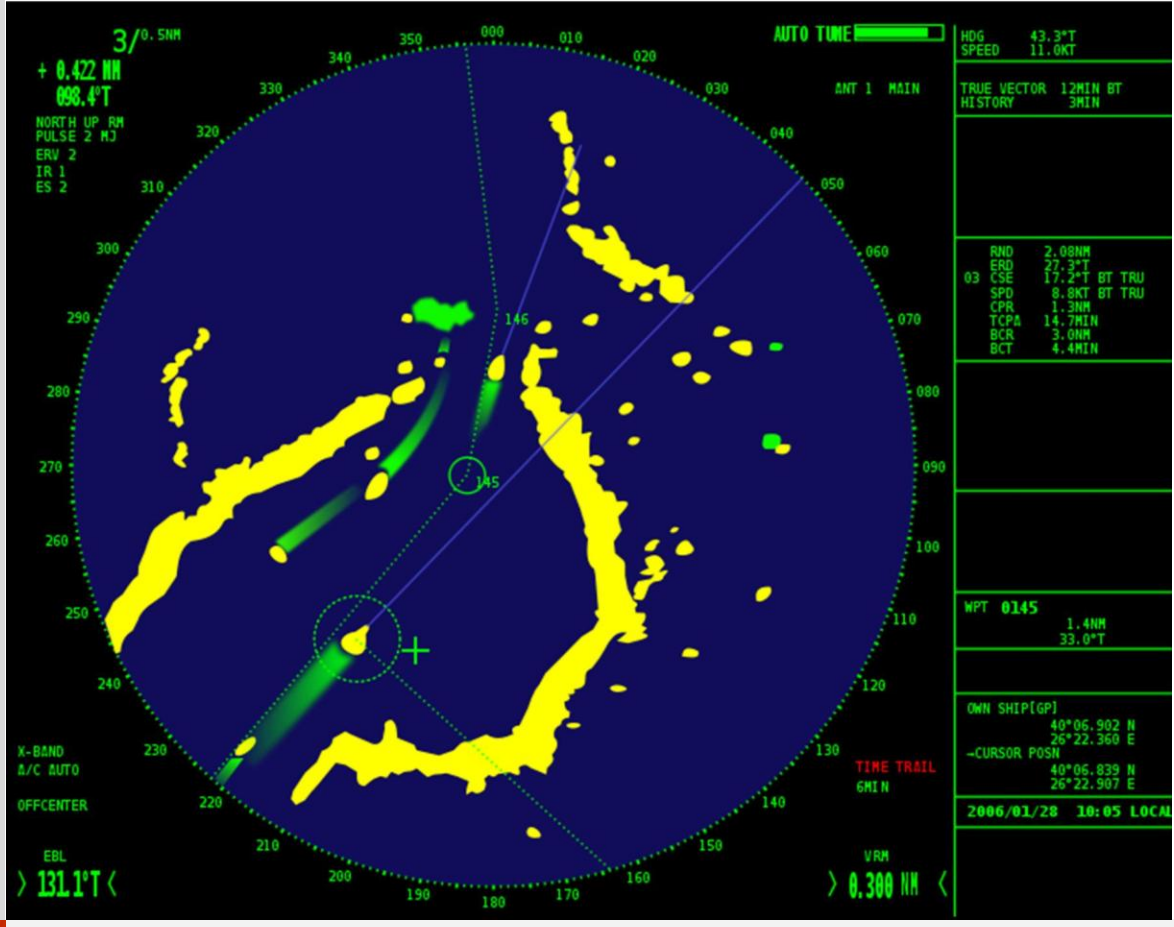

China's Evolving Reconnaissance-Strike Capabilities

Implications for the U.S.-Japan Alliance

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Cover Image: Surface-scanning radar screen [Wikimedia Commons]

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The Project 2049 Institute seeks to guide decision makers toward a more secure Asia by the century's mid-point. Located in Arlington, Virginia, the organization fills a gap in the public policy realm through forward-looking, region-specific research on alternative security and policy solutions. Its interdisciplinary approach draws on rigorous analysis of socioeconomic, governance, military, environmental, technological and political trends, and input from key players in the region, with an eye toward educating the public and informing policy debate.

Introduction

The People's Republic of China (PRC) is investing considerable resources into a military architecture that has the potential to alter the strategic fabric of the Western Pacific region. This includes the development of multiple redundant sensor capabilities for monitoring a vast maritime domain extending off of China's coastline and deep into the Pacific. China's expanding reconnaissance infrastructure is designed to support an array of precision strike capabilities for targeting ships at sea, command and control nodes, air bases, ports, and other critical facilities. The purpose of these reconnaissance-strike capabilities is to undermine the Unites States military's ability to project power into the region during periods of crisis or conflict to meet its security commitments to its allies and coalition partners.

How China's reconnaissance-strike capabilities develop in the years ahead will be a key determinant influencing the evolution of regional stability. Indeed, China's ability to hold strategic assets at risk in times of conflict with conventionally armed projectiles will challenge the security of Beijing's maritime neighbors to a far greater degree than its development of aircraft carriers or other traditional ship or aircraft platforms. Precision strike assets such as modern ballistic and cruise missiles based on road mobile launchers are exceedingly difficult to defend against and inherently destabilizing. However, China's weapons systems are not invulnerable to countermeasures that could be fielded in the years ahead.

Japan is one of the countries that will be most directly impacted by China's evolving reconnaissance-strike capabilities. Both Tokyo and Beijing are deeply distrustful of the others' intentions due to a long list of historical grievances, and, more recently, the two sides have seen a sharp downturn in their relationship due to a territorial dispute in the East China Sea. To minimize the potential for conflict erupting, it will be important for Japan and the United States to strengthen their alliance as a stabilizing force to balance against China's growing military power. Given the budgetary constraints facing the American military, wise investments and a more "normal" Japanese force posture will be essential to keep the region peaceful as China becomes more militarily capable.

This paper will examine China's emerging reconnaissance-strike capabilities and discuss their implications for the U.S.-Japan alliance. It will begin by describing China's increasing capabilities, and explain why they would be destabilizing to regional security if left unchecked. Next, this paper will explore efforts currently underway in China to assure its capacity to acquire, track and target adversaries' naval and air operations. Then it will assess capability gaps in the Japanese and American militaries that create vulnerabilities China could exploit to undermine the defensive utility of the alliance. Finally, this paper will conclude with a brief set of recommendations on

countermeasures that Tokyo and Washington could take to assure the defense of Japan in the years ahead.

China's Reconnaissance-Strike Posture

There has been a clear trend in recent years toward an increased Chinese presence and assertiveness in its surrounding waters or "near seas."[1] This trend reflects the culmination of numerous factors, but at its most essential level can be explained by the evolving strategic needs of the Chinese Communist Party (CCP) leadership in Beijing. As an unelected political organization, the CCP's claim to legitimacy has traditionally been based upon its delivery of economic success, its protection of China's territorial sovereignty, and its championship of national pride. However, for a number of years there have been growing doubts about the CCP's ability to maintain domestic stability,[2] and more recently observers have raised serious questions about China's economic health.[3] These challenges appear to have driven the CCP to resort to the exploitation of territorial sovereignty issues in the East and South China Seas to shore up its legitimacy and bolster nationalistic sentiment.

At the same time, the CCP may be seeking to exploit maritime security issues, especially those in the East China Sea, as part of its Taiwan policy. Indeed, the CCP's approach has been centered on fostering a sense of shared external threat with the Republic of China (ROC) by conflating their respective territorial sovereignty claims. This strategy appears to have been a key (if largely under-noticed) driver of China's gambit in the East China Sea.[4] For this reason, the Japan-Taiwan fisheries agreement in 2013 – considered by many as a major diplomatic achievement – demonstrated Japan's capacity to cement an official de-conflating of the dissimilar PRC and ROC campaigns to assert sovereignty over the Senkaku Islands (known as *Diaoyu Dao* in China, and *Diaoyu Tai* in Taiwan).[5]

Beijing's maritime political maneuvering also appears to be driven by perceptions of a U.S.-Japan security alliance that is in relative decline when compared to the ascendant capabilities of the Chinese People's Liberation Army (PLA). Though still far behind in terms of naval and aircraft hardware – and critical operational software – the PLA has an advantage that the U.S. military and the Japanese Self Defense Force (JSDF) cannot match: theater missiles. In recent years, the PLA's strategic missile force, the Second Artillery, has begun deploying "game-changing" projectile weapons that the U.S. and Japan are ill-equipped to defend against. These new weapons include the now infamous anti-ship ballistic missile (ASBM) as well as growing fleets of ballistic missiles and ground launched cruise missiles (GLCMs) for attacking land-based targets. The Chinese military is also investing heavily in anti-ship cruise missiles (ASCMs) for attacking maritime targets.

However, the PLA's strike capabilities would be of little actual utility without a robust network of intelligence, reconnaissance and surveillance (ISR) assets to support them. Much like a combat marksman relies on his telescopic lens to hit distant targets, the Second Artillery requires ISR in order to deliver precision strikes. According to naval experts, the Earth's curvature limits line-of-sight ISR from China's military aircraft to some 150-200 nautical miles.[6] As such, the PLA has invested in large numbers of satellites for wide-area maritime surveillance and reconnaissance.

The PLA Navy (PLAN) has also deployed a large fleet of submarines for operations around China's littorals, while deploying an over-the-horizon radar system for monitoring China's coastline and beyond. Likewise, elements of the PLA and the Chinese Coast Guard have fielded a growing fleet of "tattle-tale" ships that covertly collect intelligence while ostensibly engaged in benign activities such as fishing, environmental research, and satellite tracking. Chinese military and security officials are bolstering this network of aircraft, satellites, submarines, radars and ships with unmanned aerial vehicles (UAVs) specifically designed for maritime surveillance missions. They also appear to be developing near space vehicles for maritime ISR collection missions.

