

ELECTROMAGNETIC SENSING & SECURITY IN THE ASIA-PACIFIC

COMPETITION TO CONFLICT





Waiting until the first shots are fired will be too late. The Asia-Pacific's future security & prosperity may well depend on the timely deployment of RF capabilities >>

FOREWORD



The Asia-Pacific region is awash with tension. Emerging superpowers with a new set of rules are challenging the status quo with a revised vision for the region. Driven by national interests and forged by historical perspectives, competition in the region is edging towards conflict.

Incursions into territorial waters, grey zone tactics, increased militarization, border disputes, and disruptions to global trade are fueling recognition that nations must strengthen their electromagnetic security—preventing the competition from winning the fight for escalation dominance.

Competition and Conflict combines geopolitical analysis with a strategic framework. It is aimed at governments, border security agencies, and military forces seeking to implement wide-area electromagnetic sensing and signals intelligence to enhance resilience, protect sovereignty, and prevent escalation through superior situational awareness.

The special report could not have been written by anyone other than Tom Withington. An expert in electronic warfare, associate fellow at RUSI, and senior non-resident fellow at NATO Defence College, Tom's analysis makes sense of one of the most complex regions that is shaping today's global security.

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THE ASIA-PACIFIC SECURITY & MOUNTING TENSION

The human and economic security of the Asia-Pacific, and the wider world, depends on the collection and distribution of timely signals intelligence to help enhance regional security relationships.

The twenty-first century relationship between the United States and the People's Republic of China (PRC) has been characterized by tension. Although the two countries established formal diplomatic relations in 1979, Sino-US relations began to sour from 1989. Trade relations between the United States and PRC were normalized in 2000; an important first step towards China joining the World Trade Organization. In August 2010, the PRC would become the world's second largest economy. One year later, US Secretary of State Hillary Clinton announced a 'pivot' of Washington DC's foreign and security policy towards the Asia-Pacific. The move was a response to the PRC's growing regional and global power and influence. By November 2012, the PRC's new leader Xi Jinping was calling for the PRC's rejuvenation.¹

Since then, the relationship between the two countries has been hallmarked by existing tensions over Taiwan, and the PRC's maritime claims concerning the East and South China Seas. While this friction has not erupted into full-scale conflict, there is an ever-present risk that it might. Such is the Asia-Pacific's economic importance that any war between the US and PRC would be catastrophic to global finances. The populous nature of the region also risks horrific casualty levels and material damage. Ensuring that situational awareness in peacetime, as well as war, can be preserved and enhanced can have a powerful deterrent effect against conflict erupting in the first place. Situational awareness, in turn, depends on robust, survivable, affordable, distributed and networked Intelligence, Surveillance and Reconnaissance (ISR) assets. ISR capabilities can monitor, capture, detect, locate, and identify targets by exploiting the radio segment of the electromagnetic spectrum.

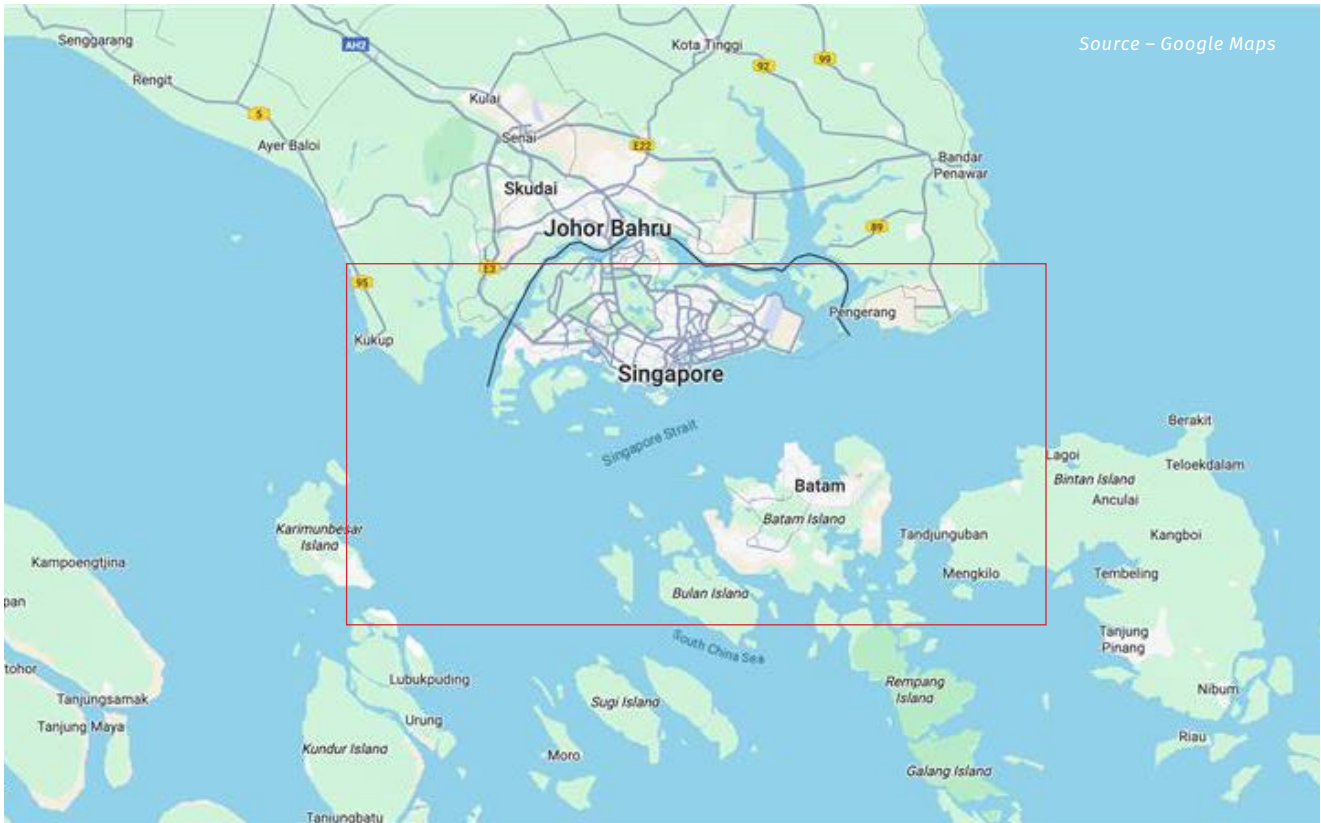
Enhancing regional ISR capabilities is vital given the pace of Chinese science and technological development in the military realm. The PRC and the People's Liberation Army (PLA) are investing in capabilities to create strategic and operational effects at range. New weapons systems are entering PLA

