



U.S. Army soldiers from the Alpha Battery, 2nd Air Defense Artillery Regiment, launch the first of two Terminal High Altitude Area Defense (THAAD) interceptors from Kwajalein Atoll in the Marshall Islands 10 September 2013 during a successful intercept test. The test was conducted by the Missile Defense Agency, Ballistic Missile Defense System Operational Test Agency, Joint Functional Component Command for Integrated Missile Defense, and U.S. Pacific Command. The test, designated Flight Test Operational-01, stressed the ability of the THAAD weapon systems to function as part of a layered defense architecture to defeat two near-simultaneous ballistic missile targets. (Photo courtesy of Missile Defense Agency)

How to Build an Armadillo

Lessons Learned from the First Forward-Deployed THAAD Battery

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In the spring of 2013, the U.S. government faced a provocation cycle from the Democratic People's Republic of Korea (DPRK), which, for the first time, involved a direct and viable threat to the U.S. territory of Guam.¹ In response to this threat, the military deployed the Terminal High Altitude Area Defense (THAAD) system to the

island. THAAD is the Army's newest and most advanced missile defense system, and it has proven itself to be an effective deterrent to North Korean aggression. Since its first operational deployment, many important lessons have been learned that military leaders should use to plan for future deployments of the THAAD system.

Background

The DPRK has executed repeated provocation cycles over the decades that have caused various types of military responses. Historically, these provocations focused on conventional military actions against its rival, the Republic of Korea. However, since his December 2011 assumption of leadership, DPRK ruler Kim Jong-un has used his country's growing arsenal of ballistic missiles as his preferred choice for provocation cycles. During the eighteen-year rule of his father, Kim Jong-il, there were eighteen missile tests. In comparison, during Kim Jong-un's four-year reign there have been twenty-five missile tests.²

Though most of the U.S. homeland is out of range of North Korea's current ballistic missile inventory, the U.S. territory of Guam is located approximately two thousand miles from the DPRK. Possibly believing they had identified a potential U.S. vulnerability, DPRK military officials made repeated threats against Guam as part of their spring 2013 provocation cycle. The distance between Guam and the DPRK puts the island's 161,000 U.S. citizens within the range of the DPRK's ballistic missiles.³ The threats of a North Korean missile attack were taken very seriously on Guam as air-raid and shelter-in-place drills were conducted on the island.⁴ Furthermore, Guam's governor, Eddie Calvo, appealed directly to then Defense Secretary Chuck Hagel to deploy missile defenses to defend the island.⁵

In response, the U.S. military initially deployed an Aegis ship equipped with SM-3 missiles to defend Guam.⁶ However, due to the persistent North Korean ballistic missile threat to the island, a sustainable long-term alternative was needed. Fortunately for Pentagon planners, the THAAD system had just received a conditional material release for two batteries and a transition of operations to the Army in February 2012.⁷

Subsequently, in March 2013, a decision was made by the National Command Authority to deploy a THAAD battery to Guam to protect the homeland of the United States from an immediate and emergent threat of a missile attack from North Korea.⁸ In early April 2013, the secretary of defense directed the Army to deploy the 4th Air Defense Artillery Unit, 11th Air Defense Artillery Brigade (A/4) THAAD battery out of Fort Bliss, Texas, to Guam. The A/4 THAAD battery was placed under the command of the 94th Army Air and Missile Defense Command (AAMDC), headquartered in

Hawaii. The A/4 THAAD battery assumed the defense of Guam mission on an expeditionary basis on 25 April 2013. The deployment had special historic significance since the soldiers were the first active-duty air defenders to deploy to Guam since World War II.⁹

Since this first operational deployment of THAAD, the Army has fielded a total of five batteries, with four already rotated to conduct the defense of Guam mission. The fifth THAAD battery became a permanently stationed unit on Guam in 2016.¹⁰ In the next two years, two additional THAAD batteries will bring the fielded total to seven.¹¹ These additional batteries have provided military planners the capacity to support deployments to areas in need of the system's unique capabilities. Additionally, it has been announced that South Korea was designated as the next location for a forward-stationed THAAD battery.¹²

Notwithstanding the deployment of these batteries, as other adversaries continue to advance their ballistic missile capabilities, the demand for THAAD will only increase. This demand means military planners need to learn the special requirements to deploy a THAAD battery now, rather than waiting until a decision to deploy is made. A study of the first operational deployment of THAAD to Guam is the best place to begin learning these planning requirements. The most salient lessons learned are noted below.