In sum, China's reconnaissance-strike capabilities present the U.S. and Japan with a considerable challenge. The PLA's capabilities are problematic because they are centered on offensive missiles systems optimized for large "surprise-attack" raids.[7] Because the PLA's missile launch units have little defensive utility, they engender a sense of vulnerability when not used at the opening of a conflict. During crisis situations this has the potential to drive the PLA to maintain a more aggressive posture than might otherwise be the case. During peacetime, the PLA's strike capabilities also require ISR collection efforts to "prepare the battlefield." As a result, the PLA's reconnaissance operations have begun intruding into American and Japanese territorial waters.[8] Moreover, recent Chinese maritime operations have been conducted in a fashion that suggests the PLA seeks to intentionally heighten the possibility of unintended incidents and regional tensions in order to extract concessions from its neighbors.[9]

China's reconnaissance-strike capabilities are also potentially destabilizing to regional security because they encourage geostrategic competition. For example, the largest of the uninhabited Senkaku Islands, Uotsuri-shima, is capped with a hill that towers 363 meters (1190 feet) above the East China Sea. Japanese military strategists and intelligence officials worry that the PLA could invade the island in order to establish a radar station on that strategic highpoint.[10] Given the elevation, a notional radar station on the island would drastically improve the Chinese ISR "picture" of the East China Sea, and could potentially give the PLA continuous coverage into the Philippine Sea.[11] While this scenario seems unlikely given the high level of vigilance Japan has demonstrated in

maintaining its control over the Senkaku Islands, nations bordering the South China Sea have not been as fortunate. Indeed, the PLA has constructed radar stations and other electronic intelligence collection platforms on a number of geographic features in the Paracel Islands and Spratly Islands that both Vietnam and the Philippines claim as their territory.[12] This has raised Chinese tensions with Hanoi and Manila, while also stoking worries in Tokyo that Japan could be next.[13]

China's Reconnaissance-Strike Capabilities[14]

The Asia-Pacific is defined by a vast maritime expanse unlike that found anywhere else on earth. Military operations in this environment require the delivery of rapid effects over great distances. Such effects can only be delivered through the exploitation of aerospace power.[15] As a maritime power, the United States is poised to deliver its power projection effects primarily from a small number of forward deployed air bases and aircraft carrier groups. However, the land territory available to the U.S. for projecting power in the Western Pacific is limited. In contrast, China, as a continental power, is poised to deliver its power projection effects from a large number of dispersed, land-based missile launch sites. In any conflict, it would enjoy abundant strategic depth, and operate close to the battle space, with less vulnerable internal lines of logistics.[16]

Recognizing the geographic advantage it would have over the U.S. in any conflict with Japan and/or Taiwan, the PLA has prioritized the development of long-range missiles in order to be able to strike American ships and air bases before they would be able to project power into the region.[17] China's precision strike capabilities are currently centered on ground-launched ballistic and cruise missiles that have ranges between 500 and 2,000 kilometers.[18] These theater missiles are loaded on transporter erector launchers (TELs) that are highly survivable due to their mobility and ease of concealment. The PLA bolsters its theater missile capabilities with cruise missiles launched from aircraft, ship and submarine platforms.

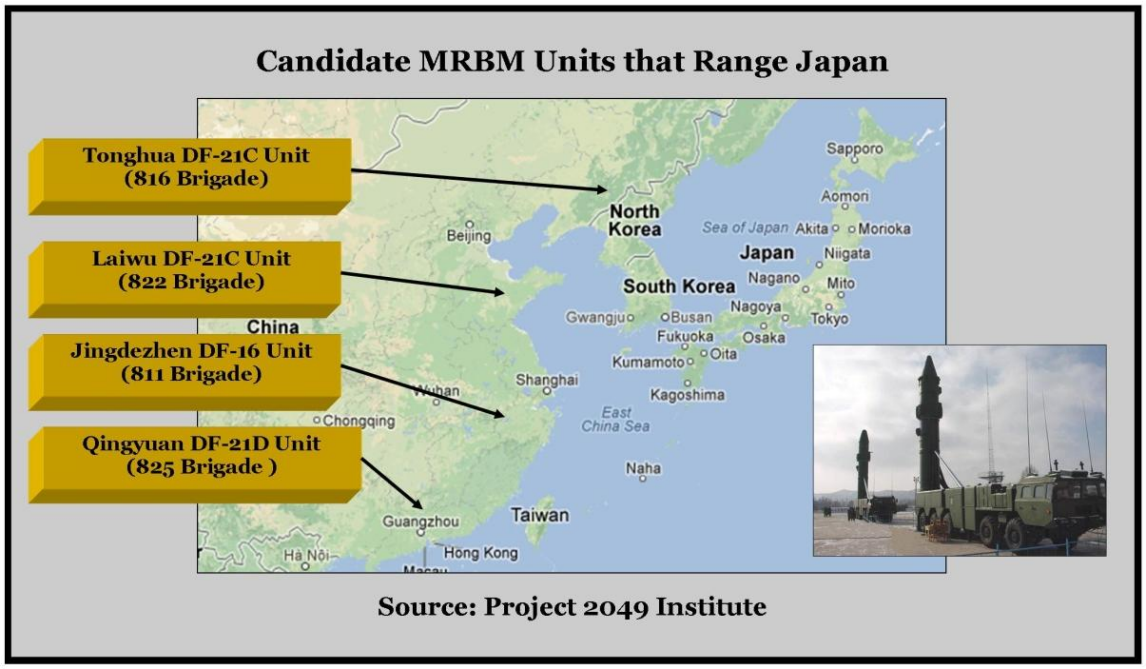
STRIKE CAPABILITIES

Ballistic Missiles. The PLA's Second Artillery Force fields the world's largest and most capable inventory of theater ballistic missiles for delivering nuclear and conventional strikes. In recent years, the Second Artillery has deployed an increasing number of conventionally armed ballistic missiles that have sufficient ranges to target virtually any point on Japan. These missiles are all solid-fueled and road mobile, making it difficult for a defender to predict when and where they will be launched. Further advancing their lethality, significant investments have been made into improving warhead accuracies and payloads while also developing methods to defeat ballistic

missiles defenses such as the Patriot-3 (PAC-3) and Standard Missile-3 (SM-3) missile interception systems fielded by Japan and forward deployed U.S. forces.

Initially, the only theater ballistic missile in the PLA arsenal that could reach Japan was the medium-range Dongfeng-21C (DF-21C). However, according to Taiwanese intelligence officials, the Second Artillery Force has also begun deploying a new medium-range ballistic missile (MRBM), the DF-16, which is reportedly aimed at "counter-intervention" missions. According to their assessments, the DF-16 would be primarily intended for targeting U.S. air and naval bases in Japan during a confrontation over Taiwan. The PLA is also extending the range of its DF-11 and DF-15 short-range ballistic missiles (SRBM) across from Taiwan, giving them notional coverage of increasingly large sections of the East China Sea. Of even greater concern, the Second Artillery began initial deployments of the DF-21D ASBM in late 2010. The purpose of the DF-21D "carrier killer" is to threaten U.S. aircraft carrier strike groups operating in the Western Pacific.[19] It could also pose a threat to Japan's Hyūga-class and Izumo-class helicopter carriers.[20]

Looking ahead, the Department of Defense's 2013 report on China's military power assessed that the PLA is developing conventional intermediate-range ballistic missiles (IRBM) for near precision strike missions against targets up to 5,000 kilometers away.[21] These missiles could eventually be used to threaten the U.S. territory of Guam, the Marianas Islands, Palau, Northern Australia, Alaska, and U.S. bases in the Middle East and the Indian Ocean. If the PLA's conventional IRBM program is successful, it is possible that China could develop the means to threaten Hawaii and the West Coast of the United States with conventional intercontinental ballistic missiles (ICBM) by sometime in the early-to-mid 2020s.[22]



Cruise Missiles. After decades of sustained investments in advanced cruise missile procurement, the PLA currently fields some of the world's most cutting-edge cruise missile systems. China has produced large numbers of ground-launched cruise missiles that are capable of standoff precision strikes. Having previously obtained cruise missiles from Russia, the PLA in recent years has been acquiring considerable numbers of domestically built systems. These include the Second Artillery Force's ground-launched *Changjian*-10 "Long Sword" (CJ-10) land attack cruise missiles (LACM); PLAN's ground- and ship-launched *Yingji*-62 "Eagle Strike" anti-ship cruise missile; and the PLA Air Force's *Yingji*-63 and CJ-20 LACMs.

With up to 500 missiles deployed on 40-55 road-mobile, tri-canister launchers in the Second Artillery Force, China's strategic CJ-10 LACM may be of particular concern to U.S. and Japanese defense planners. The CJ-10 is reported to have a stealthy design and a range of over 1,500km, giving the PLA the ability to notionally place all of Japan's main islands within the threat envelope of its cruise missiles. Likewise, the PLAN operates around 100 JH-7 fighter-bombers and some 30 H-6M maritime bombers that are armed with ASCMs. According to the Department of Defense, these could have a strike radius of over 1,500km. For its part, the PLAAF operates a small number of H-6K bombers equipped with LACMs that have maximum strike ranges out to Guam.[23]

At both the tactical and strategic levels, China's advanced cruise missiles have serious implications for regional security in the East China Sea and beyond. Like China's highly-successful ballistic missile systems, cruise missiles are technologically challenging (and expensive) to defend against. However, unlike ballistic missiles, cruise missiles are able to strike from any direction and fly at very low altitudes, making them even harder to detect and counter. Cruise missiles are also more accurate and inexpensive to build than ballistic missiles and, because of their relatively small size, can be launched from a variety of platforms, further adding to their stealth and agility. Like ballistic missiles, they also represent a major proliferation risk.

CJ-10 Land Attack Cruise Missile

Source: Air Power Australia

RECONNAISANCE CAPABILITIES

The PLA's ability to conduct maritime strike missions is likely to be limited by the range of its ISR capabilities. To expand its maritime battlespace awareness, the PLA is investing in at least seven capabilities that could allow it to monitor activities in the East China Sea and beyond: 1) manned aircraft platforms; 2) satellites; 3) submarines; 4) maritime surveillance ships; 5) over the horizon radars; 6) unmanned aerial vehicles; and 7) near space flight vehicles.[24]

Manned Airborne Platforms. The PLAN's naval aviation branch operates a small number of land-based aircraft for maritime patrol. The naval variant of the Y-8 aircraft serves as the PLANs principle maritime patrol aircraft. It carries an array of sensors for detecting and monitoring aircraft, surface ships and submarines. [25] The newly established Chinese Coast Guard also has a small number of aging aircraft for conducting maritime patrol. In recent months, these aircraft have been intercepted in Japan's Air Defense Identification Zone by Japanese F-15s operating out of Naha Air Base in Okinawa.[26] While Chinese airborne ISR platforms such as the Y-8 provide some maritime domain awareness, they are too limited in number to provide sufficient coverage. They are also vulnerable to mechanical failure and accident prone.[27] In a conflict situation, it seems unlikely that they would be capable of providing actionable ISR to theater missile launch units on a regular basis.

