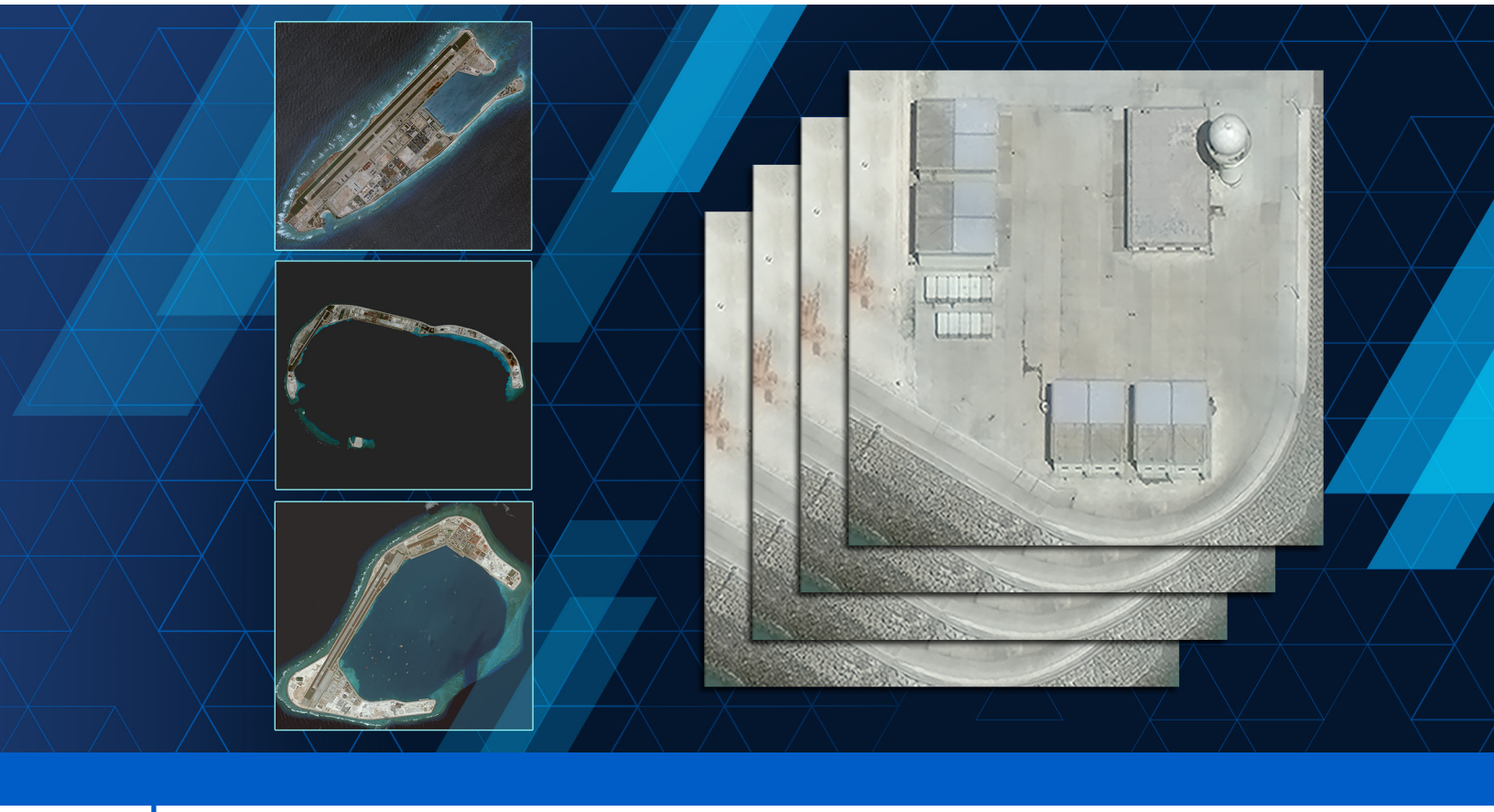
SOUTH CHINA SEA MILITARY CAPABILITY SERIES

A Survey of Technologies and Capabilities on China's Military Outposts in the South China Sea



