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The Impact of RPA Technology on Conventional Deterrence Against North Korea

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Foreword

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WILLIAM C. FREEMAN
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Biography

Lieutenant Colonel Michael Edmonston is assigned to the Air War College, Air University, Maxwell AFB, AL. He is a pilot with over 3000 combined hours in the B-1B and the MQ-1B and has commanded at the squadron level. He is also a Northeast Asia Foreign Area Officer, and he served a tour in the Republic of Korea as the Air Force Plans Officer for Combined Forces Command.

Abstract

The proliferation of Remotely Piloted Aircraft (RPAs) presents a unique opportunity to the US-ROK alliance for enhancing conventional deterrence against North Korea. An understanding of the Kim family's motivations for conducting provocations is crucial to deterrence regardless of the means employed. However, coupled with that understanding, there is deterrent value in RPA employment for depriving the DPRK regime of the element of surprise in the conduct of its provocations. Establishing accountability for North Korean actions and making the threat of response to hostile activity more credible are also benefits of large-scale RPA employment in Intelligence, Surveillance, Reconnaissance (ISR) and kinetic strike on the Korean peninsula. The integration of RPAs into a networked command and control (C2) structure, the improvement of RPA technology in the field, and timely communication with North Korean leadership about what RPA technology can achieve are necessary to realize these benefits. Since the fielding of RPAs on the Korean peninsula is still somewhat limited, this paper draws from three case studies to reinforce its claims. These include the value of a radar-based C2 system in deterring Nazi Germany from conducting a sea-borne invasion of Britain in World War II, the impact of RPAs in deterring terrorist attacks in the Middle East during the Global War on Terrorism, and the impact of US-ROK missile defense in deterring North Korean conventional and nuclear attacks. The last case study is particularly useful for demonstrating the importance of technological superiority, deterrence by denial, tailored/immediate deterrence, US-ROK cooperation, and assurance to the ROK in the employment of RPAs.

Introduction

This study assesses the impact of an emerging weapons technology platform—the drone or Remotely Piloted Aircraft (RPA)—on conventional deterrence on the Korean peninsula. This study is relevant for a few reasons. First, US and South Korean efforts to deter the conventional provocations of the Democratic People's Republic of Korea (DPRK) against the Republic of Korea (ROK) have sometimes failed, motivating leadership in both countries to ask how we might be more successful in the future. Second, the deterrent effects of employing new technologies on the Korean peninsula such as the RPA are largely unknown. Scholars studying the matter have offered only speculative hypotheses. Third, RPAs are likely to see increased employment on the Korean peninsula in the future. The United States continues to expand the roles of RPAs and already employs medium and high-altitude variants in Korea. Furthermore, South Korea is "one of a handful of countries that possess advanced aerospace industries and are pursuing wide ranging unmanned aircraft system (UAS) development programmes."[1] As development of RPA technology continues and employment on the Korean peninsula increases, the technology's impact on conventional deterrence is also likely to increase.

For these reasons, an assessment of the contribution of RPAs to deterrence against North Korea is important. Such an assessment should account for currently fielded capabilities of RPAs such as Intelligence, Surveillance, and Reconnaissance (ISR) and kinetic strike, as well as potential future roles such as electronic warfare. This study suggests that RPA-borne ISR could aid deterrence against certain provocations by removing the element of surprise and establishing accountability, while demonstrations of more offensive capabilities may be useful for making threats credible.

This study follows a building block approach that begins by defining relevant theoretical terms, explaining North Korean deterrence strategy and how conventional provocations fit into it, and describing US deterrence strategy on the peninsula. Next, it discusses the contribution of emerging technology to deterrence generally, introduces the RPA as an emerging technology with unique advantages for enhancing deterrence, and makes some initial assertions about its potential contributions to deterrence in Korea. Finally, there are three case studies to support the thesis: the impact of radar in deterring Germany from invading Britain in World War II, the value of RPA employment during the Global War on Terror in deterring terrorists from carrying out attacks in the Middle East, and the impact of combined US-ROK missile defense in deterring North Korean aggression since the 1990s. The study

closes with a conclusion and recommendations for a deterrence strategy on the Korean peninsula that incorporates RPAs.

Deterrence Theory

This study's claims rest on the theoretical foundation undergirding research in deterrence, beginning with relevant definitions. Since the study examines how to deter a particular regime—perhaps even a single, authoritarian actor—psychology plays prominently into a proper definition of deterrence. The definition set forth by In Hyo Seol and Jang-Wook Lee is fitting, namely, "a psychological process to prevent the enemy from attacking, by making it realize that the benefit it can get from the attack will be lower than the cost the attack will bring."[2]

Bringing psychology into an understanding of deterrence does not remove rationality as a tenable assumption in analysis. In fact, the conclusions of this study rest on the belief that, despite some opinions to the contrary, the ruling Kim family has often proven rational in its decision-making regarding provocations against the US and the ROK. A study in rationality is beyond the scope of this paper, but two models illustrate the breadth of considerations one should make before concluding that any act is irrational. Graham Allison and Philip Zelikow lay out one of them in their analysis of the Cuban Missile Crisis. Rationality, in these authors' conclusion, is a "consistent, value-maximizing choice within specified constraints," such as the decision-maker's goals and objectives, available alternatives, and expected consequences.[3] Another model comes from David Shin in his book, *Rationality in the North Korean Regime: Understanding the Kims' Strategy of Provocation*, which applies seven questions derived from examining the close relationship between rationality and strategy. They are:

1. What are the few vital objectives whose achievement would lead to favorable outcomes and were they achieved?
2. How much does emotion play as motivation to conduct the provocation?
3. What do the diagnoses of the "truth" reveal about the situation as the critical challenge?
4. What was the central element of design and what was done to achieve success?
5. What resources were chosen to achieve the aim and did they include an information campaign to justify its actions?

6. What is the probability of success?
7. Who opposed the strategy and who supported it, and what was done to overcome the former and exploit the latter?[4]

In answering these questions across over six decades of North Korean provocations, Dr. Shin has concluded three generations of Kims have more often than not been rational in their strategies.[5]

What these models and Shin's conclusions about North Korean leadership in particular tell us is that while the deterring power's capabilities, resolve, and credibility may weigh heavily in the success of deterrence, "the broader situational context within which deterrence is attempted" also matters.[6] Therefore, one must consider not just the means of deterrence, the policy and framework within which it is employed, and the ability to communicate intent to an adversary, but also the adversary's wider decision calculus and the situation affecting it. Such details tend to muddle the predictability of deterrence theory. However, since they cannot be ignored—particularly in an environment characterized by ongoing tension like the Korean peninsula—the contribution of any means or method to achieve successful deterrence depends at least partly on its ability to shape the adversary's situational context.

If the RPA is the means and the method is its employment within a combined US-ROK C2 network as this study recommends, a holistic assessment of the contribution of both together to deterring North Korean conventional provocations might consider a few types of historical cases. Although the United States has employed a variety of RPAs on the peninsula and South Korea has procured and begun to produce its own models in the last two decades, there is not enough evidence based on scale of employment or level of integration to conclude they have yet made a difference in North Korean decision calculus regarding provocations. Therefore, useful types of cases include the contributions of similar technology and methods of employment to deterrence elsewhere, the contributions of RPAs to deterrence elsewhere, and the contribution of a different emerging technology employed as part of a C2 network to deterrence in Korea. All three types of cases address capability, resolve, and credibility in deterrence, but only the third addresses these factors within the situational context driving the Kim family's decision calculus. Therefore, the third type is perhaps the most important.

Situational context aside, the foundation for this study's analysis includes appropriate definitions for several terms under the category of deterrence. These terms include direct deterrence, extended deterrence, general deterrence, tailored deterrence, immediate deterrence, deterrence by denial, and deterrence by punishment as they relate to the Korean strategic environment.

When one applies deterrence against an adversary to prevent attack against one's own territory, it is known as direct deterrence.[7] In extended deterrence, one seeks to prevent an actor from attacking "other countries or territories."[8] The challenge of extended deterrence for the United States on the Korean peninsula is that it must convince North Korea the cost of attacking South Korea exceeds any benefits it would gain by doing so.

It is helpful to define general, tailored, and immediate deterrence together. General deterrence is theoretically in place "when opponents who maintain armed forces regulate their relationship even though neither is anywhere near mounting an attack."[9] General deterrence is a fitting term to describe the US-DPRK nuclear deterrent posture, as well as US-ROK deterrence against a DPRK invasion of South Korea. In contrast, tailored deterrence concerns deterrence against a specific threat using specific means. Immediate deterrence may be considered a subcategory of tailored deterrence. It takes place on a relatively short timeline when "at least one side is seriously considering an attack while the other is mounting a threat of retaliation in order to prevent it."[10]

From these definitions, two observations can be made. First, tailored nuclear deterrence appears to be more effective than tailored conventional deterrence at preventing actual attacks. Second, general deterrence to prevent a North Korean invasion seems to be more effective than immediate deterrence to prevent periodic small-scale acts of aggression, based on North Korea's record of conventional provocations (targeting the ROK) and nuclear tests (primarily messaging the US). However, the DPRK's actions against a superior US-ROK alliance appear to be consistent with the conclusion of Paul Huth that when a defender has "equal or better military forces on hand than the challenger . . . [the] challenger normally looks for a quick victory or fait accompli."[11] One purpose of this study is to examine how employment of RPA technology in tailored (and possibly immediate) deterrence can create situations in which such victories appear less attainable to the North Korean regime.

