The Illusion of Missile Defense

Why THAAD Will Not Protect South Korea

By Theodore A. Postol & George N. Lewis

THE RECENT DECISION by South Korea to allow the United States to deploy a Terminal High Altitude Area Defense (THAAD) missile defense battery on its territory has major political and military implications for East Asia. The joint announcement by the two countries on July 8 that a THAAD battery would be deployed by the end of 2017 prompted immediate and strong criticism from China. A few days later, the South Korean government disclosed that the battery would be deployed in Seongju, about 220 kilometers southeast of Seoul, triggering a wave of local protests.

The planned deployment will affect not only South Korea-China relations, but will also raise tensions in China’s relations with the United States and possibly also with Japan. The consequences of the deployment do not arise solely from the system’s technical capabilities, but a full understanding of the implications does require an accurate assessment of these technical capabilities.

RADAR CAPABILITIES

A THAAD battery consists primarily of a powerful TPY-2 X-band radar, a command-and-control center and a number of launchers. A typical battery has about eight launchers, or about 48 interceptor missiles. The THAAD equipment is designed to be air-and-road-transportable and can be operational within eight hours of arriving at its deployment site. The US currently has five THAAD batteries, with two more scheduled to become operational in the next few years. One is now based in Guam, while the others remain in the continental US. The US has also sold two THAAD batteries to the United Arab Emirates.

The THAAD interceptor missile has a single-stage solid-fuel rocket booster that can reach a peak speed of about 2.6 km per second, about eight times the speed of sound. The missile is initially guided towards its target using tracking data obtained by the TPY-2 radar, and after the booster rocket motor burns out, the missile’s kill vehicle is released. The aerodynamically shaped kill vehicle then detects its intended target using an infrared seeker and maneuvers towards an intercept using both aerodynamic forces and four rocket divert thrusters. The kill vehicle does not carry an explosive charge but instead aims to destroy its target in a direct high-speed collision.

South Korea recently relented to US pressure to allow deployment of an advanced missile defense system on its soil to counter threats of a North Korean missile attack, triggering a harsh reaction from China and domestic opposition. It’s not just that its powerful radar would let the US look deep into China; it does not guarantee protection for South Korea or even the US. The deployment could thus heighten tensions in East Asia and beyond without really enhancing security, write Theodore A. Postol and George N. Lewis.
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At present, South Korea’s only missile defense capabilities are Patriot missile batteries. South Korean batteries are equipped only with older PAC-2 interceptors, while US batteries deployed with US Army units in South Korea also include the newer PAC-3 interceptors. South Korea intends to buy PAC-3s in the next few years. Even the most advanced version of the Patriot, however, has a range of only about 40 km (and much less in some directions) and thus covers a much smaller area than a THAAD battery.

It is important to emphasize that wherever THAAD is deployed in South Korea, its range is too short to give it any capability to intercept Chinese missiles unless such missiles were fired at South Korea. This would likely remain the case even if the US were to develop and deploy an extended-range version of the interceptor, which could occur by the mid- to late 2020s.

Rather, China’s concerns and complaints focus on the potential capabilities of the TPY-2 X-band radar. (“X-band” simply indicates that the radar operates in the X-band of radar frequencies between 8 and 12 GHz, most likely between about 9 and 10 GHz.) These concerns arise in part because the TPY-2 radar is designed for two distinctly different roles.

In one role, a TPY-2 radar is part of a THAAD battery in which it must continually scan the sky, searching for incoming missiles. If any are detected, the radar must then track both these missiles and the interceptors launched against them, and guide the interceptors to their predetermined intercept points, while continuing to search the sky for new targets. Operating in this way, called the Terminal Mode (as it tracks missiles during the terminal, or final, phase of their flights), the radar can only spend a very limited amount of time looking in any one direction, and so its maximum range is limited to about 600 km.

In its other role, a TPY-2 operates as a forward-based radar integrated into a larger ballistic missile defense system. For example, two TPY-2 radars are based in Japan as part of the Ground-based Midcourse Defense system, which covers US territory, and another in Turkey is part of the European Phased Adaptive Approach defense of Europe. When configured for this role, in what is called the Forward-Based Mode, the radar searches at long ranges to detect missiles early in their flight and then reports anything it detects back to the rest of the defense system. In this mode, the radar can spend much more time looking in a particular direction, and thus can achieve much greater ranges than in Terminal Mode. South Korean press reports, citing official sources, have given a range of 1,800 km to 2,000 km for a TPY-2 configured in Forward-Based Mode, and a former director of the US Missile Defense Agency has said that its range is greater than 2,900 km. Thus, a TPY-2 configured in Forward-Based Mode may have a range nearly five times that of one configured in Terminal Mode.