inventories including hypersonic missiles, and aircraft with low Radar Cross Sections (RCSs). The People's Liberation Army has taken lessons from the ongoing war in Ukraine concerning the deployment of Uninhabited Aerial Vehicles (UAVs). The potential of UAVs not only as ISR gathering assets, but also to deliver kinetic effects, is clear to the Chinese military. PRC defense science and technology modernization forms part of a wider national modernization integral to what the Chinese Communist Party (CCP) argues is the country's rejuvenation. Rejuvenation is integral to making China a leading economic and strategic power by 2049; the 100th anniversary of the proclamation of the People's Republic of China. The threatscape, as presented by PRC military technological innovation, is a cause for concern.

At the same time, there are wider security, defense, intelligence and trade questions for the US, PRC and other countries which will concentrate the minds of strategists, policymakers and the politico-military leaderships within and beyond these actors both now and in the future. For example, how can territorial waters, exclusive economic zones and international sea lines of communications be patrolled and secured over the vast maritime areas of the Asia-Pacific? How should US and allied nations manage and respond to regional security threats? These threats include both emerging and future contingencies, and existing so-called 'frozen' conflicts such as the ongoing tension between the two Koreas on the eponymous peninsula. As this report will show technology, in terms of deployed, networked and remote sensing and monitoring capabilities has a valuable role to play in helping address these challenges.

One notable security challenge is that the region lacks a formal military defensive alliance like the North Atlantic Treaty Organization (NATO). There may be regional political and financial obstacles that preclude the realization of an Asia-Pacific NATO. How then can US regional allies bolster their security in a pragmatic fashion short of developing complex supranational organizations?

Enhancing regional ISR capabilities is vital given the pace of Chinese science and technological development in the military realm >>



Map 1: Seaways around the Port of Singapore: Protecting the port of Singapore is vital for national security, economic stability, and the maintenance of a global maritime hub. Ensuring safe navigation and supply chain integrity requires systems like the Singapore Vessel Traffic Information Service (VTIS), inter-agency coordination through the Singapore Maritime Crisis Centre (SMCC), and support from the Republic of Singapore Navy and Royal Navy's British Defense Singapore Support Unit. A distributed wide area monitoring network can provide a discrete way of enhancing port security.

As noted above, one answer may be found in establishing multilateral wide area monitoring networks. These networks could be deployed to watch areas where PLA military activity has been encountered or is expected. Allied nations could host sensors on their soil to this end, or in their territorial waters. Sensors on allied ships or aircraft flying or navigating in international waters could help enrich the data collected by the monitoring network. Aircraft, ships and some missiles depend on the electromagnetic spectrum, specifically the spectrum's radio segment, for communications and navigation. These platforms and weapons also depend on radar to detect, locate, identify and track targets.

A wide area monitoring network could use Electromagnetic Support Measures (ESMs) to detect, locate, identify and track these targets via their radio signals. It is possible to derive a target's identity and intentions from their radio transmissions. RF intelligence could be shared with monitoring network participants helping to enrich their situational awareness, and the combined situational awareness of all participants.

A distributed wide area monitoring network has the asset of being potentially less expensive to procure and deploy compared to equivalent networks of radars, for example. Network procurement and operating costs could be split across participating nations. Rolling out such a network would be less politically sensitive compared to the formal activation of a regional security grouping but would enhance mutual defense and give timely early warning of potential threats.