Such a situation would be an effective demonstration of what is called deterrence by denial, in which the defender exerts control by denying the challenger strategic options.[12] For North Korea, provocations are not in themselves necessarily strategic in terms of levels of warfare, but they are options for achieving national strategic goals that the US or the ROK would seek to deny them. This type of deterrence contrasts with deterrence by punishment, in which the defender gives the challenger "powerful incentives to choose in a particular way."[13] In examining how the employment of RPAs can affect DPRK decision-making calculus, this study generally prefers deterrence by denial over punishment because, by Lawrence Freedman's reasoning, the former "offers control rather than . . . coercion" and

removes choices from the challenger rather than simply leaving it up to him to decide what he is willing to endure.[14]

Regardless of whether one seeks to deter by denial or punishment, two guarantees are usually necessary for extended deterrence to be effective. First, the deterring power must "provide assurances to allies that an adversary will not succeed in its goals if it chooses to attack," based on the deterring power's commitment.[15] If assurance is not credible, an ally may seek to deter the adversary independently, complicating the strategic environment. This should be a consideration of the United States in the employment of new technology toward deterrence. Second, as part of deterring an adversary one should also offer reassurance that "a world without aggression [is] more attractive."[16] Accordingly, for any new technology to contribute positively to extended deterrence on the Korean peninsula, it should increase the costs of North Korean attack or provocation, increase for North Korea the apparent benefits of not attacking, enhance assurance of commitment to South Korea, or some combination of all three things.

There is a flipside to deterrence that is useful for understanding some of North Korea's past provocations. Thomas Schelling introduced the concept, which he calls *compellence*. It is a commitment to acting against an adversary until the adversary stops doing something. Unlike deterrence, compellence reflects an attempt to change the status quo rather than retain it.[17] While no single North Korean provocation can be called compellent by itself (perhaps the successful launch of nuclear ICBMs), one could argue that enough conventional provocations undertaken over time could take on a compellent nature. One final term not included in Shin's list is escalation, defined as "an increase in the intensity or scope of conflict that crosses threshold(s) considered significant by one or more of the participants."[18] By this definition, if a conflict escalates, deterrence has failed. Preventing such failures—even if they only take place in the conventional realm—requires understanding North Korea's own national strategy.

North Korean National Strategy and Provocations

The ultimate aim of Kim Jong-Un in his engagement toward the United States and South Korea is the survival of his regime.[19] The challenge in deterring North Korea from escalating a conflict is understanding how the regime goes about achieving this aim and whether it is rational in doing so. Nuclear deterrence is the most evident strategy for national survival, based on the state's continued nuclear tests and launches of increasingly far-ranging missiles over the past three decades. These events, which are sometimes con-

ducted on symbolic dates or accompanied by verbal threats, serve both to assure domestic audiences and convince external actors of the regime's willingness to defend itself, should it be attacked. Pyongyang's own claim that it "pursues nuclear weapons out of self-defense against a US invasion" reinforces this assertion.[20]

On the conventional side, North Korea's strategy is more difficult to interpret. Motives seem to vary for conventional provocations, and the opaqueness of the regime requires scholars to rely for their interpretations upon current geopolitics, public statements by DPRK leadership, state media pronouncements, and what high-ranking defectors might share. North Korea's provocations have sometimes exhibited deterrent intent, as in the 1987 bombing of a South Korean airliner. Shin argues the regime directed this attack "out of desperation to prevent a successful Seoul Olympics," an event that "would have clearly signaled to the world that the Republic of Korea had won the economic competition" between the two states.[21]

Judging from this example, North Korea may conduct a provocation below the nuclear threshold as a means to deter expected actions that may not directly threaten the state's survival, but which still harm its legitimacy.[22] Terence Roehrig suggests that more recent "rhetorical barrages" and provocations "can be viewed as part of its deterrence-posturing" rather than "the more aggressive, status quo-altering actions predicted by the stability-instability paradox" that some scholars believe characterizes the nuclear state.[23] That North Korea has not repeated some of the most violent conventional provocations it conducted prior to the advent of its nuclear program supports this assertion. Along with the South Korean airline bombing in 1987, those earlier provocations included attempts to assassinate South Korean political leaders and incite social revolution in the ROK.[24] However, the failure of these provocations to accomplish their desired effects may also be a reason the DPRK has not repeated them in more recent years, despite continuing attempts—sometimes successful—to assassinate South Korean missionaries, diplomats, and even Kim Jong-Un's half-brother.[25]

Regardless, miscalculations about the effectiveness of a provocation do not detract from the regime's rationality in conducting it. In his aforementioned book, Shin has concluded that with the exception of the 1987 airline bombing and the guerrilla insurgency at Ulchin-Samchok in 1968, the regime's provocations have generally been in accordance with its goals, previous behavior, resources, probability of success, and perceived preferences of its adversaries at the time.[26] This is true even for the 1976 axe murders of two US soldiers at Panmunjom by the Korean People's Army (KPA) when the former tried to cut down a tree. Shin writes that the situation escalated beyond what the regime

anticipated, and that Kim Jong-Il "miscalculated the US reaction" to the murders. However, Kim likely viewed a provocation by the KPA as one means to prompt "a withdrawal of US forces."[27] Furthermore, Kim believed this method might work based on perceived lack of resolve by the United States during other recent incidents at the time, and he was prepared to exploit the situation with an information campaign toward internal and external audiences alike.[28] These are all indicators of rationality.

However, even a rational actor that conducts a seemingly minor provocation for strategic reasons may be hard to deter. For that reason, it is important to try and understand motives. The incidents suggest there are different motives for initiating provocations besides just improving deterrent posture. Moreover, although Roehrig may be correct that some provocations are part of the regime's desire to preserve the status quo, North Korea is not necessarily content with the way things are.[29] Other provocations have been attempts to alter the regime's internal environment, its external environment, or both, making them more compellent than deterrent. As mentioned, the 1976 axe murders are an example of a provocation conducted to help force US withdrawal from the peninsula. Other motivations through the years have included trying to incite a social revolution in South Korea, trying to discredit the ROK, driving a wedge into the US-ROK alliance, and bringing its adversaries to the negotiating table so the regime can secure concessions.[30] Understanding these motivations and when they might surface today are critical to applying extended deterrence—and making it immediate if possible—so that conflict with the US-ROK alliance remains well below the nuclear threshold.

US-ROK Deterrence on the Korean Peninsula

Extended deterrence on behalf of South Korea has been the backbone of the United States' foreign policy toward North Korean aggression for almost seven decades. The policy relies upon America's large stockpile of nuclear weapons and aims to deter a North Korean attack while assuring South Korea the United States would use the weapons if South Korea's "survival interests" were threatened.[31] With North Korea's trajectory to becoming a nuclear state now nearly assured, South Korea has leaned more heavily upon extended deterrence. However, as just discussed from the North Korean perspective, the policy has not prevented North Korea from conducting periodic provocations against its neighbor that "fall below clear thresholds of nuclear retaliation yet still risk escalation."[32]

Although some scholars cite these provocations as evidence of an overall failure of deterrence "at every level except preventing outright war," others have

a more thoughtful view.[33] Having examined the lengthy record of ROK-DPRK relations under armistice conditions—and particularly since the 1976 Panmunjom axe murders when US forces were last targeted—Dr. Shin believes deterrence below the nuclear threshold is working for US forces in Korea. However, it is not working "for the US-ROK alliance since North Korea continues to target ROK forces or civilians. Thus, with respect to deterrence, Washington will be compelled to reassure Seoul of its unwavering commitment to the alliance with periodic shows of force, but North Korea will not be deterred against conventional provocations against South Korea" or "nuclear provocations against the US-ROK alliance."[34] Pyongyang may in fact use US shows of force to justify "future provocations."[35] If these assertions are true, it will be extremely difficult to eliminate North Korea's provocative behavior.

However, as the previous section concluded, understanding how domestic and international conditions shape the thinking of North Korea's leadership will still go far in limiting that behavior. Gaining this understanding is important if provocations continue to endanger the lives of ROK military personnel. The past 70 years have shown the United States that North Korean leaders' "instant reaction" to direct confrontation "has been to get their back up and tell you off," in the words of Korea scholar Bruce Cumings.[36] At the same time, it is evident from the US response to the axe murders—namely, a comprehensive military show of force and readiness for combat while a UN "work party" finished the job of cutting down the tree—that some degree of confrontation may deter the regime from escalation.[37] More recently, South Korea also seems to have at least mitigated the provocation cycle by establishing the "Korea Massive Punishment and Retaliation" concept after Pyongyang's artillery attacks of Yeonpyeong Island in 2010.[38]

Considering the history of DPRK relations with the US-ROK alliance, there are three primary challenges for effectively deterring the regime below the nuclear threshold in the future. First, South Korea's response to the attacks against Yeonpyeong demonstrate it has become more assertive about wanting to respond to North Korea's provocations on its own terms.[39] This assertiveness calls into question the ability of the United States to apply extended deterrence below the nuclear threshold. A unilateral reaction to provocation by South Korea on its own terms—particularly in a manner that is not proportional, de-escalatory, and out of necessity—could cause escalation and render extended deterrence ineffective.

Second, the regime rarely conducts the same provocation twice. This fact may be evidence that tailored deterrence is working, but it makes predicting the next one incredibly difficult. As stated previously, understanding the geo-

political and domestic circumstances that make Kim Jong-Un likely to direct a particular action is the best recommendation for doing so.

Finally, as the 2010 torpedo attack against the ROK naval vessel *Cheonan* demonstrates, North Korea has become adept at conducting provocations in a way that escapes immediate attribution. This fact puts a greater burden on the US-ROK alliance to improve intelligence about North Korean actions before and during a provocation. A discussion about the contribution of emerging technology to deterrence below the nuclear threshold is particularly valuable for addressing this last challenge, though it may help with the first two as well.

The Contribution of Emerging Technology to Deterrence

So far, beliefs about the value of new nonnuclear technologies for improving extended deterrence on the Korean peninsula are mixed. In Hyo Seol and Jang-Wook Lee suggest emerging nonnuclear weapons systems, along with the "masterful tactics to apply them in the Korean situation raise the possibility of dramatically strengthening the overall deterrence posture against the North Korean threat."[40] However, Rupal N. Mehta states that while such technologies may generally "drive down the costs of providing extended deterrence," their use also "may increase the likelihood of low-scale conflict" and "produce uncertainty among allies."[41] This uncertainty could potentially damage assurance to our ROK allies. Caitlin Talmadge adds nuance to the debate by concluding, "technology . . . functions as an intervening variable—a sometimes necessary, but rarely sufficient, condition for escalation."[42]

This study acknowledges these views but asserts that under the right conditions, the addition of new technologies to the defense of South Korea can make positive contributions to extended deterrence below the nuclear threshold. As former Deputy Secretary General of NATO Rose Gottemoeller expressed in 2014, "Extended deterrence . . . contains within it a full panoply of weapons systems and everything that goes with weapons systems to make them effective."[43] With this view in mind, therefore, emerging technologies may be able to improve intelligence in air, land, sea, space, or cyber domains so that the US-ROK alliance can better anticipate actions taken by the North Korean regime, better attribute them, and threaten an appropriate response if the actions are carried out—all within a shorter time frame than existing technologies permit. The next section proposes that RPA technology, while limited in many ways, is well suited to aid in these advancements, thus contributing to a more effective deterrent policy toward North Korean provocations.