Y-8 Maritime Patrol Aircraft

Source: SinoDefence

Satellite Platforms. To make up for its airborne platform deficiencies, the PLA has launched a large number of satellites that are capable of supporting theater missile operations with maritime reconnaissance data. These include electro-optical (EO) satellites for digital imagery in the visual and near infrared spectrum; synthetic aperture radar (SAR) satellites for nighttime, all-weather imagery; and electronic intelligence (ELINT) satellites for locating and identifying ships by their electronic emissions. In 2012 alone, the PLA launched 11 new remote sensing satellites. It also launched three communications satellites and one relay satellite for beyond visual line of sight contact with ground stations. More recently, China launched its third series of naval ocean surveillance system (NOSS) satellites in September 2013.[28] This underscores the key role space-based ISR plays in supporting the PLA's strike capabilities.[29]

Candidate Reconnaissance Satellites Supporting PLA Strike Operations

Name	Launch Date	Satellite Type
Yaogan 9 (A,B,C)	Mar. 5, 2010	Naval Ocean Surveillance System (NOSS)
Yaogan 10	Aug. 10, 2010	Synthetic aperture radar (SAR) imagery
Tian Hui 1A	Aug. 24, 2010	Military mapping satellite
Yaogan 11	Sep. 22, 2010	Electro-optical (EO) imagery
Shi Jian 11-03	July 6, 2011	Unknown, possible early warning satellite
Shi Jian 11-02	July 29, 2011	Unknown, possible early warning satellite
Hai Yang 2A	Aug. 15, 2011	Dual-use ocean monitoring satellite
Yaogan 12	Nov. 9, 2011	Electro-optical (EO) imagery
Shi Yan 4	Nov. 20, 2011	Earth terrain mapping satellite
Yaogan 13	Nov. 30, 2011	Synthetic aperture radar (SAR) imagery
Zi Yuan 1C	Dec. 22, 2011	EO or SAR imagery satellite
Zi Yuan 3A	Jan. 9, 2012	Dual-use mapping satellite
Feng Yun 2F	Jan. 13, 2012	Meteorological satellite
Tian Hui 1B	May 6, 2012	Military mapping satellite
Yaogan 14	May 10, 2012	Electro-optical (EO) imagery
Yaogan 15	May 29, 2012	Electro-optical (EO) imagery
Shi Jian 9 (A & B)	Oct. 14, 2012	Unknown military payload, possible ELINT
Huan Jing 1C	Nov. 18, 2012	Synthetic aperture radar (SAR) imagery
Xin Yan 1	Nov. 18, 2012	Unknown, possible NOSS
Feng Niao (1 & 1A)	Nov. 18, 2012	Unknown, possible NOSS
Yaogan 16 (A,B,C)	Nov. 25,2012	Naval Ocean Surveillance System (NOSS)
Gao Fen 1	Apr. 26, 2013	Electro-optical (EO) imagery
Shi Jian 11-05	July 15, 2013	Unknown, possible early warning satellite
Yaogan 17 (A,B,C)	Sep. 1, 2013	Naval Ocean Surveillance System (NOSS)
Feng Yun 3C	Sep. 23, 2013	Meteorological satellite
Kuai Zhou	Sep. 25, 2013	Rapid reaction imagery satellite
Yaogan 18	Oct. 29, 2013	Synthetic aperture radar (SAR) imagery
Yaogan 19	Nov. 20, 2013	Electro-optical (EO) imagery

Sources: Gunter's Space Page, Space Daily, Project 2049 Institute

Submarines. The PLAN has the world's largest fleet of diesel electric submarines, and a small but growing nuclear-powered attack submarine force, giving it a potentially powerful underwater reconnaissance capability. With some 40 modern attack submarines currently fielded and up to 70 expected to be in service by the end of the decade, the PLAN's submarine force is designed to assist in efforts to achieve sea control around the first island chain, to include countering U.S. and Japanese intervention in a Taiwan conflict. The PLAN also fields nuclear-powered attack submarines (SSN) for a variety of long-range missions, including surveillance and surface interdiction missions carried out with ASCMs and torpedoes. It currently has two second-generation Shang-class (Type-093) SSNs in service and may add up to five third-generation Type-095 SSNs in the coming years. The PLAN also operates eight upgraded Kilo-class submarines that are notable for their stealth and ability to launch advanced, Russian-made ASCMs. However, it is possible that PLAN submarines would find it difficult to safely provide actionable ISR to land-based theater missile launch units during wartime due to Japan's high proficiency in anti-submarine warfare (ASW) operations. [30] Nonetheless, PLAN affiliated researchers continue to advocate for using submarines as ISR platforms.[31]

Chinese Submarine in South China Sea

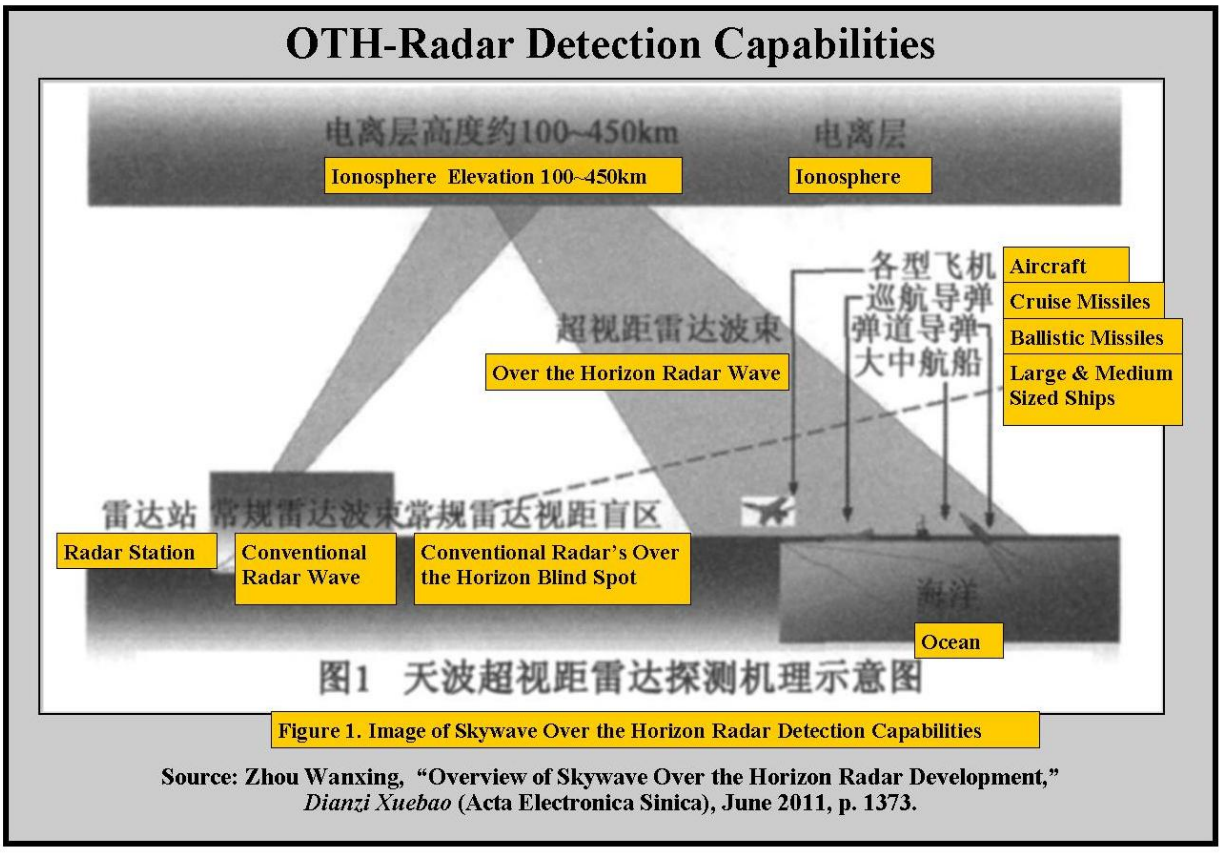
Source: People's Daily

Maritime Surveillance Ships. China operates at least three fleets of maritime surveillance, or "tattle-tale" ships, which fall under the respective jurisdictions of the Chinese Coast Guard, the PLAN, and the PLA General Armament Department (GAD). These ships have had an increasing presence in Japanese territorial waters in the East China Sea, especially since September 2012. According to Japanese Coast Guard intelligence sources, many of these ships are ostensibly disguised as fishing trailers – albeit without key equipment such as nets or tackle.[32] In 2012, Chinese naval surveillance ships also reportedly began conducting operations in American waters off of Hawaii.[33] While speculative, it is also possible that the GAD's space tracking and relay ships operate near the Reagan Test Site in the Kwajalein Atoll and Wake Island to monitor the progress of U.S. ballistic missile defense (BMD) testing.[34] Technical data collected could be exploited by PLA missile designers for penetrating American and Japanese BMD systems – something that is a key Chinese research priority.[35] The paucity of available information makes it unclear the extent to which China's fleets of maritime reconnaissance ships would be able to support PLA missile strikes against maritime targets. However, PLA affiliated writings suggest that maritime reconnaissance ship deployments were probably the earliest means China employed for tracking U.S. carrier groups.[36]

Chinese Maritime Surveillance/Space Tracking Ship

Source: CMSE News

Over the Horizon Radars.[37] In addition to airborne, space-based, subsurface, and surface sensors for maritime reconnaissance, over the horizon backscatter (OTH-B) radar systems are an important element of the PLA's extended range air and maritime surface surveillance architecture. Managed by both PLAN and PLAAF operators, a network of OTH radar systems enables the PLA to detect aircraft carriers, airborne assets, and other targets operating within range of the radar systems. Because OTH-B radars emit pulses off the ionosphere to illuminate a target from the top down, detection ranges can extend from 1,000 to 4,000 kilometers. Sea clutter and other resolution issues are likely to significantly degrade the effectiveness of systems. Nonetheless, military technical writings produced by both Second Artillery and PLAAF affiliated engineers evince confidence in the utility of OTH-B for maritime early warning.[38] While unable to provide precise targeting data to missile launch units, the PLA's OTH-B radar systems could enable other sensors and ISR assets to narrow their search areas, greatly speeding up detection times.[39]



Unmanned Aerial Vehicles. China's development of large numbers of unmanned aerial vehicles (UAV) for military missions extending into the Western Pacific represents a rapidly emerging capability for conducting maritime reconnaissance. According to Chinese officials, China plans to construct 11 UAV bases along its coastline by 2015 for maritime monitoring missions. As part of this program, the State Oceanic Administration (SOA) – now part of China's coast guard – completed a trial program in 2011 that used UAVs in Liaoning Province to take aerial imagery of 980 square miles of sea area. Reportedly, the PLAAF has already begun to deploy UAVs for missions near the East China Sea, notably to an air base near Shuimen, Fujian. Authoritative estimates state that the PLAAF alone had over 280 UAVs in service by early 2011. More recently, the PLAN aviation branch began UAV flights near the Senkaku Islands in September 2013.[40] According to a retired Deputy Chief of the PLA General Staff Department, China is likely to field over 1000 medium and large sized UAVs in the coming years.