The PRC is also working on the development and deployment of its own monitoring area networks. It realizes the importance such networks offer in terms of early warning and situational awareness. It is concerning that China is closing the technological gap with the United States vis-à-vis such capabilities. Addressing these realities is challenging, but the deployment of a regional wide area monitoring network by the US and regional allies would at least provide a nascent capability ripe for future expansion. As this report will articulate, the continued prosperity and peace this region enjoys could depend, in part, on such capabilities.

THREATS, BILATERAL EXERCISES & FREEDOM OF MOVEMENT

The Asia-Pacific region's Gross Domestic Product (GDP) has risen at breakneck speed in the last quarter century. According to Standard and Poor (S&P), the region's combined GDP was worth \$9 trillion in 2000. By 2001, APAC GDP had increased to \$35 trillion. As of 2022, the region accounted for 37 percent of global GDP.

This percentage could rise to circa 42 percent by 2040, S&P continues.² Asia-Pacific commerce relies on merchant shipping. In 2006, the region accounted for almost 66 percent of global seaborne commerce. Meanwhile, Europe's share of this commerce fell from 27 percent in 2006 to just under 16 percent by 2021. A similar pattern has been witnessed regarding United States merchant shipping which saw a reduction in share of global seaborne commerce from 20 percent in 2006 to just under 14 percent in 2021. Likewise, the Asia Pacific region is vital from a merchant shipping ownership perspective. In 2022, ten of the world's top twenty countries and territories of merchant marine vessel ownership were in the Asia-Pacific. Together, these ten nations possess over 48 percent of the world's total merchant fleet as measured in dead weight tonnage.³

The Asia-Pacific is also highly dependent on air travel. Covering 22 percent of the world's land area, stretching from China's border with Mongolia as far south as New Zealand and into the

Pacific Ocean, the region is home to 4.3 billion people; 60 percent of the world's population.⁴ The size of the region makes air travel the most practical means of moving between countries, and often within them. In 2022, air travel was responsible for 2.5 percent of the region's GDP, employing over two percent of the region's workforce.⁵ Air freight is similarly important to the region. Although dwarfed by the size of the Asia-Pacific merchant shipping trade, the regional air cargo market was worth \$117.9 billion in 2023 and is set to grow to \$225 billion by 2030.⁶ Regional e-commerce could be worth over \$4.6 trillion in 2025, increasing to \$7.4 trillion by 2030.⁷

In short, the Asia Pacific is an economically vibrant region with large and diverse populations vital to the global economy. Any major conflict erupting in this part of the world would be devastating not only to the region but potentially to the wider world. The challenge for policy makers is that, while economically vital, the region is also a strategic



Singapore – Adobe Stock



Source – Google Maps

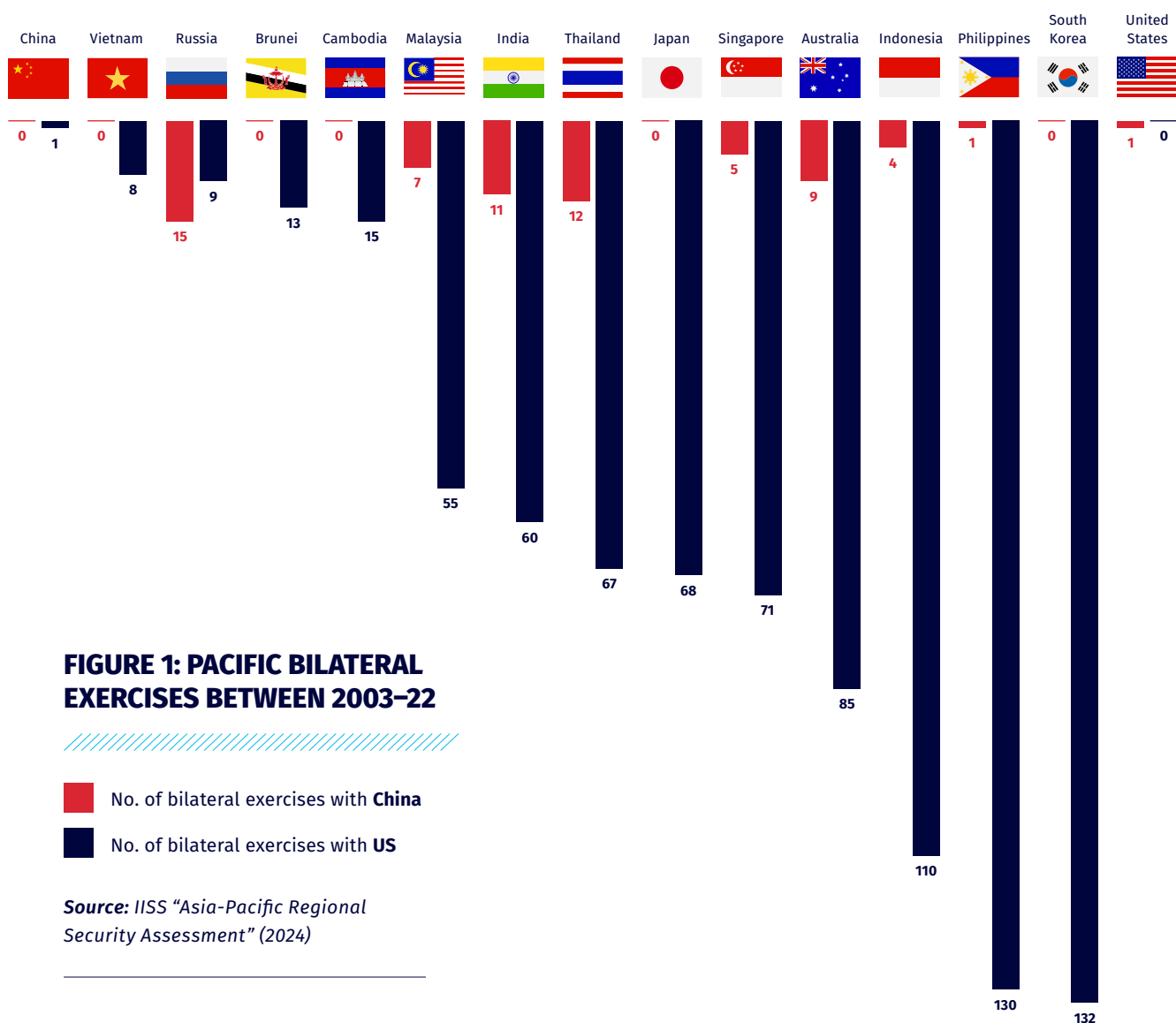
Map 2: Japanese sovereign island territories and territorial waters in the East China Sea that are subject to incursions from Chinese vessels and UAVs: Persistent, multi-domain electromagnetic spectrum surveillance (shown in red) can provide Japanese forces with early warning capabilities, pattern-of-life data, and critical SIGINT – key to active deterrence and preventing adversaries from achieving escalation dominance.