OFFENSIVE AND DEFENSIVE STRIKE

J. Michael Dahm

JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

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Introduction

This military capability (MILCAP) study focuses on offensive and defensive strike capabilities associated with seven Chinese island-reef outposts in the South China Sea (SCS). The SCS MILCAP studies provide a survey of military technologies and systems on Chinese-claimed island-reefs in the Spratly Islands, approximately 1,300 kilometers (700 nautical miles) south of Hong Kong (see Figure 1). These Chinese outposts have become significant People's Liberation Army (PLA) bases that will enhance future Chinese military operations in the SCS, an area where Beijing has disputed territorial claims (see Appendix B). The SCS MILCAP series highlights a PLA informationized warfare strategy to gain and maintain information control in a military conflict.

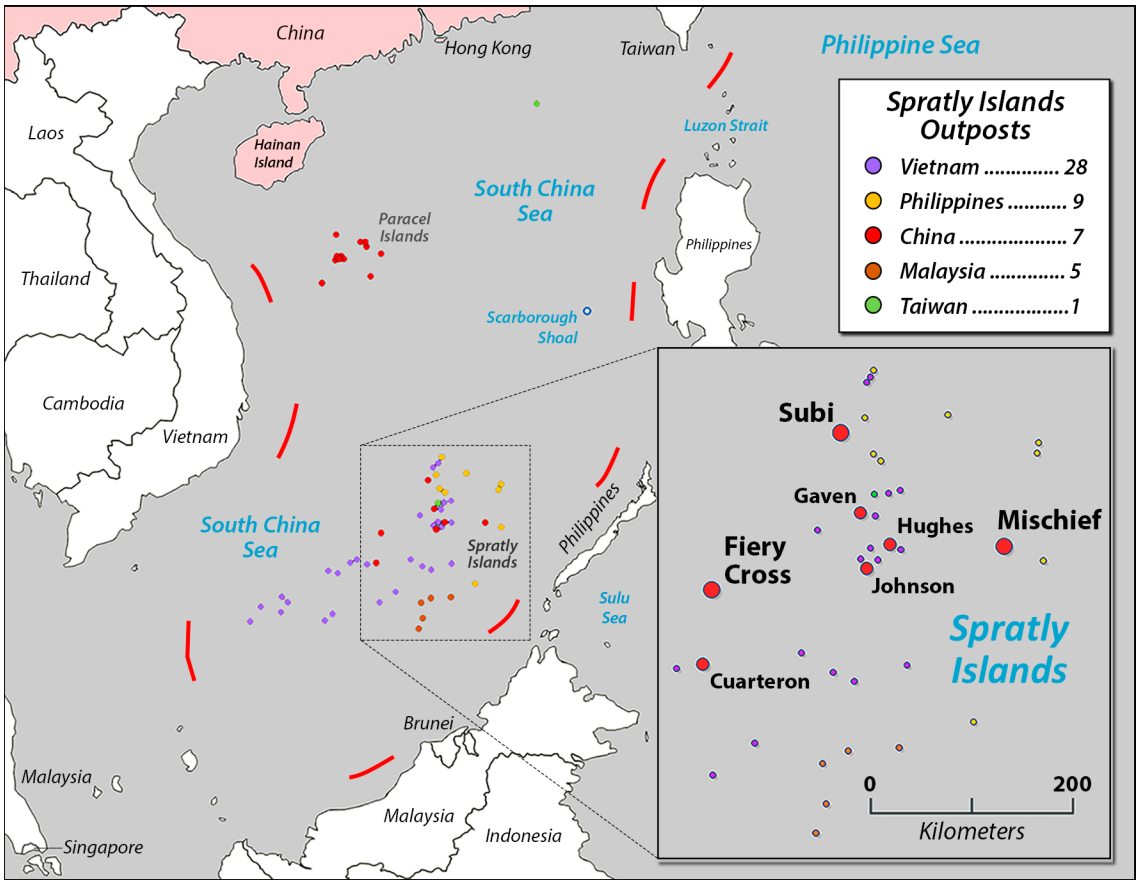


Figure 1. SCS Occupied Features

This publication serves as a capstone study, placing other SCS MILCAP studies that focused on information-related capabilities into military-operational context. The extensive PLA information power capabilities described in other publications in this series define the limits of air and sea control as well as weapons employment ranges