Command and Control/Coordination of Support

First, the command and control infrastructure for the unit needs to be developed before any decision is made to deploy a THAAD battery. The first part of developing command and control is building the organizational command structure. For the THAAD battery on Guam, a headquarters element called Task Force Talon was established. The task force was composed of personnel from the 94th AAMDC in Hawaii. The Task Force Talon staff was composed of six noncommissioned officers, five staff officers, a sergeant major, and a lieutenant colonel who commands the unit. Most of the personnel conduct one-year temporary change-of-station tours to Guam from Hawaii. The task force headquarters executes all the functions expected of a battalion staff, such as processing personnel actions, providing intelligence support, planning operations, and coordinating logistics.



The headquarters staff also serves as the organization that integrates THAAD operations with the Air Force's 36th Wing on Andersen Air Force Base and with Joint Region Marianas, which has executive-level installation management responsibilities on Guam. Integration of the battery with the 36th Wing and Joint Region Marianas has been extremely important because those organizations provide the majority of the logistical support for the task force, such as with lodging, dining facility support, medical services, and bulk fuel. All this support required the signing of various inter-service support agreements that were developed by the Task Force Talon headquarters. The task force headquarters also conducted coordination with outside organizations such as the Missile Defense Agency and the U.S. Army Aviation and Missile Life-Cycle Management Command, that provide external support to the THAAD battery.

Preparation for Visitor Protocol

Another somewhat unusual, but important, function of the Task Force Talon staff that needs to be considered in THAAD battery deployment planning is support arrangements for distinguished visitors

U.S. Army Pacific commander Gen. Vincent Brooks speaks with soldiers of the 4th Air Defense Artillery Unit, 11th Air Defense Artillery Brigade (A/4) Terminal High Altitude Area Defense (THAAD) 18 August 2013 about personnel and operational issues during his visit to the unit at Andersen Air Force Base, Guam. The A/4 THAAD deployed to Guam in April 2013 as a part of the 94th Army Air and Missile Defense Command Task Force Talon Mission. (Photo by Angela Kershner, U.S. Army Pacific PAO)

to the site. The high-profile mission of Task Force Talon has made it a key location for senior leaders to visit. Past visitors have included the governor of Guam, congressional delegations, news media, senior Department of Defense leaders, and foreign dignitaries.¹³ Without support from the Task Force Talon staff, the captain that commands the THAAD battery and the headquarters platoon personnel would have to execute all the protocol missions associated with distinguished visitors, a function for which they lack the experience and personnel to properly conduct. Most importantly, diverting assets for protocol purposes with higher headquarters' support would take away from the battery's main focus, which is executing its real-world defense of Guam mission.

This is why it is imperative that as soon as the intent to deploy a THAAD battery is confirmed, the higher headquarters be identified as well. In the case of Task Force Talon, the 94th AAMDC personnel directorate (G-1) immediately requested a derivative unit identification code to establish a higher headquarters on Guam. It is important to execute this request as soon as possible since the process takes time to complete. For example, Task Force Talon was on the ground on Guam and operating before the task force was officially recognized with a derivative unit identification code because of the rapid deployment of the THAAD battery. The Task Force Talon commander did not officially assume command until the derivative unit identification code was received.

Communications Architecture

The next part of command and control involves developing an adequate communications architecture to support THAAD battery operations. It is critical for THAAD battery operators to be able to communicate with the greater missile defense network established in the Indo–Asia–Pacific region to coordinate fires properly. Being located on an existing Air Force base allowed terrestrial communications lines for external communications connectivity to be run to the THAAD battery's location. However, for such an important real-world mission the THAAD battery required a redundant communications capability. The deployment of a Secure Mobile Anti-Jam Reliable Tactical Terminal (SMART-T) system and its accompanying squad of soldiers from the 307th Signal Battalion out of Hawaii provided this redundancy for "Site Armadillo." The SMART-T is a Humvee-mounted extremely high-frequency satellite terminal that provides robust, jam-resistant communications in support of the THAAD battery.¹⁴

Considering the increasing cyber and electronic warfare threats to military communications, the SMART-T is a critical capability that ensures the THAAD battery is always able to communicate with the greater missile defense network in the Indo–Asia–Pacific region. For future deployments of THAAD, military planners will need to determine provisions for redundant and secure communications for the THAAD battery.