tinderbox. The geopolitical picture is dominated by Sino-US rivalry and their respective allies in the region and beyond. The issues underpinning this rivalry are legion and complex, but put simply, they focus on maritime, territorial and economic disagreements. Tensions exist between Beijing and Washington DC over the PRC's actions in the South China Sea of which Beijing claims up to 90 percent. This conflicts with other maritime claims held over this stretch of water by Brunei, Indonesia, Malaysia, Vietnam, the Philippines and Taiwan. Since 1979 the US Navy has performed Freedom of Navigation Operations (FONOPs) around the world. FONOPs have been used to assert US and international freedom to navigate through international waters. The US Navy has performed such actions in the South China Sea. These operations have contrasted with the PRC's maritime claims over this stretch of water.⁸

The PRC also claims ownership of the East China Sea, and the Senkaku Islands there, which is disputed by US ally Japan.⁹ Taiwan remains a source of tension between the United States and PRC. Beijing regards the island as part of mainland China

which must be unified, by force if necessary. Washington DC arms Taipei via the provisions of the Taiwan Relations Act (TRA). The TRA says that the US "shall maintain the capacity ... to resist any resort to force or other forms of coercion that would jeopardize the security, or social or economic system, of the people of Taiwan."¹⁰ While this clause is vague, it has been interpreted as meaning the US would provide positive security assurances to the island, in the form of military force, should the PRC invade Taiwan.

The US continues to be the most significant exercise partner for Asia-Pac countries. It engaged in 1,113 exercises with regional countries between 2003 and 2022, compared to PRC's 130 in the same period. Whilst not all combined military exercises are created equal, combined military exercises are a cornerstone of the Asia-Pacific security order. How and why countries cooperate with each other can also affect their ability to respond to a range of security challenges, contingencies and shape regional security. Interoperability requires joint warfare as well as combined naval and air ISR and combat operations.



Between 2003 and 2022, the US has focused its cooperation efforts on nine security challenges (alongside South Korea, Philippines, Indonesia, Australia, Singapore, Japan, Thailand, India and Malaysia) – mainly joint warfare and naval exercises. It has maintained its position as the primary military exercise leader to meet Asia-Pacific alliance needs, to underline its commitment to regional stability, to deter adversaries, and practice interoperability for any future US war effort.

The maintenance of combined military exercises is a way for nations to maintain influence, freedom of movement and institutionalize defense partnerships. It paves the way for broader defense, military and technology transfer, as well as support for tightly managed ground operations, peacekeeping, counter-terrorism, humanitarian assistance, infrastructure protection and disaster relief.