Looking farther ahead, Chinese UAVs will support the expansion of the PLA's operational envelope, pushing its reconnaissance-strike capabilities farther out into the Western Pacific. Chinese sources note that UAVs provide the ability to engage in high altitude long endurance patrols unmatched by manned missions whose flight times are restricted by the limits of human endurance. A robust network of ISR mission capable UAVs, combined with satellites, "tattletale" ships, and other assets will make it increasingly likely that the PLA will be able to locate enemy fleets at greater distances, and, once discovered, track them continuously. This should be of particular concern to the U.S. Navy and the Japanese Maritime Self Defense Force (JMSDF) because according to Chinese sources, PLA operational thinkers and scientists envision attacking U.S. aircraft carrier strike groups with swarms of armed UAVs and theater missiles in the event of conflict.

PLA Navy Surveillance UAV

Source: Wikimedia Commons

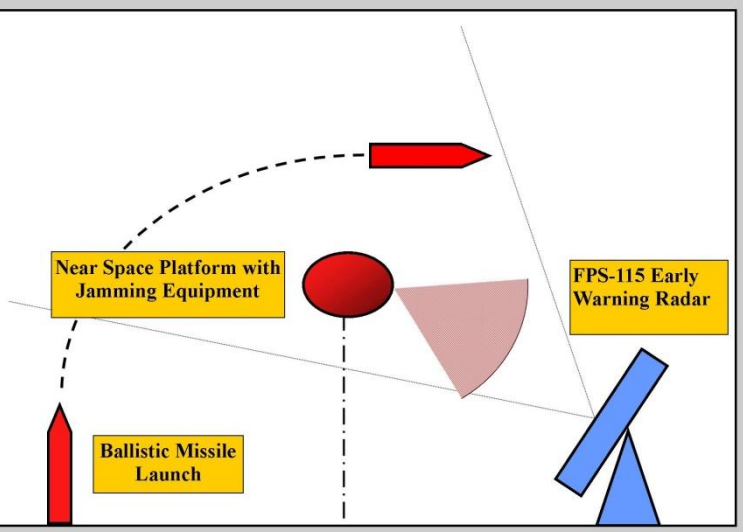
Near Space Vehicles.[41] Chinese analysts view the realm between the atmosphere and outer space – "near space" – as an area of future strategic competition.[42] Near space is characterized in Chinese documents as the region between 20 and 100 kilometers above the Earth's surface. This area is generally too high for oxygen breathing aircraft, and too low for satellites to orbit. While currently underdeveloped, the PLA Second Artillery and China's defense R&D community have become increasingly interested in near space vehicles for future long-endurance reconnaissance missions. For such missions, SAR and ELINT sensor payloads appear to be the priority. Another area of priority may be the development of electronic warfare suites suitable for near space vehicles.

One prominent PLA affiliated engineer, Zhang Xixiang, has advocated for using near space vehicles deployed 60-90 kilometers in altitude over China for persistent maritime surveillance and electronic warfare missions extending 1,000 kilometers into the East China Sea and South China Sea.[43] According to his technical research, PLA near space vehicles could be used as electronic warfare platforms to enable attacks on U.S. aircraft carriers with missiles and aircraft platforms. Zhang writes: "*In the areas of the East Sea and off our southeast coast, a foreign country's aircraft carrier formations regularly conduct activities. This has become a threat to China's security. Near space platforms could be deployed with the necessary electronic equipment to give us the ability to support missiles and aircraft during attacks on them [carrier formations].*"[44]

Aside from using near space vehicles for maritime surveillance and electronic warfare operations against aircraft carrier groups, he also envisions using near space platforms for jamming land-based early warning radars. According to Zhang: *"There are certain countries that have deployed missile defense systems around our surrounding areas to intercept our missiles systems…We could use near space platforms with jamming equipment to support [our missile attacks] by jamming enemy interceptors' early warning radars, tracking radars, and terminal guidance radars."*[45]

This research illustrates the dynamic nature of China's evolving reconnaissance-strike capabilities, and their serious implications for American and Japanese air and missile defenders in the western Pacific.

Diagram of Near Space Platform Supporting PLA Missile Attack



Source: Adapted from Zhang Xixiang, "Electronic Warfare Payloads for Near Space Platforms," p. 114.

Gaps and Vulnerabilities in the U.S.-Japan Alliance

The alliance that binds the United States and Japan has served as an anchor of peace and prosperity in the Asia-Pacific region for over half a century. American power projection, enabled by bases on Japanese territory, is foundational to the efficacy of the alliance. The U.S. military has two critical platforms for power projection in the Asia-Pacific. They are air bases and aircraft carriers. Each is important for a different set of reasons, and each has its own respective set of strengths and weaknesses. U.S. Air Force air bases – and Navy and Marine Corps air stations – have the advantage of space. In wartime, air bases allow hundreds of heavy fighter, bomber, transport, reconnaissance, airborne early-warning and control, and tanker aircraft to deliver high sortie rates around the clock. However, air bases are inherently vulnerable to theater missile attacks because their size and static nature makes them easy to target.

In contrast, aircraft carriers are far smaller, typically only supporting 44 strike aircraft, and producing 120 sorties in their twelve hours of daily operation.[46] Nonetheless, U.S. nuclear powered aircraft carriers have the advantage of mobility, making them difficult to target and giving them a high degree of survivability. Their speed also allows them to conduct operations in a flexible manner unavailable to air bases. Aircraft carriers can go anywhere in the world and can arrive off coastlines before adversaries know they are there. However, when compared to air bases on land, aircraft carriers have little built in resiliency. Unlike airbase runways, which can be repaired within hours of an attack, aircraft carrier decks, once damaged, are generally unusable for at least several months. Aircraft carriers are also more challenging to maintain during combat operations for logistical reasons.

Recognizing the unique strengths and vulnerabilities that exist in America's forward deployed air bases and aircraft carriers, the PLA's strategy is to use theater missiles against these key pillars of the U.S.-Japan Alliance, and thereby threaten Washington's ability to meet its legal commitments to regional allies and coalition partners. The PLA's reconnaissance capabilities are one key variable in the equation. Without accurate and timely information on the status of U.S. air bases and the location of aircraft carriers, the PLA would not be able to conduct effective missile raids. As such, it makes sense for the U.S. and Japan to develop and demonstrate capabilities for waging a "blinding" campaign against the PLA's sensor systems, especially its space-based ISR assets. However, the U.S. and Japan have few proven capabilities for conducting such operations.

To make matters worse, the U.S. and Japan have centralized their power projection enterprise into a small number of vulnerable facilities, offering the PLA the potential to achieve out-sized strategic effects with a relatively limited number of conventionally

armed theater missiles. This is especially true if the PLA could catch the 7th Fleet's only forward deployed aircraft carrier, the USS George Washington, in port or during vulnerable periods of transit in Tokyo Bay or around Kyushu.[47] However, even without such attacks, the PLA could still be able to threaten critical naval facilities that provide U.S. carrier strike groups with support they rely on to conduct operations. Moreover, by threatening the small number of JSDF bases on Okinawa and Kyushu that help defend U.S. air bases and carrier groups from air, missile, and submarine threats, the PLA could gain a significant tactical advantage.

This situation has led Japanese strategists to worry that the PLA's rapidly emerging reconnaissance-strike capabilities could give China conventional strike parity in the foreseeable future, and, by so doing, undermine the U.S.-Japan alliance. Indeed, with U.S. aircraft carriers and airbases in and around Japan so potentially vulnerable to the PLA's missiles, some American observers have already begun calling for a strategy to conduct off-shore control and potentially abandon the U.S. commitment to a robust forward deployed presence in Japan.[48] Others have suggested that the U.S. should take a more conciliatory approach to China by unilaterally limiting its arms sales to security partner nations.[49] These developments, while not reflective of official policy in Washington, have served to heighten Tokyo's sense of a looming security crisis.