that might radiate from the island-reefs. The United States and other regional actors opposed the weaponization of China's SCS outposts, viewing the deployment of lethal capabilities as destabilizing. However, even in the absence of a large-scale deployment of PLA weapons, the island-reefs have already been weaponized with significant information capabilities—command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR). When and if there is a large-scale deployment of weapons to the Chinese outposts, necessary conditions will have been established in the information domain. The island-reefs are equipped to provide the PLA with superior battlespace awareness and a decided information advantage in any future military conflict in the SCS. Overview graphics of all capabilities noted on major outposts appear in Appendix C.

Offensive and defensive strike capabilities on the island-reefs may best be described as "modular." Infrastructure on the PLA outposts was built to accommodate close-in-weapons systems (CIWS), surface-to-air missiles (SAMs), surface-to-surface missiles (SSMs), large aircraft, fighter-sized aircraft, and helicopters. A vast majority of PLA weapons systems are road-mobile or relocatable. The major island-reefs—Fiery Cross, Subi, and Mischief Reefs—are large enough to accommodate virtually any mobile weapons system or aircraft in the PLA inventory. Delivered by ship or aircraft, future deployments of offensive or defensive lethal capabilities to the SCS island-reefs could occur with little or no warning.

This study examines Chinese island-reef infrastructure that may support the deployment of weapons systems and combat aircraft. Likely systems and aircraft that may operate from the island-reefs and the missions they may undertake are described. This study concludes by considering how the Chinese outposts' capabilities may contribute to PLA campaign requirements for operations in the SCS, specifically a campaign to seize foreign-held island-reefs in the Spratly archipelago. It also examines how PLA SCS capabilities may be arrayed against third-party (e.g., U.S.) intervention in the conflict. This study does not offer a net assessment of PLA versus U.S. military capabilities. It demonstrates underlying informationized warfare operating concepts and the challenges that China's information-centric strategy may pose for the United States and regional military actors.

Island-Reef Strike Capabilities

The PLA has a diverse array of weapon systems that could be deployed to its SCS outposts. An examination of the infrastructure on the SCS outposts indicates that they are prepared to immediately accept and support the deployment of a variety of weapons systems, including ground-based missiles and combat aircraft.

Speculation about the deployment of weapons to China's SCS outposts received the vast majority of media coverage after land-reclamation began in the Spratly Islands in 2014. Since then, Western press featured reports on routine deployments of fighter aircraft and weapons systems on Woody Island in the northern SCS Paracel archipelago. In the Spratly Islands, HQ-9 SAMs and YJ-12 anti-ship cruise missiles (ASCMs) were deployed to the Fiery Cross, Subi, and Mischief Reefs in 2018, according to Western media citing U.S. Department of Defense sources.[1] More recently, in 2020, special mission aircraft, such as the KJ-500 airborne early warning and control (AEW&C) aircraft and KQ-200 anti-submarine warfare (ASW) aircraft, deployed to the SCS island-reefs. As of early 2021, however, fighter-sized combat aircraft had not been observed on any of the SCS outposts.

The size of China's artificial island-reefs in the SCS—over 12 square kilometers of reclaimed land—means that the PLA could deploy practically any weapon system to its largest Chinese outposts. Because China places such a premium on mobility and survivability in its force, most PLA weapons, electronic warfare (EW) equipment, and C4ISR systems are road-mobile or at least relocatable. Weapons ranging from cruise missiles to air defense systems to ballistic missiles are deployable on mobile transporter-erector-launchers (TELs) that can set up, fire, and relocate, sometimes within minutes. Setting aside geopolitical sensitivities that might preclude Beijing from placing certain strategic weapons in the SCS, there is no physical or practical limitation on the types of weapon systems that may be deployed to China's SCS outposts.