The Uniqueness of RPA Technology

In discussing the impact of such drones on deterrence, RPA will be the term of choice for this study because it is the most common US Air Force term for medium- and high-altitude unmanned aircraft and emphasizes a pilot is still in the loop for employment of the aircraft. Michael Kreuzer defines the RPA as "robotic, fixed- or rotary-winged aircraft capable of sustained controlled flight using on-board propulsion and aerodynamic lift and designed for reuse."[44] The RPA is important to distinguish from the term Unmanned Aerial System (UAS), which refers to not just the aircraft, but its ground components and infrastructure. This paper briefly makes mention of UAS in the third case study for better comparison with the missile defense system, which includes the ground components for an interceptor missile.

Many military practitioners and scholars do not see RPAs and drones as revolutionary in their own right. They "note the long time periods it takes for military developments to diffuse throughout the international system, that only great powers can appreciably use frontier technology, and that the peer pursuits of such negates them playing a decisive role."[45] However, author Steven J. Childs believes the persistence of RPA-based surveillance "in a contested area" may have strategic consequences.[46] After all, RPAs exceed both satellites and manned aircraft in their mobility and dwell time over a target, being able to provide persistent ISR over both moving and stationary targets for up to an entire day.[47] Second, RPAs "allow you to project power without projecting vulnerability," due to the distance between the operator and the asset afforded by data links and satellites.[48] This advantage extends the "range of US firepower far beyond the range of an adversary's ability to counter."[49] Third, by virtue of their size and the absence of critical life support systems, they can perform many of the same missions as manned aircraft at a fraction of the cost. Finally, they combine intelligence capability from the most advanced cameras and sensors with highly precise kinetic attack capability in a single platform. For this reason, Barry Posen cites them along with manned aircraft as the two primary assets for gaining "command of the air" in armed conflict.[50] Michael Horowitz asserts moreover "the most advanced drones remain beyond the reach of many countries, a trend that likely will continue in the short term."[51] This trend bodes well for the use of RPAs as part of a broader deterrence strategy against North Korea, particularly as RPA capabilities expand in realms such as autonomy, artificial intelligence, and electronic warfare.

Admittedly, currently fielded RPAs on the Korean peninsula have a couple of major shortcomings. First, the region's highly contested operational environment makes many of today's RPAs susceptible to ground fire or even nonkinetic

attack. They are neither maneuverable nor very stealthy, and they lack defense mechanisms against North Korea's air defenses. Although the lower average operating cost of RPAs compared to satellites and most manned platforms will allow for some acceptable attrition, the cost-per-unit may rise as payloads increase in quantity and quality, requiring some degree of survivability.

However, current weaknesses against ground attack may not be as great as one thinks. As Childs explains, a small nuclear power like North Korea "will be less likely to engage [RPAs] with precious air defenses, as they will have an incentive to husband missile for use against strike aircraft in a conflict."[52] Furthermore, the success of Turkish RPAs in destroying surface-to-air systems in Libya in May 2020 calls "the confidence of those systems into question."[53] More such cases will be necessary to make an informed assertion, since there is also evidence a Russian-made surface-to-air system downed an MQ-9 over Libya the same year, not to mention shoot-downs of various RPAs elsewhere in the Middle East in recent years.[54]

Regardless, the physical environment also limits the effectiveness of currently fielded RPAs on the Korean peninsula. Clouds much more frequently cover the Korean peninsula than the deserts of the Middle East, where the United States has employed most of its RPAs for the last two decades. This fact makes visual intelligence no more accessible to the RPA than to manned assets or satellites. However, larger RPAs that are more resistant to the elements may still be able to obtain other types of intelligence and employ GPS-guided weapons in response to provocations.

Initial Assertions About the Impact of RPAs on Deterrence in Korea

Several factors play into the impact of RPA technology on deterrence in the Korean theater. These factors include the type of RPA, combined vs. separate employment by the United States and the ROK, basing for employment of the RPA, the degree of networking with other technology, communication about intent and RPA capabilities to North and South Korea, and the role employed within larger deterrence strategies.

However, in the application of the three case studies, the paper will focus primarily on the roles RPAs can take within larger deterrence strategies. To paraphrase the hypothesis in the introduction, RPAs can augment existing deterrence strategies in the ISR role by denying North Korea the element of surprise in carrying out certain provocations and attributing the act to the regime ahead of time. Such provocations may be in the physical domain, such as artillery or missile attacks, the laying of mines, or border incursions. However, they

may increasingly come through other domains, including cyber-attacks, electromagnetic jamming, and sonic waves. Current and future payloads on RPAs may enable detection of such activity across the electromagnetic spectrum.

There is also an element to punishment in this type of deterrence. Hypothetically, in a concept similar to how King Lear's stare put fear into his subjects, knowledge of what we can "see" via RPA-borne ISR would frighten North Korea by the threat of what the US-ROK alliance can do in response.[55] This response could take various forms, from a show of force by bomber aircraft to an attack in the cyber domain or even a kinetic strike from the same RPA platform that gathered the intelligence. Unlike in the nuclear realm, such threats can be carried out from time to time, enhancing credibility. What is important is that the US and the ROK tailor the threat to the circumstances and carefully communicate it to the DPRK. That way, our intentions are understood, and the act is least likely to result in escalation.

These are ambitious claims for RPA contributions to deterrence considering currently fielded technology, but technological advances have the potential to increase their effectiveness. Combining some degree of autonomy and swarming tactics on faster and more maneuverable RPAs than those currently employed will improve performance in contested environments by increasing survivability and shortening decision-making cycles. Operator input will only be required for critical decisions such as verifying intelligence gathered, conducting a response, or terminating a mission. In a period of heightened tension on the Korean peninsula, this construct of employment may be able to overcome North Korean defenses by disabling warning systems electronically or overwhelming defenses, gaining access into areas where they can provide intelligence across the electromagnetic spectrum beyond what is obtainable from manned assets or satellites.[56] This intelligence would impinge on the ability of North Korea to "conduct surprise attacks or covert activities," which is one of the advantages upon which its deterrent strategy rests.[57]

Although such technological capabilities have not yet been fielded on the Korean peninsula, some have either been employed on manned assets in the past or tested elsewhere on unmanned assets. The United States conducted manned electronic warfare missions against North Korea in the 1960s until one aircraft was shot down by a MiG fighter, and the Israelis conducted both electronic warfare and intelligence gathering missions via RPAs as early as 1973.[58] Over the last decade, the US Army has been testing electronic warfare capabilities on its MQ-1C Gray Eagle, and the US Marine Corps has adapted tactical UAVs to become electronic jammers.[59]

However, autonomy and swarming are still largely in the conceptual realm. Although "embryonic automated capabilities already exist in . . . imagery-

based analytical tools," they are "still relatively crude and unreliable."[60] Swarming as a tactic is even farther off, but the collaboration of "1,218 autonomous drones equipped with lights . . . to form intricate pictures in the night sky" over the 2018 Winter Olympics in South Korea offered a preview of what such systems could accomplish for intelligence gathering.[61] Nevertheless, Christian Brose writes regarding intelligence gathering today that "the proliferation of low-cost, commercial sensors that can detect more things more clearly over greater distances is already providing more real-time global surveillance than has existed at any time in history."[62] To shed better light on the effectiveness of this RPA role in deterrence on the Korean peninsula, this study offers three case studies for analysis.

Building Useful Case Studies to Estimate the Impact of RPAs on Deterrence

Three case studies will bolster the claim that employment of RPAs will contribute to an effective deterrent strategy against conventional North Korean provocations. One case study features a sensing technology that emerged long before today's RPAs, but which played a prominent role in deterrence. This is a study of the value of radar in deterring a German cross-channel invasion of Britain in World War II. The second case study features RPA employment against nonstate actors, namely, al-Qaeda and the Taliban during the Global War on Terror. It aims to show that RPA-borne kinetic strike and ISR was successful in the long run in deterring these groups from carrying out terrorist attacks. Although the GWOT ultimately aimed to deter future terrorist attacks against the United States, analysis in this study focuses on deterrence against attacks overseas where RPAs targeted them directly. The third case study examines US and ROK cooperation in South Korean missile defense, as embodied by the so-called "K3 suite of capabilities: Kill Chain, Korea Air and Missile Defense (KAMD) and Korea Massive Punishment and Retaliation (KMPR)," along with the recently US-fielded Terminal High Altitude Area Defense (THAAD) system.[63] This architecture, which combines but does not fully integrate ROK and US systems, offers a potential model by which the two states can employ RPAs for both deterrence and assurance.

The first two case studies concern active conflicts in which actions taken to deter were mixed with defensive and compellent action to achieve goals. This paper examines the opponent's interpretations of the actions to distill the deterrent elements, and it determines the effectiveness of new technology in creating this interpretation. In each of the two cases, the effectiveness of the respective technology in deterrence appears to stem not only from the ad-

vances of the particular technology, but also (and perhaps even more importantly) from its integration into a networked command and control system.

However, conclusions about deterrence are different between the two cases. British radar and its integration into Fighter Command, while not the immediate cause, contributed to deterring Germany from launching an invasion of the British Isles by sea. The contribution of RPAs to stemming terrorist attacks during the GWOT is a little less clear, at least in the Middle East where RPAs were employed. However, even while accounting for significant differences between the two historical cases and today's situation in Korea, they both have lessons for deterrence against North Korean provocations below the nuclear threshold.