Toward a Stronger Alliance

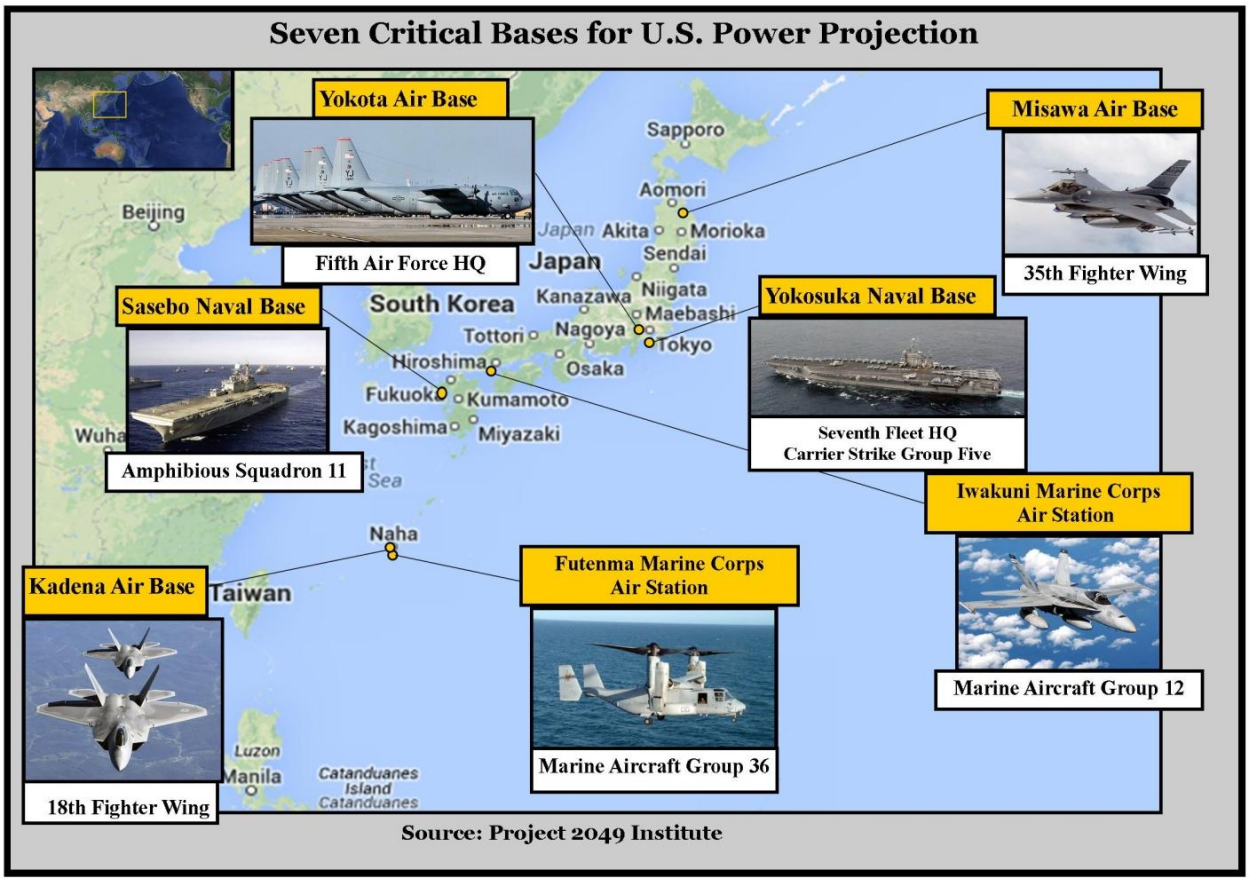
The United States and Japan have begun to take a number of steps to adapt to the rapidly changing regional security environment being driven by China's reconnaissance-strike capabilities. On the U.S. side, the Obama Administration has pledged to rebalance or "pivot" the resources and energies of the nation toward the Asia-Pacific, and the Pentagon is developing the Air-Sea Battle concept of operations. On the Japan side, Prime Minister Abe is working to normalize the nation's military by pushing legislation through the Diet that would confirm Japan's right to collective self-defense. And both the U.S. and Japan are engaged in an extended dialogue on their evolving roles, missions and capabilities as alliance partners. However, these measures, while necessary, are not sufficient. In order to assure the long term health of the alliance – and with it regional security and prosperity – there are at least three additional steps that decision-makers in Washington and Tokyo should consider.

I. Base Hardening and Resiliency[50]

As defense budgets tighten, there will be a natural tendency to attempt to cut corners and do more with less. One of the first targets is likely to be military facilities. While perhaps understandable from a narrow bureaucratic perspective, it defies logic to allow critical bases to remain vulnerable to China's increasingly lethal missiles. This is

especially true with the three Japan Air Self Defense Force (JASDF) bases on or near the East China Sea; at Naha, Tsuiki, and Nyutabaru. Unlike air bases in northern Japan, which were hardened during the Cold War to defend against a potential war with the former Soviet Union, Tokyo has not invested adequately in protecting its bases in the Southwest. In particular, JASDF has strikingly few hardened aircraft shelters for its fighters at these airfields.[51]

U.S. bases are also vulnerable to China's reconnaissance-strike capabilities. Most important are the air force bases at Yokota, Kadena, and Misawa; the naval bases at Yokosuka and Sasebo; and the Marine Corps air stations at Iwakuni and Futenma.[52] These seven facilities represent the cornerstone of U.S. power projection in the Asia-Pacific. They are irreplaceable. Without them, it would be highly difficult for the U.S. to fight and win a war in Asia. Although the U.S. is capable of generating and sustaining combat power from outside Japan, the American military would be significantly less effective without access to these forward operating bases, and their loss could mean the difference between victory and stalemate – or worst.



Unlike the U.S. military, which enjoys some measure of operational flexibility due to its other bases in the region, the JASDF has no choice but to operate from Japanese territory. It is therefore difficult to understand why Tokyo would leave the vast majority of its air combat power sitting on parking ramps in the open or in unhardened hangars. There are only 15 shelters at the U.S. air base in Kadena (a trivial number compared to the operational requirement), and none at the Marine Corps air stations at Futenma and Iwakuni. Therefore, the JASDF would be unable to use U.S. shelters in the event of conflict due to space limitations. To its credit, JASDF appears to have taken some initial (if inadequate) measures to harden its command and control, fuel, and munitions depots – and appears to have deployed air and missile defense units to its three bases on Okinawa and Kyushu. However, these bases suffer from a lack of extra runways and limited parking ramp space; their aircraft remain profoundly exposed; and Japan's rapid runway repair capabilities remain uncertain at best.[53] The JASDF also has yet to develop its potential to operate effectively in a dispersed manner across the some 100 civilian airfields in Japan that have long enough runways to support fighter aircraft.[54]

Fortunately, there are a number of cost-effective solutions to the problems Japan and the U.S. face. For the price of five F-35 Lightening II fighter aircraft, the JASDF and U.S. Air Force could construct approximately 100 hardened aircraft shelters on Okinawa and Kyushu capable of protecting up to 200 fighters.[55] This would equate to spending some 500 million dollars to protect 10 billion worth of combat assets.[56] Similarly, for the cost of one littoral combat ship, the U.S. Navy and Marine Corps could construct enough shelters and hardened hangars to house a mix of 188 fighters, helicopters and tilt-rotor aircraft.[57] Other exposed aircraft could be protected inside revetments designed to mitigate the effects of small sub-munitions and near misses.[58] These would be particularly useful for protecting large, high-value aircraft unable to fit inside hardened shelters.[59] Revetments could also be constructed to protect living and work facilities for the thousands of personnel that are required to keep a fighter wing operational. Thousands of revetments could be built for the cost of a small number of the abovementioned hardened aircraft shelters.[60] Likewise, investments are needed into redundant and deeply buried command and control centers; extra or alternate runways, taxiways, and parking ramps; and hardened power, fuel and logistical facilities. Also worthy of further development, electro-magnetic and visual deception techniques–especially when combined with force dispersal–would serve to confuse target planning officers in the PLA and degrade the terminal guidance systems on their missiles.

However, investing in hardening, dispersal, deception, and other relatively affordable and effective defense measures is not enough. Once adequate preparation is made for all critical platforms and personnel to *survive* missile raids, investments need to be made in maintaining the capacity to quickly *recover* from attacks and get back in the fight.[61] Resiliency is about being able to thrive in a wartime environment through the

optimization of recovery speeds. When properly done, it allows forces to keep sortie rates higher than the enemy would otherwise anticipate and catch them unprepared. The PLA's strategy hinges upon its ability to destroy critical facilities and force the long-term closure of bases to help it achieve air superiority. If the U.S. and Japan were able to rapidly deploy military engineering teams for heavy repair missions, they could drastically reduce the impact of missile attacks, and quickly retake and retain the initiative. This would have the effect of undercutting the PLA's strategy through the disruption of its core planning assumptions, and thereby alter China's incentives to engage in offensive operations. More importantly, investing in hardening and resiliency would demonstrate resolve in the face of a serious adversary threat. The opposite is also true. Failing to invest in needed defenses in the face of a clear threat risks sending the message Japan is not fully committed to its defense and the U.S. is not fully committed to its ally and to the region. A campaign to better safeguard bases in Japan through a mix of active and passive defensive measures is therefore needed both to assuage concerns and to help deter war.

II. Counter Reconnaissance

Another critical, but often overlooked and underemphasized, element required for protecting the U.S. ability to project power in the face of China's emerging reconnaissance-strike capabilities is counter reconnaissance.[62] It is essential that the U.S. and Japanese militaries develop the means to wage a "blinding" campaign against the sensor and communications networks that are foundational to PLA missile operations. As previously discussed, the PLA's strike capabilities would be of little actual utility without a robust network of ISR assets to support them, much in the same way that a combat marksman's skills go to waste without a telescopic lens.

The Second Artillery requires ISR in order to deliver effective strikes against all of its potential targets. Aircraft carriers at sea, and other mobile and fleeting targets are the most difficult to acquire, track, and engage in near-real time. The human software and technological hardware required for conducting these types of missions is exceedingly vulnerable to disruption because the "kill-chain" requires high-levels of jointness and complexity. However, the PLA does appear to recognize its inherent weaknesses in this area, and is attempting the necessary reforms to strengthen its integration of reconnaissance and strike capabilities.

It will likely take a minimum of several more years of maturation before the PLA considers its C4ISR systems reliable enough for conducting near real-time attacks. Nonetheless, the strategic importance of aircraft carriers is such that the U.S. Navy will be reluctant to commit the "queens" of its fleet to uncertain environments. The specter of even immature ASBM capabilities could limit the role of carriers in projecting power.

For this reason, there is a compelling need for developing proven capabilities for paralyzing the battle-networks enabling potential Chinese ASBM attacks.

In contrast to aircraft carriers, air bases and other static facilities critical for projecting power are relatively easy for the PLA to strike because missile units targeting them do not require near real-time ISR. The advent of space-based satellite constellations for positioning, navigation and timing data could enable the PLA to conduct precision attacks on pre-selected fixed targets with abbreviated kill-chains. Nonetheless, timely reconnaissance is still required for assuring the effectiveness of missile raids, both before and after attacks. PLA planners would need reconnaissance before attacks to make sure that the desired targets, be they F-22s on the runway or Aegis ships in port, have not moved to an alternate location. After a notional attack, PLA planners would need reconnaissance for producing battle damage assessments and planning the next raid. The intelligence required does not have to be near real-time, but it still has to be timely to be effective.

It will therefore be important for the U.S. and Japan to further develop a range of capabilities for denying the PLA access to its reconnaissance capabilities. At the low end of the spectrum, this could include special operations missions to board and detain the crews of suspected surveillance vessels – or to attack coastal radar sites. It could also include engaging airborne sensor platforms, land-based radars and other relatively "soft" PLA targets with electronic warfare or kinetic attacks. At the higher end of the spectrum, it would require the disabling or destruction of critical sensors onboard Chinese reconnaissance satellites in low earth orbit. Currently the easiest way for the U.S. and Japan to assure the incapacitation of Chinese satellites would be to engage them directly with specially modified SM-3 missiles or some other type of interceptor. However, the threat of producing an unacceptably high level of space debris would argue against such attacks.