CHINESE CONCERNS

US officials have insisted that the TPY-2 X-band radar to be deployed in Seongju, which will be set up and operated by US Army personnel, will be configured as a Terminal Mode radar. Thus, they argue, the radar will have no capability to look deeply into China and therefore should not be a concern to China. However, the Terminal and Forward-Based radars are essentially identical, differing only in software and possibly some communications equipment. A radar can be converted from Terminal Mode to Forward-Based Mode, or vice versa, in only eight hours. Although China would almost certainly detect that such a switch had occurred, there would be nothing it could do to prevent it. The two US TPY-2 radars in Japan are deployed in Forward-Based Mode. US assurances about how it intends to use the THAAD radar may be sincere. But Chinese leaders know that intentions can change and that in the long run it is capabilities that matter. From a Chinese perspective, the deployment of the THAAD radar undoubtedly raises several serious concerns.

First, the radar is clearly technically capable of observing ballistic missiles deep within Chinese territory. Chinese analysts have raised two related but distinct issues about such a capability. First, that the radar may be used to observe Chinese ballistic missile tests and, in particular, of countermeasures — steps to defeat a missile defense — used in those tests. Such information could help to defeat Chinese missile attacks in the event of a future conflict with the US.

Second, in the event of actual Chinese missile launches, the radar could directly observe the launches and relay information back to the US long-range national missile defense system.

The THAAD radar in South Korea would be sufficiently powerful to track the rocket stages of Chinese intercontinental ballistic missiles launched from China toward targets in the western or central United States. Such information could reduce the search requirements for the planned US Long-Range Discrimination Radar (LRDR) — scheduled to be operational in Alaska by 2020 — allowing it to focus on those points at which the Chinese missiles would be expected to come into view of the radar. Another possibility is that tracking data from the South Korean radar, together with the two Japanese radars, could be used to enable an earlier launch of interceptors or that these radars could be used to observe the deployment of decoys or other countermeasures. The data from the South Korean THAAD radar could thus assist the LRDR in distinguishing the warhead from decoys or other countermeasures.

Third, China likely views the deployment of THAAD as a significant step toward an integrated regional ballistic missile defense system such as the European Phased Adaptive Approach (EPAA). The official 2010 Ballistic Missile Defense Review said that the US will “apply phased adaptive approaches in other regions by building on current efforts, with a principal focus on East Asia and the Middle East.” Although the US has not publicly discussed what an East Asian Phased Adaptive Approach would look like, it would be apparent to a Chinese observer that the pieces for such a system are rapidly falling into place. As discussed above, the principal radar for the EPAA is a TPY-2 radar in Turkey. The deployment of the THAAD radar in South Korea, along with the two nearly identical radars in Japan, would give a total of three such radars in East Asia (four, if you count the THAAD battery that has been deployed in Guam since 2013).

The US now has seven Aegis ballistic missile defense ships — a number that will continue to grow as additional US ships are given ballistic missile defense capabilities — based in Yokosuka, Japan and equipped with SM-3 Block I interceptors. Japan itself now has six Aegis ballistic missile defense ships, with plans to build two more. Recent press reports indicate that South Korea is considering giving its three...
Sejong The Great-class Aegis missile destroyers the capability to operate SM-3 interceptors (which would require enlarging their missile launchers) or building its next three ships with this missile defense capability built-in.

After the deployment of the TPP-2 radar in South Korea in 2017, the next major step in US East Asian missile defense capabilities could occur as early as 2018, as the US begins to deploy its new SM-3 Block IIa interceptor. These new, much higher-speed missiles, which are being co-produced with Japan, will be able to intercept at much greater distances than the current SM-3 Block I missiles or the THAAD interceptors. As in the EPAA, the SM-3 Block IIAs will likely rely heavily on the TPP-2 radars for guidance. From a Chinese perspective, it is at best unclear when this large-scale build-up of US and allied missile defenses in East Asia will end and how threatening these deployments will become to the effectiveness of Beijing’s ballistic missile forces.

Fourth, the THAAD deployment could be a next step towards greater co-operation in missile defense between South Korea and the US and the integration of South Korea into a US-led East Asian missile defense system. It is true that thus far, Seoul has insisted on keeping its missile defense program independent of the US. Thus, while South Korea currently operates Patriot PAC-2 missile defenses and plans to upgrade its defenses to the PAC-3 standard, it paid for and operates these units itself. But even these nominally independent units rely on data about North Korean missile launches provided by US early warning satellites to enhance their effectiveness, as do Japanese missile defenses.