Combined missile defense on the Korean peninsula—the third case study—is an asymmetric deterrent capability whose cost and dependence on precision technology has historically made it less appealing than symmetric deterrent capabilities such as ballistic missiles and their associated delivery platforms. However, missile defense on the Korean peninsula by both the US and ROK militaries has increasingly gained traction as an effective deterrence by denial option, reinforcing the credibility of extended deterrence and assurance alike.[64] Employment of RPAs in a combined US-ROK defense architecture that leverages their ISR and strike capabilities holds the potential to do the same, though more exclusively in the conventional realm.

First Case Study: The Value of Radar in Deterring a German Invasion of Britain

The success of Britain's radar-based command and control (C2) system in helping to deter a German invasion of the country in World War II sets an analogous precedent for the value of RPA-borne ISR in deterring North Korean provocations. While it can be argued the true deterrent value of the Battle of Britain lay in the successful air campaign against German fighters and bombers crossing the English Channel in 1940, British aircraft came to rely almost entirely on the C2 system's radar-based intelligence gathering and communication capabilities for intercepting the enemy. Similar capabilities provided by swarms of RPAs may augment or even prove foundational in a C2 system for detecting hostile activity and attributing responsibility for it. The combination of mobility, dwell time, and wide coverage afforded by RPAs would mimic the tailored deterrent value of radar in such a scenario. Further combined with a kinetic or EW attack capability, these advantages would also optimize immediate deterrence via the threat of a timely, appropriate response.

The analogy between British radar and RPA-borne ISR in deterring threats rests primarily on three factors: the integration of the technology into the respective C2 system, the resulting degree of change the technology produces in each strategic environment, and the impact the two together had on German thinking. The first two factors speak largely to Britain's capability and intent, while the third speaks to credibility: how much difference radar and the system by which it was exploited made in Germany's decision not to conduct Operation Sea Lion—the seaborne invasion of Britain.

Regarding the first factor, the British Fighter Command's C2 system integrated radar technology in a way that optimized survivability. The system enabled the wide, decentralized, and redundant sharing of data across its Radio Direction Finding nodes. If German aircraft destroyed one node, another station somewhere could often continue broadcasting its signals—an adaptation that served to deceive the attacking Germans about the source of the data being used against them as well as preserve some degree of lost coverage.[65] The C2 system was also flexible in that "units [of aircraft] could relocate with no impact to the system."[66] British units moved flying units periodically in response to changes in German fighter approach patterns during the campaign—changes that were also detected by radar.

Furthermore, the system was "run against rigorous performance measures, and so improved constantly."[67] Sometimes called the Dowding System after the commander of British Royal Air Force (RAF) Fighter Command who operationalized radar-based command and control for his service, it had only been in existence since the late 1930s.[68] One author believes there was "a period of organized chaos" as the system continued in development during the German attacks in the summer of 1940.[69] However, the British made valiant efforts to reconcile "man with machine" by weighing radar reports "against the accuracy of their previous reports and against known faults in the apparatus" before making operational decisions from them.[70] This type of process is a hallmark of organizational learning, and it served to help overcome technical problems, though sometimes at the expense of valuable time.

Finally, radar towers could absorb German attacks well, making them very survivable. As one author states, "the exploding cannon shells, which did terrible damage to metal skin [of aircraft], had less effect upon any sort of girder work" like that of radar towers.[71] Their survivability combined with the other previously mentioned factors to make the overall C2 system incredibly hard to defeat. As a result, radar came to have a robust deterrent value against the Germans.

Likewise, the success of RPA-borne intelligence in contributing to deterrence on the Korean peninsula will depend on its integration into a highly survivable C2 network. That network exists already in the mating of South Korea's Kill

Chain and KAMD systems, the goal of which is to "preemptively strike North Korean nuclear and missile facilities using an integrated information, surveillance, and strike system."[72] The C2 system for RPA-borne ISR would operate similarly, with the understanding that it must be robust enough not only to withstand kinetic attack, but cyber attack as well. According to the International Institute for Strategic Studies, "US and South Korean defence agencies assume that the North will, in the event of major conflict, use cyber attacks against South Korean critical infrastructure and command and control networks."[73] Even short of a major conflict, these attacks are still a possibility.

In the Korean example, survivability of the C2 system also extends to swarms of RPAs, which have the potential to fulfill—at least en masse—an equivalent role to radar in a contested environment. When combined with offensive capabilities, either from RPAs or other assets that can add credibility to the threat of a response to detected hostile behavior, there is a potential for the strategic environment to change. In this sense, the integration of new technology into a C2 system that can exploit it is the driver for strategic change once that technology is operationalized for deterrence.

Accordingly, the degree to which RPA-borne ISR in a deterrent capacity can be compared to radar in the Battle of Britain also depends on the technological change it produces in the Korean situation. This is the second factor for evaluating the merit of the historical case. Alan Beyerchen contrasts technological change, which affects overall military strategy, with lesser operational and technical changes, which affect military operations and tactics, respectively.[74] The way Britain systematically exploited radar against the Germans was a technological change in that it altered the character of air warfare by obviating the need for "flying continuous [aircraft] patrols" to deter or counterattack.[75]

Ironically, the way the United States and Korea would operate RPAs for maximum deterrent effect against the DPRK would resurrect such patrols. The unique advantages of the platform make them feasible again, since unlike manned fighters, their continuous employment is neither overly costly nor unsafe for humans. At the same time, RPA patrol swarms would take on a character unique to their deterrent missions. As the previous paragraph suggested, the RPAs themselves would fulfill the role of radar (not to mention carriage of radar equipment as one of several means of detecting hostile activity). Ideally, the swarm would also be interspersed with armed RPAs able to carry out a threat, though it would be difficult to tell which RPAs are armed and which ones are equipped only with sensing equipment.

This means of deception will enhance deterrence by creating uncertainty in the North Korean military just as the complexity of the British radar system did for the German Air Force.

Swarms containing a mix of ISR-only RPAs, kinetic strike RPAs, EW strike RPAs, and a combination of all three capabilities on the same platform would make "a North Korean counterattack more challenging" while increasing survivability during ISR.[76] If a strike response were necessary, automation and artificial intelligence (AI) would enable the swarm to prioritize targets and re-assign surviving RPAs to them if the primary aircraft for attacking them is shot down. This is similar logic to how British Fighter Command prioritized attacks against incoming German fighters and bombers using radar, except that detection and strike capabilities were more separated in time and space.[77] That is, they were neither automated nor coupled on the same platform.

Another difference in the Korean case is that escalation of a conventional exchange is itself a failure of deterrence, whereas for Britain a maritime attack across the English Channel would have constituted that failure. Therefore, the US-ROK alliance must carefully choose any threat response and clearly communicate intentions to North Korea in carrying it out. This last need points to the importance of the adversary's decision-making in making deterrence work.

Thus, the third factor in evaluating the merit of the analogy between British radar and its C2 system and RPAs on the Korean peninsula is the change in thinking produced in the adversary. Accounts from the summer of 1940 at least indicate the British radar system produced great disappointment on the German side. For example, despite successful air attacks against the British coast on August 12, 1940—including targeting of several known radar stations—Field Marshall Albert Kesselring was forced to conclude the next day the stations had already resumed operation. Furthermore, "none of the returning [fighter-bomber] crews had been able to report a demolished [radar tower] mast."[78] Having originally expected the attacks to set the stage for a major offensive in succeeding days, Kesselring was distraught enough to apologize in person to the commander of the bomber unit that had conducted the attacks.[79]

This disappointment infected higher echelons of command over the next few weeks. Chief of the Luftwaffe, Reich Marshall Hermann Goering, stated on August 15, "It is doubtful whether there is any point in continuing the attacks on radar sites, in view of the fact that not one of those attacked has so far been put out of action."[80] By the end of the month, the number of casualties the Germans were sustaining in attacking the British coast was causing much grief and loss of morale among crews and leadership alike.[81] German fighter wing commander Adolf Galland later stated, "From the first the British had an extraordinary advantage, never to be balanced out at any time during the whole war,

which was their radar and fighter control network and organization . . . we had nothing like it."[82] While German air attacks continued into September and did not fully abate until 1941, Operation Sea Lion never took place.[83]

The relevant question for this study is the degree to which radar technology and its exploitation by command and control deterred the invasion. The accounts above make it evident radar foiled German expectations of success, but this fact was far from the only reason Hitler and Goering decided not to press with Operation Sea Lion. The operation depended on reducing Great Britain by bombing alone, depriving "the RAF of air superiority" so that Germany "could attack the British army and navy," and then prepare for a seaborne invasion.[84] These were immense expectations, regardless of how well Britain's radar experiment had worked out. The performance of the RAF pilots and their aircraft cannot be discounted in the evaluation, nor can the deterrent effect of the British navy in preventing a maritime invasion.[85] In the end, Hitler did not believe there was a danger of Britain invading the mainland after 1940. As a result, he quickly turned his attention to Russia.[86]

The conclusion that radar alone was not decisive in deterring a German invasion makes the comparison with employment of RPAs in Korea more tenable. It is unlikely any one operational innovation will be the decisive factor in deterring Kim Jong-Un from conducting conventional provocations. However, this fact does not preclude such an innovation from having far-reaching operational or even strategic effects on an adversary's decision-making. The contribution of networked, integrated RPA-borne capabilities for early detection and attribution of hostile activity together with timely, tailored threat responses may deter a particular North Korean provocation in the same way that similar exploitation of radar deterred German attacks (or at least attacks of a certain manner) in August and September of 1940. This is a measurable operational effect. If RPA employment contributes to North Korean leadership modifying how it conducts provocations, it would be a strategic change.[87] The latter has more enduring value for promoting regional stability, and it can be said that in the Battle of Britain radar at least contributed to a similar modification in the thinking of German leadership.

However, whether RPA employment will impact North Korean behavior in the way radar impacted German thinking depends on the situational context. Unlike Adolph Hitler, Kim Jong-Un is seeking to avoid large-scale armed conflict rather than become victorious through it. North Korea's national survival depends on success in this goal, so fewer demonstrations of a threat should be necessary to deter future acts of aggression unless the regime is in a particularly desperate situation. Otherwise, if Kim is merely attempting to change the status quo, deterrence by denying him the element of surprise in

conducting provocations may sometimes suffice. This contribution of RPAs to overall deterrence also figures into the next case study.