Site Requirements

When THAAD was designated to deploy to Guam, one of the most obvious issues military planners had to

determine was where to put the THAAD battery. The proper placement of a THAAD battery is critical to ensuring it is located in a position that provides the highest probability of intercepting enemy tactical ballistic missiles. For Guam, the enemy tactical ballistic missile threat to the island was coming from the northwest, where the DPRK is located. Fortunately, northwest Guam was largely unoccupied since it is home to an abandoned airfield. The airfield, known as Northwest Field, was constructed after the military recaptured Guam from the occupying Imperial Japanese military in July 1944.¹⁵ Now, seventy-two years later, the historic runways of Northwest Field have become the perfect location for deploying a THAAD battery.

The most complex piece of equipment to plan site requirements around is the THAAD battery's AN/TPY-2 radar.¹⁶ The radar is considered the world's most powerful ground-mobile X-band radar. The radar antenna is also what gives the THAAD location on Guam the name Site Armadillo. When the AN/TPY-2 radar antenna is in a stowed configuration, it looks like the hard surface of an armadillo's shell.

This powerful radar requires a very firm surface for transport and emplacement. The low ground clearance and sensitive equipment inside the radar require that a solid road be used during transport. This means that a thorough reconnaissance of the roads identified for transport needs to be completed prior to the deployment. The perfect THAAD site is of no use if the radar cannot be safely transported to the location due to poor road conditions.

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Once at its final destination, the THAAD radar needs to be emplaced on a firm surface in order to acquire objects hundreds of miles above the Earth's surface. For example, the radar would not be able to accurately track these objects if it was sitting on a soft surface and slowly sinking into the mud. The seven-decade-old runway tarmac on Northwest Field proved to be a suitable surface to emplace the THAAD radar.

Besides planning for a firm surface, an additional consideration is that safe keep-out zones for personnel and aircraft need to be maintained around the radar. The powerful radiation from the AN/TPY-2 radar could have negative effects on people's health and could damage aircraft if safe keep-out zones are not enforced. The Army Techniques Publication 3-01.91, *Terminal High Altitude Area Defense (THAAD) Techniques* manual, lists the features of safe keep-out zones. These zones range from one hundred meters for troops up to 5,500 meters for aircraft carrying munitions.¹⁷

In keeping with this guide, due to the flight operations of nearby Andersen Air Force Base and Guam's Won Pat International Airport, a temporary flight restriction was established around Northwest Field along with other safety measures to ensure no aircraft flew within the radar's safe keep-out zone.¹⁸ Additionally, the THAAD launcher also was given a back blast safety keep-out zone that was a three-hundred-meter semicircle around the rear of the launcher and eight hundred meters in front of it. For the THAAD battery on Guam, HESCO barriers and razor wire were constructed to enforce the safe keep-out zones for personnel and equipment. Maintaining and enforcing such keep-out zones will be a critical planning requirement for any future THAAD deployments.

Radio Frequency Clearance and Management

Besides being a safety consideration, the powerful X-band radar, along with other emitters from the THAAD battery, requires frequency clearance. Without proper frequency clearance and management, a THAAD battery has the possibility of interfering with the operation of other civilian and government frequencies used in the area. Due to THAAD operating in a remote area of Guam, frequency clearance was able to be properly coordinated with few issues. However, future deployments of THAAD could require it to be emplaced in or

around more urbanized areas. The more urbanized a THAAD operating location is, the more challenging the frequency clearance process will be.

Proper Grounding of Equipment

The brains of the THAAD radar is the THAAD fire control and communications (TFCC). The unit's soldiers operate the TFCC from shelters, which are located in four specialized light medium tactical vehicles. The TFCC, THAAD radar, and launchers all require appropriate grounding.

Proper grounding of the equipment ended up being an issue initially for THAAD on Guam because of the coral rock directly below the surface. The coral rock was difficult to penetrate with grounding rods and did not provide the recommended grounding for the equipment. The installation of a grounding grid for the TFCC and the THAAD radar and the construction of launcher pads with appropriate grounding within the concrete resolved these issues on Site Armadillo. Future THAAD sites will need to conduct surveys of the site's soil to determine if it meets the recommended grounding requirements for THAAD equipment.

Power Source

A final site consideration is determining the need for a long-term power source. The THAAD battery was originally designed to conduct short-term deployments in support of the warfighter and then redeploy back to its home station. However, for THAAD on Guam, the mission became an enduring one due to the persistent missile threat from North Korea. One result was that the tactical generators on Site Armadillo had to run twenty-four hours a day, seven days a week. This heavy usage meant extra maintenance had to be conducted to keep the generators operational. The maintenance became challenging because the THAAD battery was assigned only one generator mechanic. Also, the maintenance challenges only increased when additional generators were needed to power the site security cameras, communications equipment, and life-support trailers.

