planning – allows community planners to digitally predict physical impacts and costs for physical structures
- Digital twin for energy and water – provides for improved operations, resilience and “what if” scenarios
- Optimization of space utilization – analyzes space usage and provides data for stationing decisions
- Building fault analytics – monitors building systems and provides data for maintenance
- Real-time facility control analytics – controls and integrates building systems for enhanced response and planning
- Automated facility assessments – uses technology such as drones to monitor changes in structures and environmental conditions
- Frictionless entry – eliminates individual stops at the front gates for cleared personnel, enhancing security, reducing manpower and improving quality of life.
- Computer-aided dispatch and traffic monitoring – assists emergency dispatch for first responders
- Utility monitoring – connects utility monitoring systems for performance improvement
- Tactical vehicle micro smart grid–integrated installation and tactical energy for increased resilience
- 5G infrastructure utility energy service contract–tests top secret 5G capability in a controlled environment to transmit data

- Integrated sensors – tracks and integrates building environment data; CO2, temperature, occupancy rates, sound anomalies
- Autonomous vehicles – personnel and equipment transportation, environmental sensor collection
- Barracks/building analytics – full building automation and usage integration

Digital Modernization Strategy

While the DoD Digital Modernization Strategy for Fiscal Year 2019-2023, addresses modernizing Defense Information Systems Networks transport infrastructure, and refers to modernizing Warfighter Command, Control, Communications and Computer (C4) Infrastructure, it says nothing specifically about Smart Installations. It does have an appendix dedicated to “Technologies Offering Promise to DoD” and does mention IoT networks, big data, and AI, but it offers no direction and no specifics on installation aspects of those technologies.^{xviii}

Smart Installation Pilots

According to the *Army Report on Creating an Army Installations Test and Demonstration Program Using Commercial Technologies*, in 2019, the U.S. Army tested a number of Smart Installation use cases. Partnering with the USMC at Joint Base Myer Henderson Hall, the Army ran an autonomous vehicle (AV) pilot program, seeking to provide transportation between the Joint Base and the Pentagon.

Additionally, the Army is developing plans to have a pilot that creates “a ‘smart’ child development center with sensor technology to monitor facility usage, improve safety, enhance security, maintain accountability, and explore caregiver behavior interactions.”^{xix} Collecting, integrating, and protecting data through IoT networks and sensors is a central feature of the pilot.

The Army developed a few other Smart Installation pilots to date, including:

- -M&RA/ASAALT/ASA (IE&E) collaborating on a contact tracing pilot at West Point to expand to initial entry training sites,
- -ASA (IE&E) launching two additional COVID-19 related pilots; one for CDC Video Analytics and one for Master Planning.

Other Organizations with a Role in Smart Installations

In addition to ASA (IE&E), several other Army organizations are or have been involved with Smart Installation pilot programs or experiments. They include U.S. Army Research Laboratory (ARL), Army Materiel Command (AMC), Installation Management Command (IMCOM), and U.S. Army Corps of Engineers Engineer Research and Development Center (ERDC).

U.S. Army Research Laboratory

On its website, ARL reveals, “Interoperability remains a long-standing military challenge for Army networks and battlefield systems. Overcoming these problems is an essential science and technology objective for network modernization.” ARL has created GINA (Global Information Networking Architecture), “An executable-model environment... designed to facilitate integration of diverse systems through a collection of intuitive web-based user interfaces that can be used by military personnel with limited programming expertise.”^{xx} GINA could prove very useful in Smart Installation endeavors to share data within garrisons and between Army installations worldwide.

At the Technical Cooperation Program Contested Urban Environment Strategic Challenge 2019, or “CUE 19”, GINA was one portion of “a broader ARL technology package aimed at facilitating both C2 systems interoperability and processing of Internet of Things data at the network edge -- and applied toward ingest and processing of data from a collection of commercial IoT sensors operating under a set of use cases, including perimeter monitoring of installations and vehicle tracking.” Here again, ARL's efforts could prove fruitful for installations of the future with respect to installation security, traffic management and understanding exactly who is on a post at any given time.^{xxi}

In a July 2019, defensesystems.com article, ARL was featured as a military organization exploring how Smart Cities’ connected infrastructures could assist the military in conducting operations in Dense Urban Terrain. James Michaelis, an ARL computer scientist, was quoted as saying, “IoT infrastructures may be deployed in a variety of settings... One is Army installations, which can be viewed as cities in their own right and represent a target for modernization. Such modernizations will likely include smart infrastructure and intelligent systems that operate them.”^{xxii}

While ARL has Essential Research Programs that look at Artificial Intelligence for Maneuverability and Mobility, and the U.S. Army Combat Capabilities Development Program office has hosted Blockchain symposiums, and conducted research on various other technologies typically categorized under Smart City technologies, its focus is on researching specific technologies, not testing how best to integrate them into installation operations. Still, the work ARL is doing is critical to any emerging technologies being integrated into future Smart Installation operations.