Second Case Study:

The Value of RPA-borne ISR in Deterring Attacks in the Global War on Terrorism

The impact of RPAs in ISR and kinetic strike roles upon the decision calculus of terrorists in the GWOT provides a second case study to estimating their effect in Korea. The value of this analogy for the Korean situation lies in whether RPA operations in these roles helped deter individual terrorists from carrying out attacks and terrorist groups from planning them. As in the previous case study, attaining these objectives depends on the integration of RPA technology into an integrated C2 system, the resulting degree of change RPA employment produces in the operational environment, and the change it induces in the opponent's thinking. Relevant analysis is challenging because of the difficulty in obtaining reliable information from terrorists, isolating RPAs as a variable in terrorist behavior, and tying conclusions to the Korean environment. However, this study draws from strategic leaders' assessments and scholarly investigations into the localized effects of RPA employment to conclude the platforms did have an overall positive operational impact on deterrence that is transferrable to provocations by North Korea.

The foundation for affecting terrorists' decision calculus in the GWOT with RPAs was the incorporation of the platforms into a network that could quickly package information received into useful intelligence, making a timely threat response possible. As Michael Kreuzer argues, "revolutionary capabilities have come about when RPA platforms serve as critical nodes in a broader system of warfare enabling networked intelligence collection, global communication, near real-time processing, target development, decision support, and strike operations."[88] Employed in this way, RPAs were best able to contribute to a unified threat narrative that deterred terrorist activity. After all, the arguable goal of the GWOT was "preventing terror attacks against the US and extending that deterrence to other nations through a policy of denial and punishment."[89]

The process by which the United States leveraged RPA-borne ISR during the GWOT—and which also has application for Korea—entailed quick progression through six basic steps for achieving desired effects against a target. These steps were as follows: find (detect through surveillance or reconnaissance), fix (identify), track (establish location and follow), target (determine the desired effect),

engage (direct an asset to achieve the desired effect), and assess (to see if the effect was achieved).[90] For the GWOT, RPAs such as the MQ-1 or MQ-9 were the primary platforms for enabling all these steps—abbreviated as F2T2EA—in dynamic tactical or operational environments. However, in more strategic campaigns that targeted terrorist leadership, RPAs might only fulfill one or two steps. They were part of a more comprehensive process managed by analysts at distributed ground control stations and commanded by leadership in the intelligence community.

In a Korean environment characterized by the threat of conventional provocations, either the tactical/operational or the strategic scenario could play out. The primary difference in either scenario from the GWOT environment is that armistice conditions will likely discourage kinetic strike in response to provocative activity except when friendly forces' lives are immediately endangered. More often, to prevent escalation, the desired effect will be disruption of behavior via nonlethal means—effectively deterrence by denial. Operationally, that means may be jamming, an electromagnetic pulse, or a show of force by swarms of RPAs or a manned asset. Based on this study's belief that the prevention of surprise has deterrent value of its own, a strategic response would be to present to North Korean leadership proof that its forces are preparing to conduct a provocation. However, this prospect begs the question of how much deterrent value the employment of RPAs for this purpose had against GWOT targets in the Middle East.

While it is difficult to establish strategic impacts, the balance of evidence from the GWOT suggests terrorists' knowledge of strike capability, either directly or via word of mouth, drove behavioral changes that persisted even in the absence of continued strike attempts against them. An analysis of RPA strikes from 2009 to 2012 provides the first evidence for this assertion. During that period, there were approximately 1,750 kinetic strikes from RPAs across the GWOT theater, including Afghanistan, Libya, Pakistan, and Yemen. However, a good number of those strikes were carried out against personnel directly threatening coalition forces in combat operations, mostly in the first two countries. One source indicates only 2 percent of the strikes were against high value individuals, who were often living in communities far removed from coalition forces.[91] Furthermore, all RPA strikes were spread out over approximately one million flight hours, suggesting RPAs were conducting pure ISR about 99.8 percent of the time.[92] This estimate does not discount the number of strikes during the four-year period, which affected certain areas in the Middle East disproportionately and sometimes produced civilian casualties that affected the social behavior of an entire community.[93] However, the estimate means that many of those engaged in terrorist activity likely

knew of the RPA's strike capability only indirectly. Of course, a link in the mind of the terrorist between his behavior and the likelihood of falling victim to a strike is helpful in bolstering deterrence.

That link provides the best evidence there was deterrent value in RPA-borne ISR even in the absence of persistent strikes during the GWOT. However, the evidence must be qualified. Information garnered from terrorists does not make a definite case for the ability of RPAs in either a strike or ISR role to deter individual terrorist acts. It does suggest RPA presence reinforced by terrorists' awareness of periodic strikes contributed to deterring terrorists from conducting activities in the manner they preferred. This assertion assumes individuals could either sense an RPA was overhead—a possibility highly dependent on local circumstances—or knew from experience that it might be following them.

Based on interviews and data captured, these assumptions are not far from the truth. One local's "interviews with Taliban and other insurgent operatives show . . . RPAs can be heard from the ground . . . and their flights push Taliban commanders off the grid."[94] The reason is that terrorists became aware RPAs were increasingly used to track terrorists via their cell phone use. However, RPA employment also changed their social behavior in other ways. Believing they were being watched, terrorists and their cell leaders were afraid of going outside and gathering in one place—behavioral constraints that undercut "organization and communication."[95] Kreuzer also points to a letter discovered after the raid against Osama bin Laden in which he expressed concerns to al-Qaeda leaders about how to conduct their operations based on the likelihood RPAs were overhead. "From an effect-based standpoint," writes Kreuzer, "the deterrent effect achieves the strategic aims of the [RPA] program as much as the potential for decapitation."[96]

In fact, Kreuzer and other scholars suggest RPAs were largely responsible for advancing US operational or strategic goals in deterring attacks. He states, "the use of RPAs puts such pressure on terrorist organizations that it degrades their organizational capacity and ability to strike."[97] David Cortright, Rachel Fairhurst, and Kristen Wall point further to "leadership degradation, disruption of terrorist training and operations, and the denial of safe havens for terrorists" as reasons for the success of drone strikes.[98] Two other researchers, Ahmed Hashim and Gregoire Patte, believe that "drone attacks have pressured Al Qaeda and associated groups . . . to focus more on their survival than on recruitment and operations."[99]

US political leaders have come to similar conclusions about the contributions of RPAs to changing terrorists' decision-making calculus and behavior. In 2009, the Deputy for Analysis in the Office of the Director of National In-

telligence remarked to the president that "drone attacks and other counterterrorist operations had bin Laden and his organization hurting, beleaguered."[100] Obama's special representative for Afghanistan and Pakistan, Richard Holbrooke, believed the same year that al-Qaeda would confine itself to Pakistan because of "all the intelligence and surveillance capability" the US had fielded in Afghanistan.[101] Much more recently, it appears US RPA-based surveillance affected the behavior of Iranian proxy groups in Iraq. The deputy director of the Combined Air Operations Center for US Central Command remarked that in 2019, "our ability to be in the right place to monitor what was some pretty nefarious activity" by Iranian-sponsored forces succeeded in attributing certain actions and deterring further hostile behavior.[102]

Deterring hostile activity with drastically fewer actual kinetic strikes may be possible for a hierarchical organization like the North Korean military. The reason is that communication in such an organization is much more structured and robust than what terrorist networks relied upon. That the DPRK has not repeated provocations in the same manner following timely US or ROK threats reinforces this claim.[103] Moreover, instead of proving the worth of the strike threat against provocative behavior by North Korea, it may only be necessary to prove the capability in US-ROK exercises or perhaps in a demonstration close to the inter-Korean border. Considering one of the DPRK's strategic goals is to drive a wedge into the US-ROK alliance, such a demonstration should be jointly executed by the two countries and so communicated to North Korea.

One counterargument worth addressing is that despite the impacts of RPA employment upon terrorist behavior, targeted strikes contributed to an increase in the number of terrorists and shifted the activity of existing groups to locations where RPAs could not reach them. There is truth to this argument, evidenced by the number of captured terrorists who "claimed to be motivated by anger at US drone strikes" and the movement of much of al-Qaeda into Pakistan after America's 2001 invasion of Afghanistan.[104] However, the veracity of the argument does not detract from the analogy with deterrence against North Korean provocations. North Koreans are already taught from a young age to hate the United States.[105] While RPA strikes risk escalation of a conflict with the DPRK, they will not create more enemies than already exist. Furthermore, while North Korea has conducted many provocations from outside its borders, it is hard to imagine that ROK or US military strikes or intelligence gathering would be a motivation for doing so. Unlike terrorists in transnational organizations, the vast majority of North Koreans have nowhere else to go.

This assertion helps answer a second, broader counterargument, which is that lessons from deterring transnational actors in weak states is not transfer-

rable to deterring state actors in authoritarian regimes. There are two answers to this counterargument. First, as previously mentioned, the hierarchy of military command and political leadership in such a regime may make deterrence more effective than against a less structured organization like al-Qaeda. Second, US Special Operations Command (USSOCOM) is already training to use AI originally developed for hunting terrorists to track rival state targets instead. These targets are foremost Russian and Chinese, but like these two states North Korea also uses "subversion, propaganda, and proxies to achieve . . . goals below the threshold of armed conflict."[106] Therefore, USSOCOM's methods are relevant to the DPRK as well. The potential to employ RPAs in ISR roles to advance these methods is part of their deterrent value against the state's provocations.

In view of these arguments, it is possible to conclude that lessons from RPA-borne strikes and ISR in deterring terrorist activity during the GWOT are useful in deterring North Korean provocations. The most important difference is that the GWOT was an active armed conflict in which the United States was conducting deterrence and compellence almost interchangeably.[107] If the US or the ROK must resort to compellence against North Korean provocations, it means escalation has already exceeded an acceptable threshold and deterrence has failed. This caution against escalation discourages kinetic strike by RPAs in the Korean theater except for the purpose of signaling the threat. This signal having been made, employment of RPAs in a pure ISR role will buttress deterrence against those conventional provocations for which the regime most values the element of surprise and the ability to evade attribution. As was evident in the GWOT, awareness that RPAs are in the vicinity will change North Korean behavior, beginning at the tactical level. Over time, employment in this role also has the potential to cause strategic change by affecting the decision calculus of regime leadership regarding conventional provocations against the ROK. As the final case study suggests, RPAs also share with another emerging technology the potential to fill in credibility gaps in the overall deterrence architecture.