Instead, cyber operations or cruise missile attacks directed against the PLA's network of satellite ground stations would be preferable. If developed, high powered laser or other directed energy weapons could also be employed by the U.S. and Japan for the counterspace mission. Ultimately, the priority target for any counter reconnaissance campaign waged against the Second Artillery would be the command and control nodes where the PLA integrates its reconnaissance and strike capabilities. These C2 nodes are likely to be located in remote and deeply buried bunkers. Nonetheless, they could be vulnerable to cyber attacks or physical sabotage. Preparing the battlefield to the greatest extent possible with both digital and human agents would help. During a conflict, something as simple as sending an intelligence asset (or cruise missile) to cut shallowly buried PLA fiber optic lines could make a significant contribution.

III. Conventional Counterstrike

Beyond base hardening and counter reconnaissance, conventional counterstrike capabilities are essential for deterring and defeating potential PLA missile attacks. Conventional counterstrike is ultimately what power projection is all about. While missile defense and counter reconnaissance capabilities serve to mitigate the worst effects of precision strikes, they are unable to respond to them in a proactive manner. Only conventional counterstrike capabilities against Chinese command posts and TELs would allow American and Japanese forces to quickly regain the initiative after a PLA missile raid. In the era of missile-centric warfare, targeting the "archer" is a must.

Yet Japan has no current capabilities for striking PLA missile launch units, and the U.S. Air Force only has two platforms with the advanced low observable (stealth) capabilities required for penetrating China's formidable array of air defense systems. These two platforms are the B-2 bomber and the F-22 fighter. Unfortunately, they are each limited in their utility when it comes to hunting mobile targets. The B-2 bomber is restricted in the effects it can deliver because, at a total of some twenty aircraft in the entire U.S. fleet, there are simply not enough of them to maintain sufficient presence over potential assembly or launch sites. The Air Force *does* have enough F-22 fighters for relatively large scale operations, but they are too limited in range to be able to stay over Chinese airspace for short periods of time on each sortie. Fuel limitations drastically limit their ability to penetrate deep into Chinese airspace. They may be limited to targeting command posts and TELs operating in coastal areas.

The U.S. Navy is potentially well positioned to contribute to the conventional counterstrike mission. Cruise missiles carried aboard navy submarines and aegis ships are highly capable for precise long-range strikes, and some advanced variants are able to loiter above pre-selected areas while searching for targets. Theoretically, these could hit transitory targets such as road-mobile TELs, especially when paired with small UAVs in "hunter-killer" teams.[63] However, it is unclear how well such capabilities would perform in denied air space characterized by interlocking adversary air defense and advanced electronic warfare systems – especially when satellite communications links were disrupted. [64]

The Navy's F/A-18s Super Hornets are less capable for counterstrike missions. Even assuming that they could operate from forward positioned air stations or aircraft carriers (not a given in the face of China's missile threat to bases and ships) F/A-18s, like other fourth generation fighters, would not be able to penetrate China's air defenses without high attrition rates until a major suppression operation had paved the way forward, something that could take weeks (perhaps even months) for F-22s, B-2s and other platforms to fully execute. In the interim, the PLA's missile units would likely have

launched their requisite missile raids, and PLA aircraft could have achieved air superiority over desired airspace.

F-22 Fighter Emerges From Hardened Shelter

Source: Kadena Air Base Media Gallery

Therefore, to deter China from exploiting its reconnaissance-strike capabilities for launching potentially devastating attacks on Japanese and forward deployed U.S. targets–especially against the critical bases in Misawa, Yokota, Yokosuka, Iwakuni, Sasebo, Kadena and Futenma–military leaders in Tokyo and Washington should focus their foremost energies on conventional counterstrike. Developing and demonstrating a credible capacity for holding the PLA's command posts and missile launch units at risk is critical for maintaining allied air superiority and sea control.

More broadly, conventional counterstrike will be important for keeping the PLA from achieving long-term conventional strike parity with the U.S. in the Western Pacific. Eventually, if the PLA's reconnaissance-strike capabilities are not met with superior *conventional* force, the U.S. and Japan will be forced to place a greater emphasis on *nuclear* force – something that could spiral out of control in a conflict and lead to an unintended nuclear war. It is therefore essential to the future peace and prosperity of the Asia-Pacific region that smart investments are made to bolster conventional counterstrike capabilities in the context of the U.S.-Japan alliance.

Recognizing that the U.S. will take time to fully recover after two long wars and a great recession, Japan should be encouraged to do more to contribute to the conventional counterstrike mission. With the F-35 program now many years behind schedule, it makes sense for Tokyo to study options for deploying conventionally armed ballistic and cruise missiles. Indeed, Japan's civilian space program has recently developed and

launched one of the world's most advanced solid-fueled space launch vehicles.[65] If required, these rockets could be converted into ballistic missiles for the deterrent mission with relatively little modification.[66] Less controversial would be a Japanese decision to partner with American companies to produce next-generation, long-range cruise missiles. Such a program would benefit from Japan's cutting edge aerospace engineering capacities – and have the added benefits of increasing joint operability and bringing unit costs down.

Looking ahead, the PLA's evolving reconnaissance-strike capabilities are going to force some difficult choices in Tokyo and Washington. It is critical that they be made with an eye toward deterring aggression through strength. If the past shows students of military history anything, it's that muddling through and hoping for the best in the face of an emerging threat only serves to increase the risk of conflict. There are no easy solutions to the challenges Japan and the U.S. face. Improving base hardening and resiliency, counter reconnaissance, and conventional counterstrike capabilities is the place to start.

Notes

[1] For example, Japan scrambled its F-15 interceptors at Naha Air Base on Okinawa in response to Chinese intrusions into Japan's Air Defense Identification Zone (ADIZ) in the East China Sea 15 times from April 1, 2012 to June 30, 2012. During the same period of time in 2013, the number of scrambles had increased to 69. By August 2013, Japan was scrambling its fighters on a daily basis. See Hannah Beech, "Angry Skies: Japanese Jets Scramble as Tensions With China Escalate," *Time Magazine*, September 18, 2013, at http://world.time.com/2013/09/18/angry-skies-japanese-jets-scramble-as-tensions-with-china-escalate/. Chinese naval activity in the East China Sea, the Philippine Sea, and the South China Sea has also increased dramatically from 2008 to present, and further increases are expected. Interviews with Japanese Ministry of Foreign Affairs (MoFA) Officials in Tokyo, February and August, 2013; and interview with Japanese Maritime Self Defense (JMSDF) officers and Japanese Coast Guard (JCG) official in Okinawa, August, 2013.

[2] For example, see Murray Scot Tanner, "It's Not About the Economy," *New York Times*, March 1, 2011, at http://www.nytimes.com/roomfordebate/2011/02/28/why-is-china-nervous-about-the-arab-uprisings/its-not-about-the-economy; Andrew Jacobs and Jonathan Ansfield, "Well-Oiled Security Apparatus in China Stifles Calls for Change," *New York Times*, February 28, 2011 at http://www.nytimes.com/2011/03/01/world/asia/01china.html?pagewanted=all; "Hearing and Roundtable: China's Internal Dilemmas," *U.S.-China Economic and Security Review Commission*, February 25, 2011, at http://www.uscc.gov/Hearings/hearing-and-roundtable-china%E2%80%99s-internal-dilemmas.

[3] Derek M. Scissors, "Should America Root for a Reforming China?" *The National Interest*, October 16, 2013, at http://nationalinterest.org/commentary/should-america-root-reforming-china-9241; Richard Silk, "Chinese Consumers Step Back, Pinching Firms," *Wall Street Journal*, August 22, 2013, at http://online.wsj.com/article/SB10001424127887324619504579028523534713550.html; and "Global Economy: Fear of Fed and China Slowdown take a toll," *Reuters*, July 14, 2013, at http://www.reuters.com/article/2013/07/14/economy-global-weekahead-idUSL4N0FI3BN20130714.

[4] See Banyan, "Seas of Trouble," *The Economist*, May 18, 2013, at http://www.economist.com/news/asia/21578106-taiwan-and-china-share-same-maritime-claims-have-very-different-interests-seas-troubles.

[5] Interview with MoFA official in Tokyo, August 2013.

[6] Greg Chaffin, "China's Navy and Air Force: Advancing Capabilities and Missions–An Interview with Andrew S. Erickson," *The National Bureau of Asian Research*, September 27, 2012, at http://www.nbr.org/research/activity.aspx?id=276#.UkWPdj9kmUM.

[7] For an excellent assessment of Chinese views on the necessity for preemption, see Roger Cliff, et al. *Entering the Dragon's Lair: Chinese Antiaccess Strategies and Their Implications for the United States* (Arlington, VA: RAND Corporation, 2007), pp. 31-34, accessible online at http://www.rand.org/content/dam/rand/pubs/monographs/2007/RAND_MG524.pdf.

[8] Kiyoshi Takenaka, "Japan defense chief wants more surveillance in key areas east of islands," *Reuters*, September 27, 2013, at http://www.reuters.com/article/2013/09/27/us-japan-defence-idUSBRE98Q0AT20130927; and Andrew S. Erickson, "Pentagon Report Reveals Chinese Military Developments," *The Diplomat*, May 8, 2013, at http://thediplomat.com/2013/05/08/back-on-track-pentagon-report-reveals-chinese-military-developments/.

[9] See Bill Gertz, "China driving U.S. out of Asia," *Washington Times*, January 22, 2014, at http://www.washingtontimes.com/news/2014/jan/22/inside-the-ring-china-trying-to-drive-us-out-of-as/; and watch "Schieffer Series: Crisis in the East China Sea: Strategic Implications of China's Air Defense Identification Zone," *Center for Strategic and International Studies*, January 15, 2014, at http://csis.org/event/schieffer-series-crisis-east-china-sea-strategic-implications-chinas-air-defense-identificatio. For a detailed study on the issue, see Mark E. Redden and Phillip C. Saunders, "Managing Sino-U.S. Air and Naval Interactions: Cold War Lessons and New Avenues of Approach," *China Strategic Perspectives*, No. 5, September 2012.

[10] Interviews with Japanese analysts and Ministry of Defense (MoD) officials in Tokyo, July-August 2013; and email exchange with high ranking MoD official in October 2013.

[11] However, one official pointed out that such an undertaking would be a "logistical nightmare" that Japan could easily counter. Another official pointed out that the island has little fresh water available, and what water is available may be poisonous to humans. Interviews with Japanese MoD and Coast Guard officials in Tokyo and Naha, July-August 2013.

[12] James C. Bussert, "Facilities in the South China Sea reflect technologies otherwise hidden," *Signal*, October 2003, at http://www.afcea.org/content/?q=node/80.

[13] Interviews with Japanese MoD and MoFA officials in Tokyo, July-August 2013.