Army Materiel Command (AMC) & Installation Management Command (IMCOM)

AMC oversees 10 major subordinate commands, including Installation Management Command, Army Contracting Command, Army Medical Logistics Command, Aviation and Missile Command, and Communications-Electronics Command.^{xxiii} AMC is currently overseeing development of up to eight new future weapon systems. Needless to say, AMC has a lot on its plate, and while much of its work focuses on modernization, Smart Installations specifically are not a primary focus for the command at this time.

In March 2020, AMC became the higher headquarters for Installation Management Command. It is worth noting that AMC’s science and technology (S&T) mission was taken from IMCOM in February and moved to Army Futures Command. This shift likely attributed to a noticeable decrease in R&D on Smart Installation efforts since the move. Prior to its transition under AMC, IMCOM was working on smart metering initiatives. Because of the shift, any ongoing or future Smart Installation initiatives will fall under specific IMCOM directorates and/or individual garrisons in the Army. Pilots will continue to focus on applying smart

technologies toward installation readiness. IMCOM will continue to partner with individual garrisons as they develop Smart Installation pilots from the grass roots level.

AMC and IMCOM are currently involved with one high-profile program that could very well be considered a Smart Installations-related initiative: the Barracks of the Future initiative (also referred to as Smart Barracks). In coordination with the U.S. Army Corps of Engineers, (Huntsville Center) and located on Fort Benning, GA, the pilot program will likely begin in FY21. The program will pull together and harvest as much data as possible from smart sensors and IoT networks within a barracks structure. Phase I will focus on installation of study elements, later moving to Phase II and collection of data in occupied spaces. Currently the plan is for a Proof of Concept to occur after 12-18 months. The Barracks of the Future Initiative is focused on the following four areas:

- Quality of Life (millennial and post-millennial connectivity and Wi-Fi expectations, possibly use of telehealth kiosks)
- Security (enhanced situational awareness of soldiers, monitoring vandalism, sexual assault, physical and cyber security). For security reasons, networks will have to be isolated against external and internal cyber security threats.
- Sensors and Data Collection (including HVAC sensors, Smart Building condition sensors, predictive maintenance, energy and utility management)
- IT Modernization (including Smart Tech, AI-compatible systems, and 5G)

As previously mentioned, while IMCOM does not formally list development of Smart Installations as a priority, it continues to coordinate and facilitate Smart Installation initiatives at the garrison level. Both AMC and IMCOM are tasked with an enormous amount of responsibility at this time and, quite honestly, lack the resources to lead Army-wide Smart Installation implementation efforts effectively. However, as a futures and innovation focused organization, Army Futures Command is better resourced and postured to take the Army's Smart Installations implementation lead.

Engineer Research and Development Center (ERDC)

The U.S. Army's Corps of Engineers (USACE) Engineer Research and Development Center (ERDC) retains a focus on R&D for installations. From its website, "ERDC conducts research and development in support of the Soldier, military installations, and the Corps of Engineers' civil works mission, as well as for other federal agencies, state and municipal authorities, and with U.S. industries through innovative work agreements. ERDC operates more than \$1 billion in world class facilities at seven labs located in four states with more than 2,100 employees to administer an annual research program exceeding \$1 billion."^{xiv}

ERDC representatives have been working closely with ASA (IE&E) on Smart Installations and smart technology projects, looking at capabilities from training, readiness, force projection, and sustainment perspectives. From June-August 2019, ERDC was instrumental to the success of a three-month long Joint Base Myer-Henderson Hall Autonomous Vehicle (AV) pilot.^{xv} Olli is an AV that uses radar and Lidar and can transport up to eight individuals at a time without a driver. However, the pilot at JBMHH was not the first time a military installation experimented with AVs; Fort Bragg in 2017 tested transporting wounded personnel

from their homes on-post to the nearby hospital. Additionally, ERDC is currently orchestrating another AV pilot on Fort Carson, again focused on transporting Soldiers and family members with LIDAR enabled AVs. Fort Carson will also use AV drones to detect and analyze foreign object debris to improve safety at the airfield.