In addition to facilities that could host virtually any ground-based weapon system, airfields on the major island-reefs can accommodate any aircraft in the current PLA Air Force (PLAAF), PLA Navy Air Force (PLANAF) or PLA Army (PLAA) inventories, as well as any future heavy-lift aircraft or bombers. The outposts' naval facilities appear to have quays sufficient to berth, resupply, and rearm most ships in the PLA Navy (PLAN) or Chinese Coast Guard. Deep draft ships, such as aircraft carriers, however, probably cannot enter the relatively shallow island-reef lagoons.

This case study cannot practically examine every PLA weapon system that could deploy to the island-reefs. A number of key long-range weapon systems are worthy of consideration as they relate to the Chinese informationized warfare strategy. These include SAMs, ASCMs, anti-ship ballistic missiles (ASBMs), and artillery, as well as

[1] Amanda Macias, "China Quietly Installed Missile Systems on Strategic Spratly Islands in Hotly Contested South China Sea," *CNBC*, May 2, 2018, updated April 5, 2019, https://www.cnbc.com/2018/05/02/china-added-missile-systems-on-spratly-islands-in-south-china-sea.html.

strike-fighter aircraft armed with long-range air-to-air missiles (AAMs), air-launched ASCMs, or land-attack cruise missiles (LACMs).

The broad range of PLA weapons systems that might be deployed to the island-reefs incorporate both passive and active targeting as well as different missile flight profiles and propulsion technologies, lending themselves to attack geometries that significantly challenge the defenses of any would-be adversary. There appears to be widespread acknowledgment among U.S. military leaders that the range of many PLA weapon systems is increasing, often beyond the range of similar weapon systems operated by the United States. Capabilities and ranges of Chinese platforms and weapons provided in this study are based on publically available sources, which are sufficient to demonstrate the dependencies of these long-range systems on the information power capabilities generated by and through China's SCS outposts.

Ground-Based Air Defense

SAM Infrastructure. Fiery Cross, Subi, and Mischief Reefs each have facilities that probably house a typical PLAAF or PLAN SAM battalion, consisting of eight TELs and associated radar and support vehicles (see Figure 2). Each SAM TEL building (20 × 22 meters, 66 × 72 feet) has two drive-in bays. The buildings have retractable roofs that allow a TEL for a vertically launched weapon, such as the HQ-9 long-range SAM or the HQ-16 medium-range SAM, to drive into the garage and elevate its missile tubes inside. These garages obscure the presence and operational status of PLA SAM systems (see Figure 3). A SAM-associated radar appears to be co-located in an tower at the SAM facility that also thwarts reconnaissance that might indicate SAM battalion readiness or intent to employ these missiles (see Figure 4). Surface-to-surface missile (SSM) TEL garages are co-located with SAM facilities on the Fiery Cross and Mischief Reefs. For more information on SSM facilities, see the section in this study titled, "Anti-Surface Warfare."