[14] Unless otherwise noted, this section draws from Ian Easton and Randall Schriver, *Assessing Japan's National Defense: Toward a New Security Paradigm in the Asia-Pacific* (Arlington, VA: Project 2049 Institute, June 2013), accessible online at http://project2049.net/documents/assessing_japan_national_defense_easton_schriver.pdf.

[15] For more on this topic see Mark A. Stokes and Ian Easton, *Evolving Aerospace Trends in the Asia-Pacific Region: Implications for Stability in the Taiwan Strait and Beyond* (Arlington, VA: Project 2049 Institute, May 2010), accessible online at http://project2049.net/documents/aerospace_trends_asia_pacific_region_stokes_easton.pdf.

[16] For more on the role geography plays in driving Chinese strategy, see Ian Easton, *China's Military Strategy in the Asia-Pacific: Implications for Regional Stability* (Arlington, VA: Project 2049 Institute, September 2013), pp. 8-9, accessible online at http://www.project2049.net/documents/China_Military_Strategy_Easton.pdf.

[17] Ibid., p. 8.

[18] Ibid., p.11.

[19] Of the recent literature on the DF-21D, see Andrew S. Erickson, *Chinese Anti-Ship Ballistic Missile (ASBM) Development: Drivers, Trajectories and Strategic Implications* (Washington D.C.: Jamestown Foundation, May 2013). See also Henry J. Hendrix, *At What Cost a Carrier?* (Washington D.C.: Center for National Security Studies, March 2013), accessible online at http://www.cnas.org/files/documents/publications/CNAS%20Carrier_Hendrix_FINAL.pdf.

[20] Although a number of factors could make it considerably more difficult for the PLA to acquire and track Japanese helicopter carriers. Unlike U.S. aircraft carriers, Japanese helicopter carriers do not operate fixed wing aircraft, so they have reduced electronic emissions signatures during air operations. This lowers the probability that Chinese electronic intelligence (ELINT) sensors on aircraft and satellites would be able to detect them. Likewise, Japanese helicopter carriers' smaller wakes would also make finding and tracking them with air and space-based synthetic aperture radar (SAR) sensors more difficult; and their smaller radar cross sections would make detection with over the horizon backscatter (OTH-B) radars less likely. Nonetheless, if they were acquired and tracked, their slower speeds and relatively limited operating areas could leave them more vulnerable to Chinese attack. For details on Japan's newest helicopter carrier, see Hiroshi Hiyama, "Japanese Navy Unveils Biggest Warship Since WWII," *Defense News*, August 6, 2013, at http://www.defensenews.com/article/20130806/DEFREG03/308060004/Japanese-Navy-Unveils-Biggest-Warship-Since-WWII.

[21] Military and Security Developments Involving the People's Republic of China 2013 (Arlington, VA: Office of the Secretary of Defense, 2013), p. 42, at http://www.defense.gov/pubs/2013_china_report_final.pdf.

[22] This estimate is probably somewhat overly pessimistic. While China has been able to field large numbers of advanced SRBMs over the past decade, its production of conventional MRBMs has taken place at a much slower pace. This calls into question China's ability to develop and field large numbers of IRBMs and then move on toward developing conventionally armed missiles with intercontinental ranges. Nonetheless, defense planners are tasked with assuming the worst. Some naval planners, for example, take it for granted that the PLA will eventually be able to hold the Third Fleet's ships in Hawaii and San Diego at risk with long range ballistic and cruise missiles. However, the veracity of such estimates is unknowable at the current time.

[23] However, it should be noted that due to range (fuel) limitations these bombers would not be able to fly low radar evading flight paths on their way out past the first island chain. Only by flying high in less dense air could they hope to get close enough to launch their LACMS on Guam. Given their large radar cross sections, these antiquated PLA bombers would be easy targets for American, Japanese and Taiwanese air defenders long before they could get within range of Guam.

[24] While beyond the scope of this study, other reconnaissance capabilities including signals and cyber intelligence operations and human intelligence operations are also major areas of focus for the PLA. For more see Mark A. Stokes and L.C. Russell Hsiao, *Countering Chinese Cyber Operations: Opportunities and Challenges for U.S. Interests* (Arlington, VA: Projeect 2049 Institute, October 2012), at http://project2049.net/documents/countering_chinese_cyber_operations_stokes_hsiao.pdf; Mark A. Stokes, Jenny Lin, and L.C. Russell Hsiao, *The Chinese People's Liberation Army's Signals Intelligence and Cyber Reconnaissance Infrastructure* (Arlington, VA: Project 2049 Institute, November 2011), at

http://project2049.net/documents/pla_third_department_sigint_cyber_stokes_lin_hsiao.pdf; and Peter Mattis, "The Analytic Challenge of Understanding Chinese Intelligence Services," *Studies in Intelligence*, September 2012, pp. 47-57, at https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/csi-studies/studies/vol.-56-no.-3/pdfs/Mattis-Understanding%20Chinese%20Intel.pdf.

[25] "Yun-8X Maritime Patrol Aircraft," *SinoDefence*, February 23, 2009, at http://www.sinodefence.com/airforce/specialaircraft/y8mpa.asp.

[26] Interview with Japanese Air Self Defense Force (JASDF) officers in Okinawa, August 2013.

[27] Interview with JASDF officers and JCG officials in Okinawa and MoD officials in Tokyo, August 2013.

[28] Gunter Dirk Krebs, "Yaogan 9, 16, 17," *Gunter's Space Page*, September 2, 2013 at http://space.skyrocket.de/doc_sdat/yaogan-9.htm. See also, Ian Easton and Mark A. Stokes, *China's Electronic Intelligence (ELINT) Satellite Developments: Implications for U.S. Air and Naval Operations* (Arlington, VA: Project 2049 Institute, February 2011), at http://project2049.net/documents/china_electronic_intelligence_elint_satellite_developments_easton_stokes.pdf.

[29] For an excellent discussion on the subject, see Eric Hagt and Matthew Durnin, "Space, China's Tactical Frontier," *The Journal of Strategic Studies*, October 2011, pp. 733-761.

[30] Interviews with multiple U.S. and Japanese naval experts in Washington and Tokyo, December 2012 and August 2013; and Japanese Maritime Self Defense Force (JMSDF) P-3C unit in Okinawa, August 2013. For an interesting, but non authoritative, Chinese source on the subject, see Wang Yifeng and Ye Jing, "The Sino-Japanese Submarine Incident and Our Nuclear Submarine Penetration Capability [从中日核潜艇事件看我国核潜艇的突防]," *Shipborne Weapons*, January 2005, pp. 27-31.

[31] For example, one relatively recent PLAN affiliated study explored the effectiveness of submarine-based radar for battlefield reconnaissance missions. See Xia Ming, "An Assessment of the Effectiveness of Submarine Radar Reconnaissance Equipment [潜艇雷达侦察装备效能评估]," *Jianchuan Dianzi Duikang* [Shipboard Electronic Countermeasures], April 2010, p. 40.

[32] Interview with JCG officials in Tokyo, August 2013.

[33] Andrew S. Erickson, "Pentagon Report Reveals Chinese Military Activities," *The Diplomat*, May 8, 2013, at http://thediplomat.com/2013/05/08/back-on-track-pentagon-report-reveals-chinese-military-developments/; and author's interview with Japanese naval expert in Tokyo, September 2013.

[34] For an excellent article on China's fleet of potentially dual-use space tracking and maritime surveillance ships, see Andrew S. Erickson and Amy Chang, "China's Navigation in Space," *Proceedings Magazine*, April 2012, pp. 42-47, at http://www.usni.org/magazines/proceedings/2012-04/chinas-navigation-space.

[35] Of the many PLA research articles focused on finding ways to defeat U.S. ballistic missile defense systems, see Zhang Changfang, et al., "Overview of America's Ballistic Missile Defense C2BMC System Development [美国弹道导弹防御 C2BMC 系统发展综述]," *Zhuangbei Xueyuan Xuebao* [Journal of the Equipment Academy], June 2012, pp. 60-63.

[36] For example, see Nie Yubao, "Electronic Warfare in the Struggle against Aircraft Carrier Formations [与航空母舰编队作斗中的电子战]," *Hangtian Dianzi Duikang* [Aerospace Electronic Countermeasures], No.

1, 1997, pp. 47-48. See also Xu Minfei, et al., "Analysis on Possible Anti-Ship Ballistic Missile and Related Technologies that are Needed [试析弹道导弹反航母的可能性及需要解决的相关技术]," *Guofang Keji Cankao* [National Defense Reference], December 1997, pp. 126-130.

[37] Unless otherwise noted, this section draws from *Military and Security Developments Involving the People's Republic of China 2013* (Arlington, VA: Office of the Secretary of Defense, 2013), p. 42 and 68, at http://www.defense.gov/pubs/2013_china_report_final.pdf, and Mark A. Stokes and Ian Easton, *Evolving Aerospace Trends in the Asia-Pacific Region: Implications for Stability in the Taiwan Strait and Beyond* (Arlington, VA: Project 2049 Institute, May 2010), pp. 19-20, at http://project2049.net/documents/aerospace_trends_asia_pacific_region_stokes_easton.pdf.

[38] See Zhang Shaolei and Su Lina, "Over-the-Horizon Radar and its Application in Reconnaissance and Early Warning [天波超视距雷达及其在侦查预警中用]," *Gaoxiao Like Yanjiu* [High Efficiency Physics Research], 2010, p. 100; and Wang Anyi and Yang Tiaomin, "Research Assessment of Sky Wave Over-the-Horizon Radar Maritime Detection Effectiveness [天波超视距雷达对海探测效能评估研究]," *Kongjun Leida Xueyuan Xuebao* [Journal of Air Force Radar Academy], June 2012, p. 199.

[39] For an example of PLAN collaboration with the Second Artillery in this area, see Peng Ruihui, et al., "Analysis of ESM Cueing 2D Radar Located at Different Sites [导地配置下 ESM 对 2D 雷达的引导分析]," *Xiandai Leida* [Modern Radar], January 2009, p. 13.

[40] Edward Wong, "Hacking U.S. Secrets, China Pushes for Drones," *New York Times*, September 20, 2013, at http://www.nytimes.com/2013/09/21/world/asia/hacking-us-secrets-china-pushes-for-drones.html?pagewanted=all&_r=0.

[41] Unless otherwise noted, this section draws from Mark A. Stokes and Ian Easton, *Evolving Aerospace Trends in the Asia-Pacific Region: Implications for Stability in the Taiwan Strait and Beyond* (Arlington, VA: Project 2049 Institute, May 2010), pp. 19-20, at http://project2049.net/documents/aerospace_trends_asia_pacific_region_stokes_easton.pdf.