Beyond geostrategic issues, other areas of tension exist between the United States and the PRC. The former maintains a trade deficit with the latter: US exports to the PRC were worth \$143.5 billion in 2024 whereas imports of goods from the PRC to the US were worth \$438.9 billion.¹¹ The disquiet of the administration of US President Donald Trump regarding this deficit prompted the imposition of tariffs on a host of goods that the PRC is exporting to the United States. Beijing responded with tariffs on US imports.¹² As of mid-October 2025, it would be fair to say that the PRC and United States are positioned for a security conflict beyond a pure trade war. Additional points of friction exist between both countries. The US accuses Beijing of failing to meet international obligations to combat human trafficking. Likewise, Washington DC claims that China is a major source of precursor chemicals for illegal narcotics like fentanyl.¹³ The United States is experiencing large-scale fentanyl addiction in its population.

For now, the geostrategic competition underlined by the points of friction discussed above, remain areas of tension which have not, so far, erupted into war. Nonetheless, the risk of armed conflict between these two countries cannot be discounted. Should tensions between the US and China erupt into hostilities, it is likely that the war will primarily be fought at sea and in the air. This would immediately hold at risk the sea lines of communications and air corridors Asia-Pacific commerce depends on. Likewise, attacks against undersea infrastructure like communications cables could have serious adverse effects on regional e-commerce.

There would be little point in the US trying to invade and occupy parts of the PRC and vice versa. The huge distances that such operations would require make such land invasions all but impossible. Nonetheless, the PRC may decide to attempt an invasion of Taiwan, or of US allies in the region such as Japan or the Republic of Korea (ROK). US territories like Guam in the Pacific Ocean could be attacked by the PRC, particularly by Chinese intercontinental ballistic missiles. Ballistic missiles may also be used to attack regional US allies. Beijing would seek to blunt the power of US Navy Carrier Battle Groups (CBGs). The US military would attack People's Liberation

Army Navy surface action groups. Chinese and US military bases throughout the region can be expected to experience air attacks using conventional means, or ballistic missiles and/or UAVs. Both the offensive and defensive aspects of any conflict would demand robust, survivable, distributed and networked sensor assets to support ISR tasks. The need for such ISR assets is underpinned by the scope and pace of Chinese military technological innovation. ISR assets have an important deterrent effect: Being able to determine an adversary's intentions can be a powerful disincentive to the adversary performing hostile action.



Map 3: The Philippine archipelago: There have been an increased number of Chinese incursions into internationally recognized Filipino territory, the Spratly Islands, Chinese-claimed islands in the South China Sea. Conducting persistent, wide-area electromagnetic sensing using fixed sensors complimented by easily deployable UAVs and USVs acting as an early warning system, providing an active deterrent and vital intelligence.

THE TECHNOLOGICAL ARMS RACE



The key operational and strategic threats facing the US presence in the Asia-Pacific, and allied forces, are conventional air and ballistic missile attack, UAV deployments and PRC naval activity.

The PLA places a high premium on precision strikes. PLA doctrine correctly determines that hitting the key Centres of Gravity (COGs) of US and allied forces at an early stage in any conflict would be vital to degrading not only the ability to use kinetic force against the Chinese military, but to degrade enemy Command and Control (C2).¹⁴

Chinese investment is flowing into kinetic capabilities that could hold COGs at risk. The US Department of Defense's (DOD) annual Military and Security Developments involving the People's Republic of China publication makes clear the areas where China is prioritizing research and development. For example, the PRC is working hard to develop hypersonic conventional and nuclear armed missiles. Hypersonic weapons can typically achieve velocities exceeding 3,333 knots (6,174 kilometers-per-hour). The rapid speed of such weapons can greatly reduce early warning times. The DOD report stated that China's YJ-21 hypersonic anti-ship ballistic missile is already thought to be in service with the PLAN equipping the 'Type-55/ Renhai' class cruiser.¹⁵

In the air domain, the PRC is finally replacing its ageing Xi'an H-6 series strategic bombers with a new aircraft using a design optimized with a low Radar Cross Section (RCS). The AVIC H-20 strategic bomber employs a stealthy flying wing design to this end. In any future conflict, it is likely to be escorted by the J-20 fifth-generation fighters with similar low RCS characteristics. Both the People's Liberation Army Air Force (PLAAF) and PLAN will also receive Shenyang J-35 fifth-generation fighters. The latter will deploy them from its aircraft carriers in the next five years.¹⁶

In common with other countries around the world, the PRC is investing in UAV technology for both civilian and military applications.¹⁷ The Ukraine theatre of operations has underscored the threat posed by UAVs both as ISR-gathering platforms and to deliver kinetic effect. UAVs can be challenging to detect using conventional radar given the small physical size

of some aircraft and their largely non-metallic construction. Both these factors conspire to give many UAVs low RCSs with some radars discounting these aircraft as spurious targets. There are tactics discussed in more detail below, that can be used to detect, locate, track and identify UAVs. Of particular concern is the commanding position that specialist UAV companies in China have as regards commercial uninhabited aircraft. These may be easier, and less conspicuous, to export compared to their military counterparts. Nonetheless, as the war in Ukraine has illustrated, commercial and hobby UAVs can

be retrofitted for military applications with comparative ease. UAV deployments can have operational and/or strategic consequences. An uninhabited aerial vehicle deployed from a warship could be used to reconnoitre a beach in preparation for a future amphibious landing. The war in Ukraine is also illustrating that long-range UAV attacks can have a strategic impact. Ukrainian