Third Case Study:
The Value of Combined US-ROK Missile Defense in Deterring North Korean Aggression

This section makes the claim that the combined commitment of the US and the ROK to ballistic missile defense has been a valuable contributor to deterring the DPRK from launching missiles of various types against its neighbor or US forces. Furthermore, the US contribution to missile defense

architecture on the peninsula improves assurance to our ally that we are dedicated to its defense. Despite obvious differences between missile defense and RPAs in technology, purpose, and present application on the Korean peninsula, there are several similarities that make a case study of missile defense on the peninsula useful in estimating the contribution of RPAs to deterring conventional provocations. A brief discussion of the history of missile defense in Korea sets the stage for making this claim.

The development of theater missile defense (TMD) in US deterrent and defense policy precedes its employment on the Korean peninsula. The 1991 Gulf War was the first large-scale realization of that policy, as played out by Patriot systems against Iraqi SCUD missiles. Despite the Patriots' lackluster performance, the "increasing scale of the ballistic missile threat and rising interest of allies facing these threats . . . prompted the United States to move forward with TMD and, later on, more ambitious missile defense systems in the post-Cold War era."[108]

Several developments in the last three decades have pushed the US and the ROK toward gradual agreement on a theater combined US-ROK missile defense system. The improvement of missile defense technologies and the build-up of the DPRK's "ballistic missile arsenals" since the 1990s despite harsh international economic sanctions generated "rising interest" in a protective missile shield among leaders on both sides of the alliance.[109] The 2010 sinking of the *Cheonan*, North Korea's shelling of Yeonpyeong Island the same year, and the regime's testing of a third nuclear device in 2013 further contributed to convincing the alliance that a more comprehensive missile defense concept was necessary to protect the ROK.[110] Such a concept shifted the alliance away from a strategy of pure deterrence by punishment to one that also incorporated deterrence by denial.

An executable missile defense concept first emerged unilaterally on the ROK side, followed by US support. In response to the 2010 artillery shelling, South Korea "espoused a new 'Proactive Deterrence Strategy'" in its 2014 Defense Reform Plan that advocated for preemptively striking "North Korean nuclear and missile facilities using an integrated information, surveillance, and strike system" that included missile defense.[111] Concerned the ROK might respond in an escalatory manner on its own under such a concept but recognizing the need to better deter new conventional provocations, the United States pushed for bilateral agreement on how to respond to future threats from the DPRK. The product was the 2013 Combined Counter-Provocation Plan (CPP). According to the CPP, the ROK would take the lead responding to various provocations and the United States would provide support.[112] The 2014 US-ROK Security Consultative Meeting further emphasized the "US

commitment to providing and strengthening extended deterrence for the ROK using the full range of military capabilities, including . . . missile defense capabilities."[113]

In terms of the systems for implementing the CPP, missile defense has emerged as a triad of capabilities, starting with the KAMD program that includes "a mix of short, medium, and long-range land and sea-based interceptors."[114] These interceptors consist of surface-to-air missiles and multiple models of US-imported Patriot missile defense systems.[115] The other two points of the triad are offensive, including "a mixture of surveillance and strike capabilities designed to neutralize North Korean WMD capabilities" known as the kill chain, and the KMPR to "target leadership and strategic facilities in North Korea with ballistic and cruise missiles."[116]

Out of concern for protecting its own facilities on the peninsula, and upon recognizing that KAMD and the kill chain could not "effectively defend [against] North Korean missiles and shield large protective zones," the United States pushed the ROK to include a more capable system as part of its larger concept.[117] US Forces Korea had been pushing for deployment of the THAAD as such a system since 2008, but up until 2016 the ROK rebuffed the proposal because of Chinese opposition.[118] The North Korean regime's September 3, 2017 nuclear test finally motivated the ROK to accept the system, which has a better chance of intercepting missiles in higher trajectories than South Korea's SAMs and reinforces a "multilayered" missile defense concept.[119]

Although the combined deployment of THAAD with other missile defense systems across South Korea has not prevented Kim Jong-Un from continuing to test missiles, they seem to be deterring him from other more provocative acts. He has not launched any missiles on a trajectory that would threaten the ROK, and there have been no further artillery attacks like those against Yeonpyeong Island in 2010. As a new technology implemented by both sides of the alliance in a combined (though not fully integrated) fashion, missile defense has arguably strengthened rather than weakened extended deterrence and assurance.

The introduction of the ROK's combined missile defense concept and associated systems yields several lessons for the value of RPA technology in deterring conventional provocations. These include the value of technology superiority, deterrence by denial, tailored (and immediate) deterrence, US-ROK alliance cooperation in deterrence, and assurance to our ROK allies. Although RPA operations and associated infrastructure may not bolster deterrence and assurance to the same degree as fielded forces in terms of demonstrated commitment, their advantages more than offset shortcomings, enhancing credibility in communicating US alliance commitments to both

North and South Korea. These advantages extend to the prospect of integrating RPA employment and missile defense in the future.

First, the value of US-ROK missile defense systems and their concept of employment in deterring North Korean provocations depends at least partly on the superiority of the technology relative to what the North Korean regime can field. Currently, "North Korea lacks both the missile defense system to deny" an attack by the United States or South Korea "and the retaliatory capacity" that its adversaries possess.[120] The North has not even mastered or demonstrated "reentry technology" for its longer-ranging missiles, should confrontation escalate to the point that it would decide to employ them against the United States itself.[121] Their inferiority in these respects is a psychological inhibitor that, while possibly driving the regime to enhance its deterrent capabilities in other areas, discourages it from conducting a provocation that would test the accuracy of US or ROK missile defenses. Granted, it may only take one failure of these layered defenses to cause catastrophe to the ROK, and there are both "avoidance" and "manipulation" countermeasures that can be taken against them.[122] However, if the defenses work, the national embarrassment of being intercepted and the likelihood of greater retaliation that the regime is unable to counter minimize the likelihood of the DPRK conducting a missile or artillery attack—at least based on the assumption that the Kims have mostly been rational actors. In this way, deterrence by punishment on the strategic level helps underwrite deterrence by denial at the operational level.

Although the employment of RPAs in an ISR role is a much more passive means of defense than missile defense systems, it likewise presents an asymmetric technological advantage. This advantage lies in an intelligence gathering capability the regime cannot replicate. While satellites may contribute to this advantage already, RPAs further enhance it by being unpredictable in terms of expected location and the type of intelligence they can gather across the electromagnetic spectrum, depending on payload. Furthermore, their employment in an integrated C2 network may enable US-ROK forces to act upon that intelligence while it is still current, including generating a strike from the same RPA or another one. In this way, the alliance can get inside the regime's decision-making cycle, denying it surprise and the expected psychological effects of a provocation.

Accordingly—and as a second lesson missile defense offers for the prospect of RPA employment—deterrence by denial is a feature of both missile defense and employment of RPAs in certain roles. Missile defense systems are more expensive than symmetric means of deterrence like offensive missile systems. However, diversifying one's deterrent investment by including mis-

sile defense—perhaps even as substitutes for some offensive systems—is a more efficient use of US and ROK money than relying solely on the deterrence by punishment strategy under which offensive missiles are employed. The first reason is simply that "we don't know where all of North Korea's installations are."[123] Employment of missiles in the search for them would, at best, "only delay temporarily North Korea's missile and nuclear programs."[124] At worst, the endeavor would waste a lot of missiles. Even if intelligence did yield the locations of decisive points in the regime's missile architecture, the depth to which many installations are buried makes them impervious to all but the largest, most penetrating weapons.

In contrast, the employment concept of missiles in a denial role is to wait for the KPA to bring its systems into the light of day. By this concept, the missile is susceptible to interception once it is launched (and the launcher is potentially susceptible to strike as well). Furthermore, missiles employed in defense are less likely than offensive missiles to cause unintentional North Korean casualties, considering the target—that is, another missile—is in the air instead of on the ground.[125] Therefore, an emphasis on missile defense—at least in environments short of war—puts the US-ROK alliance on the moral high ground.

Like missile defense, employment of RPAs in ISR and some nonlethal attack roles like jamming are a cost-worthy complement to offensive airborne systems employed to punish the regime by dropping bombs. If Kim Jong-Un becomes more desperate in the future—either to preserve the status quo or because of severe domestic problems like his regime faced in the 1990s—he may either turn to diplomacy as he did in 2018, or he may resort to attention-getting provocations. The latter possibility is the greater security concern, and RPAs can fill in critical gaps in deterrence for such cases. Although the alliance will never be able to field RPAs in great enough numbers to catch all hostile activity, their continuous presence in key areas like Panmunjom and along the DMZ and the Northern Limit Line will enhance tailored deterrence if followed up with the right signaling to the DPRK regime. This signaling may take the form of a change in overall defense posture. Or, with armed RPAs, the US or the ROK retains the option of a kinetic strike in response to hostile activity—either directly or "across the bow" in warning. In this way, RPAs would serve a similar response-on-demand function to missile defense systems, preventing the type of loss of face South Korea suffered after the 2010 Yeonpyeong Island artillery shelling.