[42] See Li Jun, et al., "Research on Information Countermeasures to Near Space Platforms [对临近空间平台的信息对抗问题研究]," *Daodan Yu Hangtian Yunzai Jishu* [Missiles and Space Vehicles], No. 6, 2008, p. 23.

[43] Zhang Xixiang, "Electronic Warfare Payload Technologies for Near Space Platforms [临近空间平台电子战载荷技术]," *Journal of the Chinese Academy of Electronics and Information Technology (CAEIT)*, April 2010, pp. 113. Note that Zhang (b. 1933) is an award winning academician in China's Academy Engineering and a technology consultant to the 863-8 program committee. A 1955 graduate of the PLA communications engineering academy, he is said to have had a strong influence on the PLA's electronic warfare community, having personally cultivated many of its core technical units.

[44] Ibid.

[45] Ibid.

[46] Henry J. Hendrix, *At What Cost a Carrier?* (Washington D.C.: Center for New American Security, March 2013), p. 6, at http://www.cnas.org/files/documents/publications/CNAS%20Carrier_Hendrix_FINAL.pdf.

[47] Interview with Japanese maritime security expert in Tokyo, September 2013.

[48] See T.X. Hammes, "Offshore Control: A Proposed Strategy for an Unlikely Conflict," *INSS Strategic Forum*, June 2012, at http://www.dtic.mil/dtic/tr/fulltext/u2/a577602.pdf.

[49] For example, see Piin-Fen Kok and David J. Firestein, *Threading the Needle: Proposals for U.S. and Chinese Actions on Arms Sales to Taiwan* (Washington D.C.: East West Institute, September 2013), at https://dl.dropboxusercontent.com/s/aa6ynk4jhad2b93/TAS.pdf.

[50] This section benefited greatly from a detailed briefing on the history of air base defenses presented by Alan Vick at the RAND Corporation in Arlington, VA, January 2014. It also draws from the email exchanges that followed. The author is indebted to Alan Vick for sharing his knowledge about aircraft shelters. He is also indebted to Stacie Pettyjohn at RAND for the thoughtful introduction.

[51] Google Earth imagery taken in the 2012-2013 timeframe indicates that there are four hardened shelters at Naha, six at Tsuiki, and four at Nyutabaru. Each shelter could protect two fighters in an emergency (or perhaps even three), but housing more than one fighter at a time inside a shelter significantly reduces sortie generation rates and greatly increases the risk that a mechanical mishap or one "lucky shot" from an adversary ballistic or cruise missile would destroy multiple fighters.

[52] However, it is important to note that not all seven bases are equally vulnerable. For example, the U.S. Air Force took measures to significantly harden Misawa Air Base in northern Japan during the Cold War. It has also invested in a buried (and perhaps hardened) command and control facility at Yokota Air Base. For its part, Naval Activities Yokosuka has some underground office spaces. Presumably, the U.S. and Japanese militaries also operate hardened military facilities at undisclosed locations. Indeed, numerous underground military facilities were constructed in the region during the Second World War, and many are rumored to have been maintained. Nonetheless, according to private interviews, even many of the hardened U.S. bases in Japan have potentially serious gaps requiring further investment.

[53] Note that all three (Naha, Tsuiki, and Nyutaburu) currently have only one runway apiece, with minimal taxiways, parking ramp space, and hangar facilities. Naha Air Base, arguably now one of Japan's most important strategic facilities outside of Tokyo, has to share this single runway with aircraft from the Maritime Self Defense Force, the Japanese Coast Guard, and the local international airport. The latter of which is responsible for more than 150 flights daily according to its Wikipedia page. See http://en.wikipedia.org/wiki/Naha_Airport. Fortunately, a second runway is planned for construction on reclaimed land. However, it is unclear whether this project (scheduled for completion around 2019) will include an expansion of facilities for the military. Interview with JASDF and JMSDF officers at Naha Air Base, August 2013.

[54] Interview with high-ranking MoD official in Arlington, VA, January 2013.

[55] This (very rough) estimate assumes an F-35 unit cost of 100 million dollars, for a total budget of 500 million dollars. If we assume that a modern hardened aircraft shelter would costs five million dollars to construct in Japan, than 100 could be built on this budget. However, prices vary considerably. For example, hardened aircraft shelters reportedly cost 3.2 million dollars each for the U.S. Army Corps of Engineers to build in South Korea in 2004. See Franklin Fisher, "New shelters promise brighter days ahead for Osan mechanics," *Stars and Stripes*, March 30, 2004, at http://www.stripes.com/news/new-shelters-promise-brighter-days-ahead-for-osan-mechanics-1.18211. Inflation, local conditions, and other factors would increase costs in Japan. As such, five million per shelter is an optimistic estimate. A more conservative estimate might posit costs up to ten million per shelter. Nonetheless, because they would protect assets that are far more valuable, including fighter aircraft, pilots, and maintenance crews – and have a deterrent value that is impossible to quantify – hardened aircraft shelters are well worth the expense.

[56] This (again, very rough) estimate assumes that a mixture of fifth generation and fourth generation fighter aircraft would be housed inside these shelters. It further assumes that two aircraft would be placed

in each shelter. The ten billion dollar estimate is reached simply by adding the approximate cost of 50 fifth generation fighter aircraft (5 billion) to the approximate cost of 150 fourth generation fighter aircraft (5 billion). The same number can be reached by taking fourth generation fighters out of the equation altogether, and simply assuming that one fifth generation aircraft is housed inside each shelter. In any event, the cost estimates used for fourth and fifth generation fighter aircraft are probably overly conservative. They also fail to take into account the value of pilots, ground crews, equipment, deterrence, etc.

[57] This estimate assumes a Littoral Combat Ship unit cost of $470 million dollars per ship. This notional budget would be sufficient to purchase 94 the above mentioned five million dollar hardened aircraft shelters. However, the sheltered aircraft number is a very rough estimate, as Navy and Marine Corps aircraft generally have folding wings (and rotor blades) for carrier and amphibious ship operations. This attribute could allow for placing a larger number of aircraft in shelters when compared to U.S. Air Force aircraft. In actual practice, it would be unlikely that either the Navy or Marine Corps would consider the need to shelter aircraft that could be deployed to mobile aircraft carriers and amphibious assault ships in times of high tension. Moreover, they might not be inclined to shelter their remaining fighters, helicopters and tilt-rotor aircraft for three reasons: 1) most of these aircraft could be dispersed to short or semi-prepared airfields; 2) shelters would create complications for tilt-rotor aircraft operations that they do not for fighters due to space limitations; and 3) there would be institutional aversion because sheltering would denote a defensive and static (as opposed to offensive and expeditionary) posture. Nonetheless, given the importance of air stations in Japan for supporting U.S. Navy and Marine Corps operations in the region (and given the volume of aircraft likely to be parked at these sites in a crisis), it is important that measures are taken to assure they could withstand missile attacks.

[58] A revetment is a steel or reinforced concrete wall or earthen works enclosure that surrounds a parked aircraft on three sides and is open in the front.

[59] For example, the U.S. Air Force has a number of revetments at Kadena Air Base on Okinawa to protect its large reconnaissance, AWACS, transport and aerial refueling aircraft. Interview with USAF officer at Kadena Air Base, November 2013.

[60] While cost estimates for revetments are currently unavailable, note that a relatively recent example of a large scale revetment building project can be seen in the U.S. Air Force's 1993 construction of 2.5 miles of revetments to protect army helicopters deployed to Mogadishu, Somalia. These revetments were installed by a 19 member team, suggesting that the cost was quite low. See Ronald B. Hartzer, "Heritage to Horizons: Commemorating 60 Years of Air Force Civil Engineering History," *Air Force Civil Engineer*, Vol. 15, No. 3, 2007, p. 19, at http://www.afcec.af.mil/shared/media/document/AFD-120926-122.pdf.

[61] For more detailed discussions and recommendations on air base hardening and resiliency, see Roger Cliff, et al. *Entering the Dragon's Lair: Chinese Antiaccess Strategies and Their Implications for the United States* (Arlington, VA: RAND Corporation, 2007), pp. 31-34, accessible online at http://www.rand.org/content/dam/rand/pubs/monographs/2007/RAND_MG524.pdf, p. 95-96; John Stillion and David R. Orletsky, *Airbase Vulnerability to Conventional Cruise-Missile and Ballistic-Missile Attacks: Technology, Scenarios, and U.S. Air Force Responses* (Arlington, VA: RAND Corporation, 1999), pp. xv-xvii, accessible online at http://www.rand.org/content/dam/rand/pubs/monograph_reports/1999/MR1028.pdf ; and see also Alan Vick, *Snakes in the Eagles Nest, A History of Ground Attacks on Air Bases* (Arlington, VA: RAND Corporation, 1995), accessible online at http://www.rand.org/content/dam/rand/pubs/monograph_reports/2006/MR553.pdf.

[62] For more, see Jan Van Tol, et al., *AirSea Battle: A Point of Departure Operational Concept* (Washington D.C.: Center for Strategic and Budgetary Assessments, May 2010), pp. 56-60; and Roger Cliff, et al. *Entering the Dragon's Lair: Chinese Antiaccess Strategies and Their Implications for the*

United States (Arlington, VA: RAND Corporation, 2007), p. 107, accessible online at http://www.rand.org/content/dam/rand/pubs/monographs/2007/RAND_MG524.pdf.

[63] John Reed, "Navy Partnering Tomahawks and Small Drones as Hunter-Killers," *DefenseTech*, April 20, 2012, at http://defensetech.org/2012/04/20/navy-partnering-tomahawks-and-small-drones-as-hunter-killers/.

[64] For an example of Chinese military technical research in these areas, see Shen Guiming, et al., "Noise and concentrated false targets jamming effects analysis [噪声加密集假目标复合干扰效果分析]," *Hangtian Dianzi Duikang* [Aerospace Electronic Countermeasures], March 2012, pp. 35-37; Chen Baoquan, et al., "Space Electronic Attack Systems Combat Effects and Development Policy [空间电子攻击的体系作战效用及发展对策]," *Hangtian Dianzi Duikang* [Aerospace Electronic Countermeasures], No. 1, 2012, pp. 11-13.

[65] Interview with Japan Aerospace Exploration Agency official in Tsukuba, September 2013.

[66] Interview with MoD scientist in Tokyo, August 2013; and MoD official in Tokyo, September 2013.