To reduce the generator maintenance burden, Task Force Talon was able to acquire a Mobile Electric Power 810A generator to power Site Armadillo from a single power source. This prime power source allowed all the tactical generators on the site to be powered down and



serviced after two years of near continuous use. It also had the side benefit of improving the quality of life on Site Armadillo due to the decrease in generator noise.

However, relying on tactical generators should not be regarded as a permanent solution. As part of the planning process for future THAAD deployments, a plan for long-term power generation to sustain a THAAD site will need to be developed. Depending on tactical generators for long-term operations is not a sustainable course of action. Prime power generators or, if available, commercial power, are options that should be explored for the long-term power needs of future THAAD sites.

Environmental Considerations

Due to the remote nature of Site Armadillo and the availability of the abandoned runways, the site considerations were easily resolved for the deployment of THAAD to Guam. However, some things that would prove to be far more challenging were the environmental considerations.

The National Environmental Policy Act (NEPA) requires that all branches of the government give

The first elements of a Terminal High Altitude Area Defense (THAAD) system arrive in the Republic of Korea (ROK) 6 March 2017. U.S. Forces Korea continues its progress in fulfilling the ROK–U.S. Alliance decision to install the THAAD system on the Korean Peninsula as a defensive measure in response to ongoing provocative North Korean missile tests. (Photo courtesy of 7th Air Force PAO)

proper consideration to the environment prior to undertaking any major federal action.¹⁹ Since Guam is a U.S. territory, the Department of Defense had to comply with the NEPA guidelines as part of any THAAD permanent stationing action on Guam.

This required the Department of Defense to conduct an environmental assessment (EA) to document the environmental impacts associated with the operation of a permanently stationed THAAD battery on Guam. The EA is an extremely detailed document that looks at air quality, noise pollution, water resources, biological resources, cultural resources, hazardous materials, socioeconomic impacts, and a host of other factors that are part of any stationing action.²⁰ If the EA determines that the permanent

stationing of THAAD will not have significant environmental impacts, a finding of no significant impact will be issued. A finding of no significant impact is a document that presents the reasons why the EA concluded that there are no significant environmental impacts for the project.

Along with complying with NEPA requirements, THAAD on Guam had to comply with local environmental regulations. For example, the previously mentioned installation of a grounding grid required a well-drilling permit from the Guam Environmental Protection Agency.²¹ The THAAD radar has grounding rods for the radar that are nine feet long (in three three-foot sections) and one-half inch in diameter.²² Due to the coral rock below the surface, a drill was required to install the grounding rods. In order to drill the grounding rods into the ground, the local vendor had to secure a well-drilling permit from the Guam Environmental Protection Agency that cost the task force thousands of dollars to purchase.

Community Relations

Another environmental consideration is the impact on-site noise will have on local communities. The THAAD radar is powered by two powerful prime power units that can generate noise in excess of the eighty-five-decibel level, which can cause hearing damage with prolonged exposure.²³ Fortunately, the isolation of Site Armadillo prevented any noise issues with the local community. However, at a forward-based radar site that uses the AN/TPY-2 in Kyoga-Misaki, Japan, noise pollution has been a serious point of contention between the Army and the local community.

The issue was contentious enough that then Japanese Defense Minister Gen Nakatani made a visit to the U.S. base at Kyoga-Misaki in December 2015 as part of a public relations campaign to show the local community that all efforts were being made to reduce noise.²⁴ The installation of muffling devices and sound barriers eliminated most of the low-frequency noise on Kyoga-Misaki. These measures, together with future announced plans to hook up the site to commercial power to fully eliminate noise pollution, have done much to allay community concerns. For future THAAD sites, military planners need to determine if the noise from the prime power units will have an

adverse impact on local communities and develop ways to reduce it, like at Kyoga-Misaki.