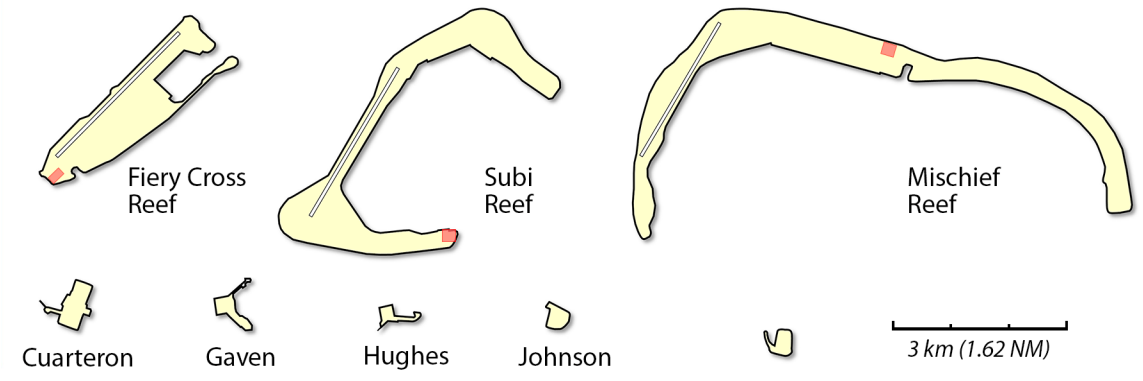


Figure 2. Locations of SAM Facilities

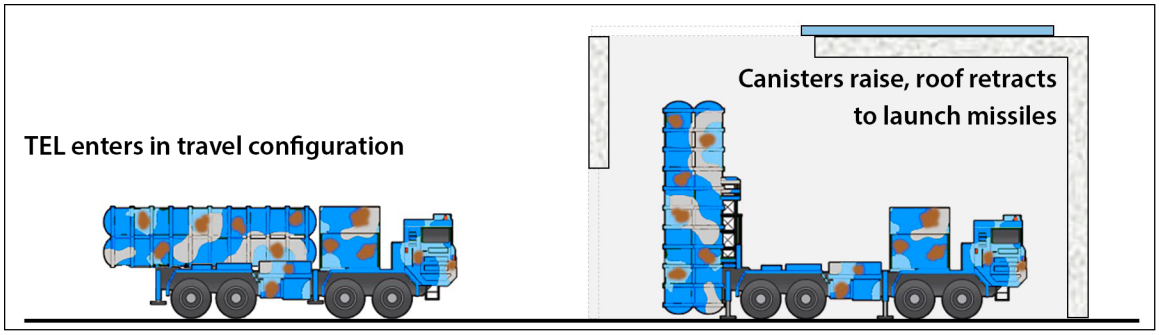
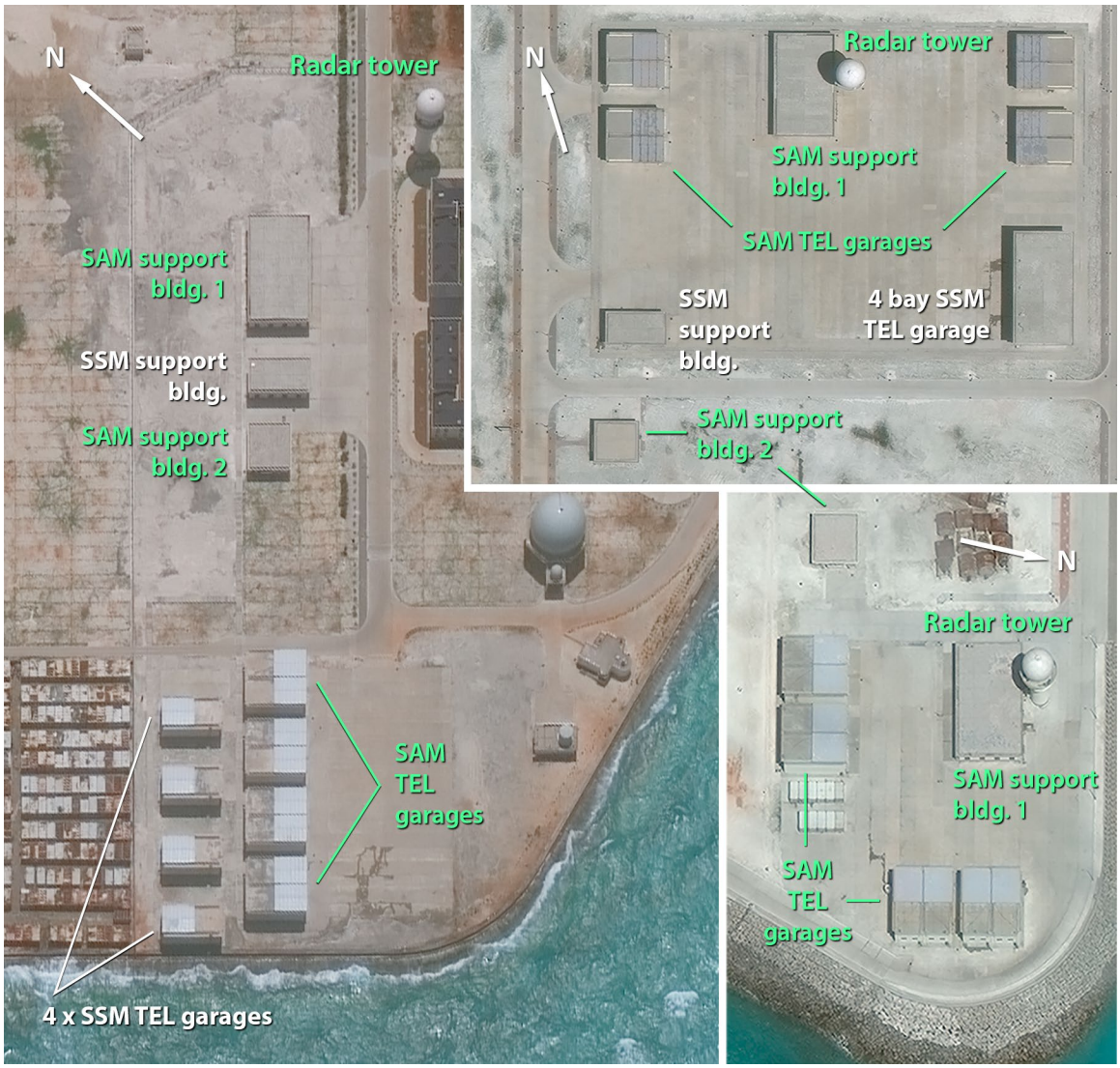