forces have used uninhabited aircraft to this end to attack targets in Russia.¹⁸

Taken together, Chinese innovation in these areas is a cause for concern among US and regional powers. Equally worrying is the technological direction of travel. As noted below, the US maintains a technological edge on the PRC in some areas, notably the wide area remote monitoring technologies that are the focus of this report. Nevertheless, Chinese military science and technology research and development is moving at pace. Innovation in this regard has the risk that China could equal, if not better, US efforts regarding these technologies in the future. Interestingly, PRC military modernization dovetails with the wider CCP goal of national rejuvenation. Central to this goal is the embrace of innovation writ large for the country, particularly in advance of the centennial of the PRC proclamation of 1949.¹⁹ This helps explain why the military/civilian dual use trajectory for scientific and technological development in China is so important to the country: Military and civilian technological development is, in essence, seen as by the CCP leadership as two sides of the same coin.

The Ukraine theatre of operations has underscored the threat posed by UAVs both as ISR-gathering platforms and to deliver kinetic effect >>



Malacca Strait – Adobe Stock

SPECTRUM ALLIES – EXPLOITING THE RADIO SPECTRUM FOR COOPERATIVE SENSING & EARLY WARNING



A major problem for the US and its allies in the Asia-Pacific is that the region has no NATO equivalent. The South East Asia Treaty Organisation, better known as SEATO, was founded in 1955 and disbanded 22 years later.

Intended as a collective security pact to counter Communist expansion in southeast Asia, SEATO comprised Australia, France, New Zealand, Pakistan, the Philippines, Thailand, the United Kingdom and the United States. Today, the Asia-Pacific has a patchwork of multilateral organizations such as the Quadrilateral Security Dialogue, also known as the Quad, and AUKUS (Australia, United Kingdom and United States). The Quad includes Australia, India, Japan and the US and, like AUKUS, is focused on countering the rise of Chinese regional strategic and economic power.

Beyond these groupings, the US maintains strong strategic relationships with Japan and the ROK, deploying military assets to both countries. Meanwhile, Washington DC is deepening its strategic relationship with Manila.²⁰ US bilateral relations with Australia, India, Japan, New Zealand, the ROK and the Philippines arguably constitute the strongest such partnerships America has in the Asia-Pacific region vis-à-vis the PRC. Alongside the Philippines, the US is deepening its security relationship with Vietnam.²¹ It would not be unreasonable to suggest that Vietnam and the Philippines might enjoy the depth of

security relationship that the US maintains with Australia et al in the coming years. Several nations in the region work to maintain good relations with both the US and the PRC, such as Bangladesh, Malaysia, Singapore and Thailand. Finally, nations like the Burma and the DPRK can be considered PRC allies.

This patchwork of bilateral and multilateral regional relationships creates challenges for the US and regional allies. Developing a regional equivalent of NATO may well be impossible for this reason given the spectrum of relations vis-à-vis the PRC. One geopolitical option could be to develop a regional, multilateral 'SEATO Redux'. This may be easier said than done as Beijing would almost certainly criticize such a move and could employ regional economic clout to make nations think twice about joining any alliance. China would almost certainly object to any regional grouping that included NATO Article 5-style provisions. The Atlantic Charter formed NATO in April 1949. Article 5 famously states that; "if a NATO ally is the victim of an armed attack, each and every other member of the alliance will consider this act of violence as an armed attack against all members and will take the actions it deems necessary to assist the ally attacked."²² One