Though most of the environmental considerations mentioned resulted from compliance with NEPA due to the location being on U.S. soil and under its jurisdiction, future THAAD deployments will likely be to areas external to the United States, which would fall outside the jurisdiction of the NEPA. However, planners will still be required to identify any potential environmental regulations that will need to be complied with before a THAAD deployment. Likewise, a campaign to educate the public about THAAD will also be needed. For example, due to negative media coverage about the possible environmental impacts of THAAD in South Korea, various political figures have come out against the deployment.²⁵

On Guam, Task Force Talon has been able to avoid such criticism by proactively engaging the public and the island's political leadership about the deployment of the THAAD system. The task force leadership conducted a series of town halls in local villages to educate and receive feedback from the public about the permanent stationing of THAAD.²⁶ The task force also participated in major local events, sponsored schools, and hosted site visits for local dignitaries to strengthen bonds between the task force and the local community. These bonds built trust with the local community and the island's political leadership to support the permanency of THAAD on Guam.²⁷

Security Requirements

After working out if a location can support a THAAD battery, the next thing planners need to consider is how to secure the potential site. Due to the unique nature of THAAD being a strategic asset, for security, it falls under Strategic Command (STRATCOM) Instruction (SI) 538-02 (classified), *Ballistic Missile Defense System (BMDS) System Security Level (SSL) Designation*. Inside SI 538-2 it clearly identifies physical security requirements such as the fencing, lighting, and sensors needed to secure a THAAD site. The original expeditionary deployment of THAAD caused the site to be secured with non-permanent physical security features such as concertina wire and wooden guard towers. The reason more rugged physical security structures could not be built on Site Armadillo initially was because of the pending

environmental assessment. Once the EA is complete, permanent fencing, concrete guard towers, and other physical security enhancements can be constructed.

The expeditionary physical security infrastructure became a major concern when Typhoon Dolphin hit Guam in May 2015 and destroyed some of the temporary security infrastructure.²⁸ Powerful storms are a regular occurrence on Guam, which makes building permanent infrastructure for a long-term presence on the island a priority. For future THAAD sites, military planners will need to complete an assessment to determine what permanent physical security enhancements are required by the STRATCOM instruction and then develop a course of action to properly secure the site.

The STRATCOM instruction also identifies the amount of personnel needed to secure a THAAD site. Since a THAAD battery does not have enough personnel to conduct its missile defense mission and still comply with the SI 538-2 security requirements, it has to be augmented with a security force (SECFOR).

To comply with the instruction's security requirements, U.S. Army Pacific deploys a SECFOR company on a four-to six-month rotation to Guam to defend Site Armadillo.²⁹ The SECFOR units supporting this task have ranged from military police to artillerymen, engineers, and infantrymen. Future deployments of THAAD will require a SECFOR, and the size of the element will depend on the security infrastructure in place around the site. More personnel are needed to secure an expeditionary site compared to a permanent site.

Once a SECFOR unit is established, the security personnel will need to be well trained in the escalation of force. In all operations, the starting point for engagement criteria is the standing rules of engagement (SROE) and standing rules for the use of force (SRUF). The definitions for these terms are found in Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3121.01B, *Standing Rules of Engagement/ Standing Rules for the Use of Force*, which explains the distinct difference between SROE and SRUF.³⁰

The SROE from the CJCSI 3121.01B provide the inherent right of self-defense and the application of force for mission accomplishment. The SROE are designed to provide a common template for development and implementation of rules of engagement for the full range of military operations,

from peacekeeping to war, when outside the territory of the United States. Within the U.S. territory, the SROE apply only to air and maritime homeland defense missions. Included in the SROE are SRUF, which apply to land-based homeland defense missions within the territory of the United States. This means the SROE apply only to the air defense personnel regarding use of their THAAD weapon system, and the SRUF apply to the SECFOR personnel.

The distinction between the two caused some initial delays in understanding the SROE for THAAD and the escalation of force authorized for the SECFOR personnel when the unit first deployed to Guam. For future THAAD sites, planners will need to closely work with the legal community and confirm that the correct kill chain for THAAD is written into the deployment order. Additionally, planners will need to develop an internal standard operating procedure that clearly depicts what escalation of force measures are appropriate, how they are used, and when the use of deadly force is authorized for the SECFOR unit.

Conclusion

As adversaries continue to build and proliferate their ballistic missile capabilities, the demand for THAAD will only increase. In order to meet the demand, military planners must become familiar with some of the complexities involved with deploying a THAAD battery. Deploying a THAAD battery requires some unique planning considerations when compared to other more common air defense systems such as the Patriot system. The first operational deployment of THAAD to Site Armadillo on Guam provided many important operational lessons to better plan for future THAAD deployments. Not all planning considerations for THAAD can be described in this paper due to security classification reasons, but planning for the command and control, site requirements, environmental considerations, and security for a THAAD site is where planners need to start in order build their own "armadillo." ■

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