The Potential Role of Army Futures Command (AFC)

On its website, AFC states, “Army Futures Command leads a continuous transformation of Army modernization in order to provide future warfighters with the concepts, capabilities and organizational structures they need to dominate a future battlefield.”^{xvii} To outsiders, installations and the role they play in fighting wars does not seem to inherently fit into AFC’s role. However, AFC focuses on the future, innovation, emerging and disruptive technologies. AFC understands the role big data plays in smart sensor and IoT networks and decision-making. It understands peer adversaries’ fixation on influencing friendly operations at the fort-to-port phase of Army operations. No other Army organization could as readily assume the role of implementing Smart Installations or Installations of the Future initiatives.

“Army Futures Command leads a continuous transformation of Army modernization in order to provide future warfighters with the concepts, capabilities and organizational structures they need to dominate a future battlefield.”

During the course of interviewing half a dozen key leaders for this article, one consistent theme came up. Given its purview, its focus on the future, its emphasis on innovation, emerging technologies, collecting and analyzing data for decision making, no other organization in the Army would better serve as the lead for Installations of the Future as Army Futures Command.

Good News & Recent Updates

The U.S. Army just released its latest *Army Installations Strategy* in December 2020. Addressing the operational environment, including an expectation of a “persistently contested homeland,” the strategy focuses on how Army installations serve as platforms providing “critical capabilities essential to strategic readiness and the Army’s ability to ‘Deploy, Fight, and Win our Nation’s wars.’”

Covering 2021-2035 and beyond, the twenty one-page strategy (including six pages dedicated to terms, references, and abbreviations) describes, “how installations will transform by 2035 into MDO-ready platforms that protect, support, and enable the Total Army.” It identifies the DCS, G-9 as the organization that will develop the initial Army Installations Strategy Implementation Plan “ensuring integration across each line of effort.” The document identifies DCS, G-9 as the supported organization “with the establishment of a formal operational planning team and support from all installation operations stakeholders.” AMC is the ACOM execution lead for

- Lines of Effort (LOEs)**
- Take Care of People
 - Strengthen Readiness and Resilience
 - Modernize and Innovate
 - Promote Stewardship

all of the Lines of Effort, “responsible for developing an execution plan with metrics and associated outcomes.” Briefings to the governance body will take place at least twice annually.^{xxvii}

Corresponding desired strategic outcomes or objectives include:

- Attract, Retain, and Enable People.
- Project Combat Power and Sustain Operations from a Contested Environment.
- Modernized Installations Supporting the Modernized Army.
- Healthy, Sustainable Training, Working, Living Environment.

The desired Final End state is, “modern, resilient, sustainable installations, enhancing strategic readiness in a contested MDO battlespace while providing quality facilities, services, and support to our Soldiers, Families, and Civilians.”^{xxviii}

In addressing an accelerating rate of technological change, the Strategy specifically addresses Smart Cities.

With respect to recruiting and retaining a modern workforce, “Future Soldiers will expect installations to modernize at pace with civilian sector smart cities initiatives. Opportunities that leverage technology through the creation of data-informed, smart installations will allow the Army to pivot from an industrial-age paradigm, characterized by rigidity and purpose-built specialization, to a data-rich, reconfigurable, and technology-enhanced information-age construct.”

Keeping Our Eyes on the Future

While ASA (IE&E) has created a strategy identifying organizations required to address future Army installations, smart installation operations will likely have to continue to take place at the grass roots level before taking off Army-wide. That will occur when the Army directs and resources a lead. Successful use cases will likely have to begin at the garrison level, through funds that can be allocated toward practical requirements, and their successes, then advertised to other installations. IMCOM directorates will work closely with those garrisons in such efforts. It might not be ideal, but those innovative and creative garrisons, in turn, through enough replication of a proven successful technology and with monies saved or processes greatly improved, could cause Big Army to consider making their experiments more permanent programs of record.

If the Army hopes to dominate the information space and/or build critical capacity to respond to emergency situations, grasp the advantages offered by emerging technologies, and prepare our installations to commit to successfully fight wars against peer adversaries in the future, it needs a Smart Installations champion. A lead organization must stand up and execute and assess Smart Installation pilots, identify and compare data collection methods, analyze and determine which installation requirements could be met by emerging and

smart technologies, and integrate the most promising emerging technologies into installation operations of the future. Lessons learned and best practices need to be recorded and shared as the professional knowledge base of those efforts to date is extremely limited. ASA (IE&E) has done an excellent job carrying the mantle in developing a strategy and initiating pilots, but it is not organized, manned, or equipped to handle the implementation requirements of such an undertaking. Perhaps it is time that Army Futures Command consider its role with respect to modernization of installations and lead the charge in creating truly Smart Installations. Until then, we will have to closely watch those garrisons that implement smart technologies into everyday operations, collecting data and making related decisions that ultimately improve Soldiers' and their families' quality of life.

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