Figure 3. SAM TEL Garage Cut-Away



(Images © 2021 Maxar/DigitalGlobe, Inc.)

Figure 4. SAM Facilities on Fiery Cross (Left), Mischief (Upper Right), and Subi Reefs (Lower Right)

Long-Range Air Defense Systems. HQ-9B SAMs were deployed to the major island reefs in 2018, according to media reports. The HQ-9B (红旗-9B) is the newest fielded variant in the PLA's HQ-9 SAM series. This road-mobile Chinese SAM system, with four missile canisters per TEL, is based on the Russian S-300 (SA-20) SAM system. The HQ-9B missile reportedly integrates a passive infrared seeker with the HQ-9's semi-active radar homing. The ship-based variant of this SAM, the HHQ-9 (海红旗-9B), is believed to have been fielded onboard newer classes of PLAN's guided-missile destroyers (DDGs) and Type-055 guided-missile cruisers (CGs). While earlier versions of this missile system advertised a maximum range of 200 kilometers (108 nautical miles), the HQ-9B reportedly boasts a range of up to 300 kilometers (162 nautical miles) (see Figure 5).[2]

(JHU/APL Photo)

Figure 5. HQ-9 Missile TEL

[2] Numerous Western sources reported the maximum range of the HQ-9B SAM as 160 nautical miles (and the YJ-12 ASCM as 270–295 nautical miles). See, for example, US-China Economic and Security Review Commission, 2018 Report to Congress (Washington, DC: US GPO, 2018), 171 (footnote). Effective ranges for the HQ-9 and HHQ-9 may fall in the 200- to 250-kilometer (108- to 135-nautical-mile) range. See also, for example, Liu Le, "建军 90 周年阅兵武器装备亮点评析" [Comments on the PLA 90th Anniversary Military Parade], *兵器知识 [Ordnance Knowledge]*, October 2017, 21–22.

Medium-Range Air Defense. In addition to long-range SAMs, the PLA would likely deploy a shorter range system, such as the HQ-16 (红旗-16), to the island-reefs. The HQ-16 is supposedly based on the Russian Buk (SA-11) missile. Like the HQ-9, the HQ-16 is road-mobile and raises its TEL vertically to launch missiles from its six missile canisters. The HQ-16 provides area air defense for critical assets and is optimized to intercept aircraft, unmanned aerial vehicles (UAVs), low-flying cruise missiles, and air-to-ground weapons with a maximum range of 40 kilometers (21.6 nautical miles). Deployments of the HQ-16 or another medium-range air defense system to the SCS have not been confirmed, but such a deployment is likely given the operational requirement for low-altitude area defense of the island-reef bases.