One counterargument to these claims is that RPAs would not be able to survive in a North Korean anti-access, area-denial (A2/AD) environment, making them cost prohibitive in the long run. However, even more than for

missile defense systems, the scalability of RPA employment holds the potential to change the cost equation for deterrence by denial. Although there are size thresholds to armed RPAs, the absence of onboard pilots allows for smaller, less expensive intelligence gathering RPAs in greater quantities. This potential, which will become more achievable as nanotechnology continues to improve, responds to "the need for geographic agility" and "provides a viable solution for the challenges of the A2/AD environment. Though these [RPAs] may not be able to survive a complex air defense environment individually, in large quantities they may be able to saturate" the DPRK's "engagement capability."[126] Their small size would also enhance "low observable characteristics," while the expense of stealth technology would be reserved for larger unmanned or manned weapons platforms, if the situation called for them.[127]

As a third comparison with missile defense, these possibilities give additional credence to the value of RPA employment for tailored and even immediate deterrence across the range of provocation scenarios the armistice environment on the Korean peninsula permits. The fielding of a diverse offering of RPAs would enable the US-ROK alliance to "sustain protracted, low intensity conflicts with acceptable political, economic, and casualty risks" as well as "provide real-time response to fleeting circumstances," thereby denying the North Korean regime "opportunities for short-term surprise."[128] Having this flexibility is important because, "in the case of the Korean Peninsula, the need for immediate deterrence has not yet dissipated."[129] The severe wounding of two South Korean soldiers by North Korean-planted landmines in August 2015 and the exchange of artillery fire across the border that followed is a reminder of this fact.[130]

Despite differences in application, missile defense on the peninsula provides a current example of such flexibility in tailored, immediate deterrence. The combined architecture of ROK SAMs and Patriot missiles and the US deployed THAAD system operates as part of a disaggregated network that offers "a range of scalable response options."[131] Admittedly, the THAAD's 200 kilometer interception range does not cover all of South Korea.[132] However, the system provides one option among several that "clearly signal" to Kim Jong-Un "that any provocation will result in an effective, proportionate strike quickly negating any perceived gains."[133] Although some scholars argue the geographic mobility of missile defense platforms actually reduces their deterrent (and assurance) value, that same mobility also allows the United States to "quickly flow or surge between theaters," helping the United States "make the most efficient and effective use of critical, but scarce, defense resources."[134]

The Unmanned Aerial System (UAS), to include not just RPAs but their required infrastructure and ground components as well—is still a somewhat

scarce resource. However, it will become less of one in the future, and it shares the relative geographic mobility of missile defense platforms (not to be confused with the mobility of the RPA itself). This characteristic augments the usefulness and flexibility of both missile defense systems and RPA employment as means of deterrence. For some time, Pyongyang has been shifting away from the prospect of a "heavy ground assault across the Korean demilitarized zone," emphasizing ballistic missiles instead.[135] Employment of missile defense platforms and UASs together is a fitting response to this growing threat not just because of the assets' inherent capabilities, but also because their geographic mobility makes them a more fitting response to escalation by the DPRK than simply bringing in additional ground forces. While ground forces have historically been the most convincing demonstration of commitment to extended deterrence against North Korea alongside the US nuclear umbrella, mobile means such as missile defense and UAS that have smaller personnel and infrastructure footprints provide additional levers of deterrence and fill credibility gaps against both nuclear missiles, conventional missiles, and emerging threats. They enable "escalation . . . at various speeds and from multiple directions."[136]

In fact, employing missile defense systems and UASs in combination presents at least two potential benefits in terms of deterrence. Continuous RPA patrols have the potential to boost "the reconnaissance capabilities of forward units in a groundbreaking manner" by enabling the US and the ROK to "strike down North Korea's ballistic missiles in near-real-time."[137] Furthermore, the armed RPA presents a low-cost missile defense option, should it be in position to target a missile launcher and its weapon (conventional or nuclear) before launch. This possibility has the potential to turn "deterrence theory on its head," removing from North Korea any doubt that the US can adhere to its extended deterrence commitments.[138] Moreover, such capabilities may force the DPRK to "recognize the futility of resistance" and "conclude it is better off ceasing" various provocations it might otherwise conduct.[139]

A fourth lesson missile defense platforms offer for RPAs in deterrence on the Korean peninsula is the value of their combined employment by the ROK and the US. The strength of the US-ROK alliance itself is critical to extended deterrence, and Kim Jong-Un likely recognizes that "for years, US and South Korean officials have held regular meetings to collaborate and coordinate planning for the defense of the peninsula."[140] Like his father and grandfather, he would prefer to drive a wedge into his adversaries' alliance so he can engage each one independently.

Although US-ROK agreement on missile defense for the peninsula has proceeded in fits and starts, there is less and less division on the issue for Kim

to exploit. For one thing, the 2013 CPP defines "action down to the tactical level and locks in alliance political consultations at the highest level" in response to North Korean conventional provocations, including missile defense response.[141] Although there is no evidence THAAD has been integrated into the CPP, the willingness of South Korean President Moon Jae-In to accede to its deployment on the peninsula is a signal of strong alliance commitment even as he has made conciliatory gestures to his counterpart over the last three years.

The United States has also taken steps to demonstrate greater trust in its ally regarding the employment of missiles in both defensive and offensive roles. After decades of gradually increasing the range and payload it permitted for ROK-developed missiles, the US finally lifted all limitations after the September 2017 North Korean nuclear test.[142] This demonstration and the deployment of THAAD are both signals to Kim Jong-Un that responses to missile launches will be increasingly joint and undergirded by mutual trust between the ROK and the United States.

The US and the ROK should proceed on a similar trust trajectory in the employment of RPAs on the peninsula. It is not necessary or beneficial to fully integrate their operation, since, like THAAD and ROK-fielded missile defense systems, there are several different platforms with varying capabilities. However, there should be enough coordination between the two allies in their employment of RPAs at the operational and strategic levels that there is no decoupling that would provide an opening for the North Korean regime to exploit. Future revisions of the CPP should incorporate RPA response to provocations, including employment in ISR and strike roles. This step will help ensure proportionality, necessity, and de-escalation in the response.

There should also be some degree of coordination in the conduct of routine ISR missions to detect hostile activity prior to provocations being carried out. At the strategic level, this coordination should extend to the RQ-4 Global Hawk that the United States and ROK Air Forces both possess. In the future, coordination may also be useful to cross-cue data gathered from such medium altitude long endurance assets as Korea's Israel Aerospace Industries-purchased Heron I, Korea Aerospace Industries' Next Corps UAV, and Korean Air Aerospace Division's Medium Altitude UAV with US-fielded assets such as the MQ-1C Gray Eagle or even the MQ-9, should it deploy to the peninsula.[143] In addition to what the combined missile defense concept in Korea offers, US cooperation with Turkey in the processing, exploitation, and dissemination of data from RPAs and other platforms operated by both countries provides a model the US-ROK alliance can draw from.

Regardless, the unified stance of the two countries in responding to the discovery of hostile activities by the DPRK in an appropriate, timely manner is essential to the effectiveness of combined RPA operations in contributing to deterrence. Militarily, the conduct of combined exercises that test and employ RPA capabilities by both sides will help achieve this goal. These capabilities should include the more visible act of engaging a target kinetically, and public affairs messaging from the US and ROK militaries should clearly link strikes to timely intelligence gathered from ISR missions. Similarly, US and ROK diplomatic messaging to North Korea regarding both partners' determination to deny the regime the element of surprise in carrying out provocations should be carefully coordinated. All these lines of effort also have the additional benefit of providing assurance to South Korea.

Accordingly, the value of assuring the ROK of the United States' commitment to its defense is a fifth and final lesson combined missile defense offers for the employment of RPAs on the Korean peninsula. Missile defense in Korea is part of the US effort in "building, bolstering, and sustaining regional security architectures that allow for the seamless development of combined defense plans and operations with its allies."[144] Support of ROK-fielded missile defense platforms through the CPP and augmenting them with THAAD ensure the United States remains South Korea's "primary security guarantor, strengthening the two states' defense relationship and ensuring the latter does not pursue capabilities such as nuclear weapons."[145]

Although US contribution to combined RPA operations likely bears no weight on the ROK decision whether to pursue nuclear weapons, it does lessen the likelihood that South Korea will employ RPAs in offensive roles that threaten stability on the peninsula. This is particularly true following a provocation that threatens ROK sovereignty or loss of face. If the United States commits itself on the peninsula to the sustained employment of technology for which it possesses an equal or greater capacity than the ROK, it is demonstrating assurance and constraining independent action by its ally. This is as true in the conventional realm as it is in the nuclear realm.

Conclusion

Considering these studies, there are a few primary lessons worth revisiting regarding the employment of RPAs on the Korean peninsula. Each one has caveats to account for relevant differences in context. First, integrating the enhanced "seeing power" of new technology into a networked command and control system has the potential to deter the enemy by denying it the element of surprise. The use of radar against Germany in the Battle of Britain first il-

lustrates this assertion. Although incorporating radar into Fighter Command's C2 system helped compel Germany to halt its air offensive, radar also had a deterrent effect in that it persuaded Germany an invasion of the British Isles would not be successful. The British would be able to see the invasion well ahead of time and put against it all the forces at its disposal.

A similar argument applies to deterring North Korean provocations below the nuclear threshold today. The Korean situation is different in that the level of violence being deterred is much lower and provocations are likely to take on more diverse forms. This assessment is based on the history of inter-Korean relations and added domains such as cyber and space in which provocations can now take place. The diversity of options creates uncertainty, making detection—and therefore denying the element of surprise—more difficult than it would be for sensing the approach of an aircraft across the British Channel. Nevertheless, the coordinated employment of RPAs in the air near where provocations are most likely to originate or with equipment that can detect provocations attempted outside the physical domain will have a similar effect to radar in removing the element of surprise.

The seemingly ubiquitous presence of RPAs in the Middle East during the GWOT accomplished a similar goal, albeit in a much more clandestine fashion. Even though RPAs could not really be everywhere, their combined effectiveness in ISR and kinetic strike roles—made possible by integration into the F2T2EA cycle—caused many in the Taliban and al-Qaeda to fear they might always be overhead. As a result, terrorists were less willing to take hostile action or communicate openly with each other. That some terrorists became suicide bombers only decreases the value of this argument slightly, since records show Taliban and al-Qaeda leadership also had to change its behavior under fear of being watched.

In North Korea, a hierarchical command structure is likely to increase the deterrent value of RPAs in these roles unless regime leadership is desperate enough to ignore threats from the United States or the ROK. While this is certainly possible, previous threats against the regime have generally worked in preventing further provocations of the same type. Providing the regime evidence of its activity from data gathered by RPAs and notifying other states with a vested interest in northeast Asia regional stability will reinforce these threats.