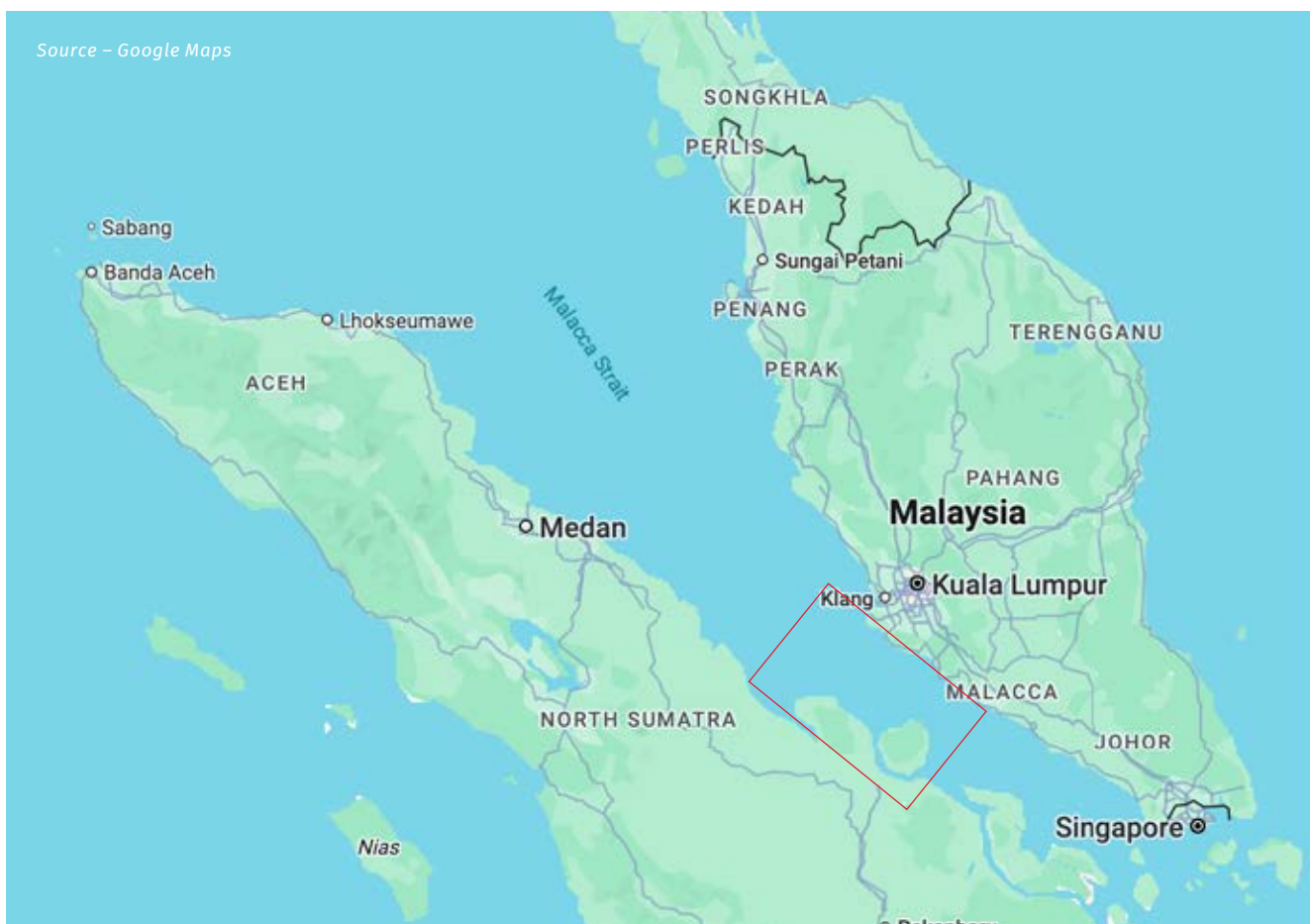
alternative to a new regional alliance is to ensure that nations are apprised of any PRC military activity that could constitute a threat. Developing such provisions would, at the least, give a material underpinning to the military adage that 'forewarned is forearmed'.

The Asia-Pacific covers a vast area: The PRC's coastline is around 14,500 kilometers (nine thousand miles) long. The East China Sea occupies an area of 219,248 square nautical miles (752,000 square kilometers), with the South China Sea being around one million square nautical miles (3.5 million square nautical miles) in size. Clearly, PLA threats in terms of conventional air and ballistic missile attack, UAV strikes and naval actions can emerge across a huge area. Thus, for the US and regional allies, the early detection, identification and tracking of such threats is paramount. A key mechanism to ensure the early warning of potential threats is to use wide area monitoring networks.

The wide-area monitoring networked approach focuses on the deployment of sensors to cover a large geographical area. These sensors can be attributable in that the accidental, or deliberate, disabling or destruction of one sensor will only

cause a slight degradation in overall sensor coverage, as opposed to the outright collapse of the entire system. Sensors will need to be securely networked to share their data with those who need it. Networking should be achieved using a combination of conventional radio, satellite and fiber optic links. Ideally, each sensor should be networked using more than one of these links. Networking the sensors in this fashion provides redundancy: Should the physical fiber optic link become damaged or unavailable the conventional radio and/or Satellite Communications (SATCOM) links can be used instead. If the radio links or SATCOM is jammed through electronic warfare, fiber optic cables are available.

Information saturation is a potential problem for deployed wide area sensors: The Strait of Malacca which connects the South China Sea to the Indian Ocean is one of the world's busiest waterways. Over 300 large merchant vessels alone pass through the strait every day.²³ How to tell whether one, or several, of these ships is in fact a PLAN surface combatant heading out to the Indian Ocean? Likewise, how is it possible to ascertain whether any of the thousands of aircraft flying daily in the region belong to the PLA?



Map 4: **Malacca Strait:** The Malacca Strait is one of the world's most important shipping lanes. As such, the area is an ideal location for a multi-national, distributed wide-area sensor network to identify the origin of transiting vessels. Effective covering of territorial and international waters would require the cooperation of Singapore, Malaysia, and Indonesia.