In those parts of South Korea that will be covered by THAAD, the effectiveness of the Patriot units will be enhanced if they work co-operatively with THAAD to form a layered defense system. This synergistic effect was highlighted in August, when the Director of the US Missile Defense Agency (MDA), Vice Admiral James Syring, told attendees at the 2016 Space and Missile Defense Symposium that MDA was committed to testing THAAD and Patriot together at every possible opportunity. Even those Patriot units deployed in areas not covered by the THAAD interceptors could still potentially benefit from missile tracking data gathered by the THAAD radar.

Thus, the deployment of the THAAD battery in South Korea will produce strong technical and operational reasons for more closely integrating US and South Korean ballistic missile defense systems. Should South Korea decide to upgrade its current Aegis destroyers to operate SM-3 interceptors or to give its next missile defense destroyers this capability, these pressures for greater integration will be even further magnified, because these SM-3 interceptors would need the greater range of the TPP-2 radar to fully realize their capabilities for long-range missile defense, as is the case with the SM-3 interceptors and the TPP-2 radar in the EPAA.

WHY IT WON’T WORK

As threatening as these developments might appear to Chinese planners, and as destabilizing as their responses might be, they might be seen as worthwhile if they provided reliable and effective ballistic missile defense. But they cannot. In the context of a possible Chinese missile attack on the US, THAAD and other US missile defense deployments in East Asia do not solve the fundamental problem facing the US national missile defense system, that of mid-course countermeasures. While these deployments might assist the LRDR in detecting incoming Chinese warheads earlier, or enable earlier launching of interceptors, they do not change the fact that the LRDR and the other national missile defense sensors would have little chance of distinguishing the actual warheads unless China neglected to employ effective above-the-atmosphere countermeasures. In the face of rapidly expanding US ballistic missile defenses, the probability of China failing to implement such countermeasures is far too low to serve as the basis for any defense planning.

This problem of above-the-atmosphere countermeasures is reflected even in statements by US Secretary of Defense Ashton B. Carter. Before he became defense secretary, Carter authored a report on the capabilities of missile defenses such as the US national missile defense, the interceptors of which home in on the infrared signal from warheads and decoys; he concluded that “...it is a straightforward matter to design RV [re-entry vehicle]/light-decoy pairs which appear identical to infrared sensors,” that “there is no fundamental principle on which infrared sensors can rely to guarantee discrimination,” and that “there is no impediment in principle to deploying lightweight decoys which have temperature characteristics indistinguishable from those of true RVs.”

This same reality also applies to THAAD if it attempted to intercept North Korean missiles above the atmosphere. We have shown that such THAAD interceptors could be readily defeated if North Korea simply cut its rockets into many pieces, or caused their rockets to tumble end-over-end after they completed powered flight. North Korea has already demonstrated some command of this technology by cutting up the first stage of the Kwangmyoungseong satellite in the 2016 launch of its second satellite. This countermeasure presents THAAD interceptors with numerous decoys and warheads, each of which can only be observed as a distant point of infrared signal. As explained by Carter in his lucid analysis, the interceptor would then have no way of knowing which point of infrared signal was a warhead and which was a decoy.

This would leave THAAD only with a narrow window of opportunity to intercept a re-entering North Korean missile in the upper atmosphere, before the THAAD interceptors reach their minimum intercept altitude. Because THAAD interceptors accelerate slowly, the interceptors would need to be launched before the atmosphere can remove any decoys accompanying the warhead. Aside from the obvious fact that a THAAD battery has far fewer interceptors (typically 48) than the many hundreds of North Korean Scud and Nodong missiles, the futility of attempting to defend South Korea with THAAD is highlighted by the decision to base the THAAD unit too far south to even attempt to defend the Seoul metropolitan area. This leaves the South Korean government in the awkward position of arguing that Seoul will be protected by deploying additional Patriot batteries. Yet, the US THAAD deployment clearly implies that it does not consider the Patriot as adequate to protect its own forces.

Thus, the decision to allow the US to place a THAAD defense unit in South Korea provides Seoul with the worst of both worlds. It will not provide any useful level of defense against North Korean ballistic missiles, and it will appear to China as a willing ally of the US in deploying defenses that threaten its nuclear deterrent forces. The net result will be no useful additional defensive capability for South Korea and a considerably more hostile and dangerous political environment for South Korea and the other nations of East Asia.

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