The technological limitations of currently employed RPAs are also a concern. Unlike in uncontested air environments like Afghanistan, limited speed, maneuverability, and defense capabilities may make RPAs "easy targets for a state with an active air defense system" like North Korea.[146] High speed, "stealth, and electronic protection," along with more autonomy and the employment of RPAs in large enough swarms to overwhelm enemy defenses

would augment the contribution of RPAs in the ISR role to deterrence by increasing their survivability, therefore making it more likely they will be able to deny North Korea the element of surprise in carrying out provocations.[147]

Key to denying the element of surprise is attributing a provocation to North Korea before it can be carried out. Attribution is important in deterring the regime because even if intelligence reveals hostile intent ahead of a provocation, North Korea may attempt to deny responsibility. Like terrorists, the regime sometimes likes to operate in the gray zone of conflict to prevent conventional retaliation. The sinking of the *Cheonan* in 2010 and the laying of mines that injured two ROK soldiers in 2015 are two past examples of this behavior.

While increased RPA employment is not the sole solution to the regime's failure to take responsibility for its actions, the onboard intelligence collection capabilities employed aboard RPAs during the GWOT are applicable to state actors if they are using modern methods of communication. As hinted at in the USSOCOM example, the potential for RPAs to demonstrate AI in the future will enable them to trace hostile forces to their state of origin—either by physically following them or sorting through vast amounts of electronic data without human input. Manual intervention would only be required to decide whether to carry out a threat in response to the pertinent data.

The third case study—the deterrent value of combined missile defense—demonstrates the relationship between "seeing power" and "strike power" in making such a decision. The success of seeing power in deterrence by denial depends on communicating to the adversary the reliability of strike power, whether that strike comes from a Patriot missile or a Hellfire missile.

This decision is the topic of a third lesson from the case studies. In all three case studies, it was either necessary or at least very helpful to carry out threats of physical destruction to make deterrence credible. The near total character of World War II and the determination of Germany to knock Britain out of the conflict required that the threat be carried out repeatedly against a large number of forces. In the GWOT, there were fewer malign actors and greater concerns about collateral damage. Therefore, despite RPA pilots conducting over 1,700 kinetic strikes in a four-year period, the sheer number of hours flown during this time makes this number seem relatively small. A large proportion of terrorists who altered their behavior out of fear they were being watched had likely never seen or heard an RPA.

The case study on missile defense is less instructive in this area because the technology for intercepting missiles in flight is still maturing and credibility in deterrence may depend more on the success of a single test than the interception of German fighters or terrorists. This is where RPA employment is different, however. There are a lot more examples of successful kinetic strikes

from an unmanned platform than there are successful missile interceptions. Beyond that, RPA strikes are more likely to result in human casualties, adding some value to deterrence by punishment alongside (or perhaps reinforcing) the deterrence by denial effected by pure ISR. Therefore, the need for carrying out kinetic threats to reinforce the deterrent value of RPA-borne ISR against North Korea will likely be much less than for missile defense, let alone for either of the first two case studies.

Like the case of missile defense, however, North Korean recognition that a cohesive US-ROK alliance is wielding RPA technology in a combined operational architecture has deterrent value. Incorporating both routine RPA-borne ISR and immediate response to provocations by RPAs into the Counter Provocation Plan will ensure that the DPRK is unable to drive a wedge into the alliance. As a result, Kim Jong-Un will be increasingly likely to come to the negotiating table and less likely to exhibit provocative behavior in the future.

This expectation is based on the belief that North Korea does not wish to escalate a confrontation to the level of active armed conflict unless its national survival is threatened. The regime's willingness to stand down after being threatened in response to past provocations suggests that even though Kim Jong-Un can be an inhumane actor, he is generally a rational one. Provocations have decreased the last couple years as diplomacy has ensued with both the ROK and the United States. Nevertheless, absent a diplomatic breakthrough that is acceptable to all sides, provocations are likely to resume in the future. This possibility makes it incumbent upon the United States to have a sustained deterrence strategy that leverages the value of RPA-borne ISR for detecting hostile behavior ahead of provocations.

Recommendations for the Employment of RPAs as part of a Sustainable Deterrence Strategy

Each of the three case studies in this project examined the integration of technology into a networked C2 system—either organizationally or in the framework of an alliance—and the impact of the technology itself in deterring the opponent from carrying out certain actions. Recommendations for the employment of RPAs in a larger deterrence strategy follow similar reasoning. First, US-ROK strategy to deter North Korean provocations should build from a networked C2 system that is flexible enough to confront a myriad of situations and be able to dynamically leverage various RPA roles and capabilities for doing so. Second, the strategy should provide a combined US-ROK plan for fielding assets on the Korean peninsula and developing future RPAs.

The third case study touched on these two requirements, and this section will further address them.

Integrating RPA employment into a C2 system that provides a perfectly tailored solution for every situation ahead of time is impossible, but deterrence strategy should remain as flexible as possible for confronting future provocations. The reasons have to do largely with North Korea itself. Despite what Kim Jong-Un's national strategy appears to be, his "military strategy is uncertain" and his political base within the country is fragile.[148] Add to this uncertainty and fragility the increasing diversity of possible provocations North Korea may conduct if it feels threatened, and the US-ROK alliance has a "wicked problem" on its hands.[149]

What is needed to best leverage RPAs for deterrence against the regime in such a complex environment is a multi-domain command and control (MDC2) system that can "seamlessly analyze, fuse, and share what was once domain-centric information" in a manner "that supports all domains."[150] According to the Headquarters of the US Air Force Strategic Integration Group, advanced technologies are one of three parts to the framework for MDC2. The primary question to ask for integrating these technologies is whether they can connect into the system.[151] For RPAs, this is a question not just about the platform, since like other aviation assets each one is a mobile technology suite. It is also a question about how data gathered by increasingly capable and diverse sensing payloads onboard the RPA can be fused with data from other sources, simplified, and displayed on a common interface for decision-makers from the ROK and the US to see and react to quickly. This is because there may be a limited time to respond between discovery of an imminent provocation and its execution.

This possibility points to another allowance the MDC2 must have, which is for flexibility in communication. If time is limited, allied lives are in danger, and the activity can be attributed to North Korea, a military response may be appropriate without the need for communication at the national level. However, if time allows, communicating evidence of the planned provocation to ROK and US strategic leadership allows the best chance for confronting North Korea about it. In confronting the regime, the alliance will need to find the right balance between preserving security and providing enough information for deterrence to be effective.

A second consideration for integrating RPAs into a strategy for deterrence is the aircraft itself: its fielding on the Korean peninsula, its, roles, and its capabilities. Developing a plan for the geographic fielding of RPAs is important to their deterrent value against North Korea. This plan should first distribute RPA operating locations across the region and the Pacific theater—depending

on asset range—to increase survivability. The two primary fielded models today on the peninsula are the RQ-4 Global Hawk, operated by both the US Air Force and the Korean Air Force, and the US Army's MQ-1C Gray Eagle. Short range restricts the Gray Eagle to basing on the peninsula itself, while the RQ-4's range of over 12,000 miles permits it to launch from the United States.[152]

Future growth of the RPA inventory should also incorporate models that fill capability gaps between the MQ-1C and the RQ-4. These might include the MQ-9, which has a much greater range, endurance, and payload capacity than the MQ-1C, and more futuristic Unmanned Combat Aerial Vehicles that are currently in development by both the US and the ROK.[153] As the third case study mentioned, the ROK is also developing models whose capabilities are like the MQ-1 and MQ-9, respectively.

ISR will remain the primary deterrent role of RPAs going forward, but the role can be better leveraged in the future via sensor improvements as well as "increased autonomy to reduce pilot workload and processes that allow for more efficient use of limited communication bandwidth."[154] Autonomy will allow RPAs to fly free of the satellite data link that is currently the biggest inhibitor of maneuverability and speed as well as one of the most expensive day-to-day expenses of operating RPAs like the MQ-9. Maneuverability and speed have the added benefit of increasing survivability against North Korea's Integrated Air Defense System.

Together with AI, autonomy will also pave the way for RPA swarming, which as discussed in this study is a means to overwhelm North Korean defenses if necessary to detect a suspected provocation or carry out a threat in response to one. Furthermore, AI will enable the swarm to self-prioritize targets and reprioritize them among different RPAs in the swarm should some get shot down. Employment of a diverse mix of ISR and strike aircraft in the swarm will also aid in deterrence by creating confusion in the North Korean military about which ones to fire upon. Or, as suggested in the third case study, outfitting armed assets with stealth technology may be necessary since they will be larger and therefore more susceptible to radar detection, while preferring quantity to size for ISR-only platforms. Determining which employment option is best may require a wargame that simulates North Korea's contested environment. Regardless, for swarming to be practical, the best means of deployment may need to be from the back of a larger aircraft, which may need to be survivable against North Korean air threats unless each RPA can fly far enough on its own that it puts the carrier aircraft outside the range of those threats.

In view of North Korea's aim to drive a wedge into the US-ROK alliance, all such ventures should be combined where possible and appropriately commu-

nicated to the regime. Through information channels and diplomatically where possible, the US and the ROK should inform North Korea that both members of the alliance are equally invested in efforts to uncover hostile activity. Together with a plan for improving the capabilities of RPA technology to stay ahead of North Korea and integrating RPAs into a peninsular MDC2 system, this combined investment will communicate to the regime that provocations against its neighbor are unlikely to achieve its objectives.

Notes

(All notes appear in shortened form. For full details, see the appropriate entry in the bibliography.)

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Abbreviations

AI	Artificial intelligence
CPP	Counter-Provocation Plan
DGCS	Distributed ground control stations
DMZ	Demilitarized Zone
DPRK	Democratic People's Republic of Korea
EW	Electronic Warfare
GWOT	Global War on Terror
ISR	Intelligence, Surveillance, and Reconnaissance
KAMD	Korea Air and Missile Defense
KMPR	Korea Massive Punishment and Retaliation
KPA	Korean People's Army
MALE	Medium altitude long endurance
ODNI	Office of the Director of National Intelligence
RAF	Royal Air Force
RDF	Radio Direction Finding
ROK	Republic of Korea
RPA	Remotely Piloted Aircraft
SAM	Surface to air missile
THAAD	Terminal High Altitude Area Defense
TMD	Theater missile defense
UAS	Unmanned aircraft system
UAV	Unmanned Aerial Vehicle
UCAV	Unmanned Combat Aerial Vehicles
USFK	US Forces Korea
USSOCOM	US Special Operations Command
WMD	Weapons of Mass Destruction

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