The sensors equipping a wide area monitoring network will need to have the computing hardware and software to interrogate the data they collect to determine whether they have spotted a potential target. For example, merchant ships on innocent passage routinely share details of their identity and voyage across the International Maritime Organization-mandated Automatic Identification System (AIS). Information is shared by these vessels using conventional radio and SATCOM links. AIS information can be easily viewed by the public on websites such as marinetraffic.com along with the vessel's location. Aircraft share similar information via their Secondary Surveillance Radar (SSR) transponders. Websites like flightradar24.com serve a similar purpose to the air domain as marinetraffic.com. A sensor which detects a target resembling an aircraft or ship which is transmitting false AIS or SSR data should be an immediate cause for concern. Artificial intelligence-enabled software equipping the sensor could be 'trained' to notice something suspicious. This information regarding the target could then be shared with the sensor network's users for further investigation.

Exploiting the radio segment of the electromagnetic spectrum offers significant potential in terms of wide area monitoring. Ships and aircraft all rely on radio transmissions. The AIS and SSR signals they transmit use conventional radio signals and SATCOM, the latter of which also exploits radio. Radio is used by ships and aircraft for voice and data communications. Radar is essential for maritime and air navigation. Militarily, radar is vital for detecting targets and for guiding weapons like surface-to-surface and air-to-surface missiles. Wide area monitoring networks equipped with radio-signal sensing ESMs can derive much information about the target they have detected from the target's radio transmissions alone.

For example, the International Telecommunications Union (ITU), the United Nations organization which regulates the global use of the radio spectrum, reserves X-band (8.5 gigahertz/GHz to 10.68GHz) radar frequencies for vessel navigation, meteorology, air traffic control and for military fire control radars, including those used by combat aircraft. Suppose an ESM determines it has detected an X-band radar signal. Further investigation by the ESM through triangulation, for instance, determines that this signal is coming from a target moving at 500 knots (929 kilometres-per-hour). The ESM's software may determine it has detected a radar signal from a fighter aircraft or a subsonic anti-ship missile. The ESM could cross-correlate this information with SSR monitoring software. If the target is not 'squawking' an SSR signal, it may indicate that it is a military target. Fighter aircraft using their radar to spot a target and guide a weapon towards it are unlikely to share details of their identity via SSR transmissions.

Moreover, air threats can be detected from some considerable distance. The X-band radar signal from a combat aircraft flying at 40,000 feet (12,192 meters) could potentially be detected by an ESM at sea level at a range of circa 243 nautical miles (450km). Similarly, signals from the active radar homing seekers used by hypersonic missiles to guide towards their targets could betray the presence of such weapons. UAVs, meanwhile, can depend on radio frequency links to connect the aircraft to their pilots. Very/

Ultra High Frequency links spanning a waveband of 30 megahertz to three gigahertz tend to be used for UAV control. ESMs would be able to detect certain transmissions and to use their processing to ascertain whether these signals are likely to be going from, or to, a UAV and thus warn of the presence of these aircraft.

Wide area monitoring networks using radio-sensing ESMs have the asset of being passive. The moment a radio signal is transmitted, the source of that transmission is potentially detectable. Sensing technologies like radar have their uses, but this too can be detected. Once a radar is detected it can be avoided by a ship or aircraft that wants to avoid being tracked, or worse, jammed using EW or destroyed kinetically. Moreover, illuminating a warship or combat aircraft with radar could be interpreted as a hostile act. For all intents and purposes, a PLA fighter plane flying in international airspace above the East or South China Seas cannot determine whether it has been detected by networked ESMs and is being tracked. Another important consideration is cost. A military-grade ground-based air surveillance radar may have an average procurement price of \$29 million.²⁴ An unattended networked ESM, together with its accompanying antennas, can easily cost under \$2-3 million.²⁵

US and allied nations could agree to pool their financial resources to develop and deploy such a wide area monitoring network. The requisite sensors could be deployed on their territories and in their territorial waters. The data these sensors collect could be shared to provide early warning of potential threats and to inform decision-making. Such a course of action would represent a relatively low cost means of enhancing regional surveillance. It would stop short of a formal security alliance but would at least provide an improvement in multilateral threat detection.

A residual benefit is that regional participants would receive a means of enhancing their signals intelligence collection capabilities: Navies and air forces need Electronic Intelligence (ELINT) concerning radars. By collecting ELINT militaries can determine the characteristics of particular systems. By determining radar characteristics, ELINT experts can identify a platform based on these radar signals: The PLA's 'Type-55/Renhai' class cruiser uses the Type-346B S-band (2.3GHz to 2.5GHz/2.7GHz to 3.7GHz) naval surveillance radar. Should an ESM detect signals matching a Type-346B radar, there is a likelihood that one of these cruisers may be in range of the sensor. Assuming the ESM's assessment is correct, the accompanying ELINT data can be stored or interrogated further to learn more about the radar: Is the Type-346B transmitting a waveform not previously encountered? Has the radar's signal been detected beyond what was previously considered this radar's maximum instrumented range? This useful electronic intelligence could be shared amongst the wide area monitoring network's participants, helping enrich local ELINT threat libraries. At a stroke, the situational awareness of all the participants is enhanced, both in terms of current and future threats.

ABOUT THE AUTHOR



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