Short-Range Defenses. Over thirty observation posts and gun mounts provide visual surveillance and close-in defenses for China's SCS outposts (see Figure 6). Identical "large-type" and "small-type" posts are shown in Figure 7. These defensive outposts are probably manned by sentries and equipped with surface search radar, probable fire control radar for the gun mounts, and long-range electro-optic and infrared cameras.

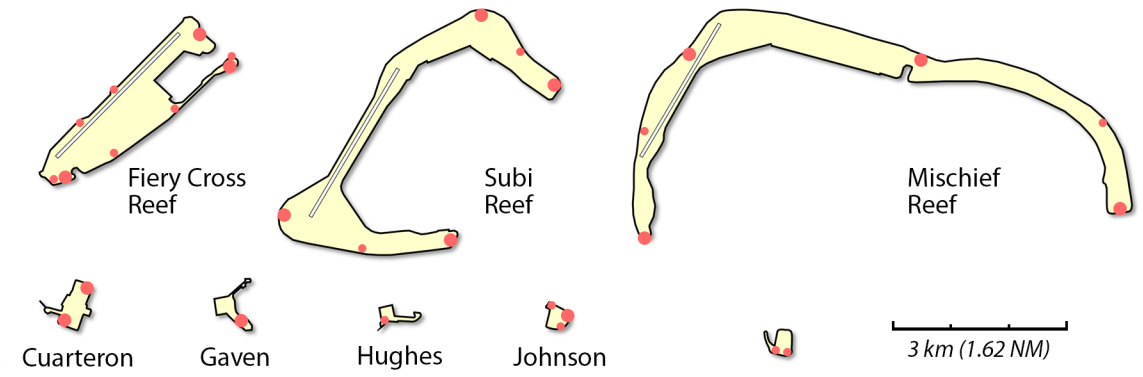


Figure 6. Locations of Visual Observation Posts and Gun Mounts

Together, the observation posts with their sensors and weapons provide 360-degree protection of each Chinese outpost against incursions by surface craft and low-flying targets, such as cruise missiles or helicopters. The large-type observation posts are topped with small radomes, one of which was missing from a Fiery Cross observation post in commercial satellite imagery. The mount is topped with what appears to be a surface search/navigation-type radar that probably feeds an integrated low-altitude and surface surveillance picture for each island-reef. The large-caliber gun mounts clearly visible on the large-type observation posts are probably supplemented by a CIWS, such as the LD2000 radar-directed Gatling gun (see Figure 7). The LD2000 is a land-based variant of the PLAN ship-mounted Type-730 CIWS.

(Images © 2021 Maxar/DigitalGlobe, Inc.)

Figure 7. Large-Type Observation Post and Gun Mount on Fiery Cross Reef (Top Left), Small-Type Observation Post and Gun Mount on Mischief Reef (Top Right), and LD2000 CIWS (Left)

(JHU/APL Photo)

Counter-Infiltration. The observation posts may also house an anti-diver defense system. In 2017, Chinese authorities announced that the PLA installed the Norinco CS-AR1 55-millimeter anti-frogman rocket launcher on Fiery Cross Reef, purportedly to defend against Vietnamese commandos (see Figure 8).[3] To cue this underwater defense system that salvos grenade-sized depth charges, the island-reefs may incorporate physical barriers, a hydroacoustic array, or a high-frequency sonar for close-in detection of divers or underwater vehicles.

(JHU/APL Photo)

Figure 8. CS-AR1 55-millimeter Anti-Frogman Rocket Launcher

[3] Philip Wen, "China Installs Rocket Launcher on Disputed South China Sea Island: Report," *Reuters*, May 17, 2017, https://www.reuters.com/article/us-southchinasea-china-idUSKCN18D0ER.

Air Defense and Strike Aircraft

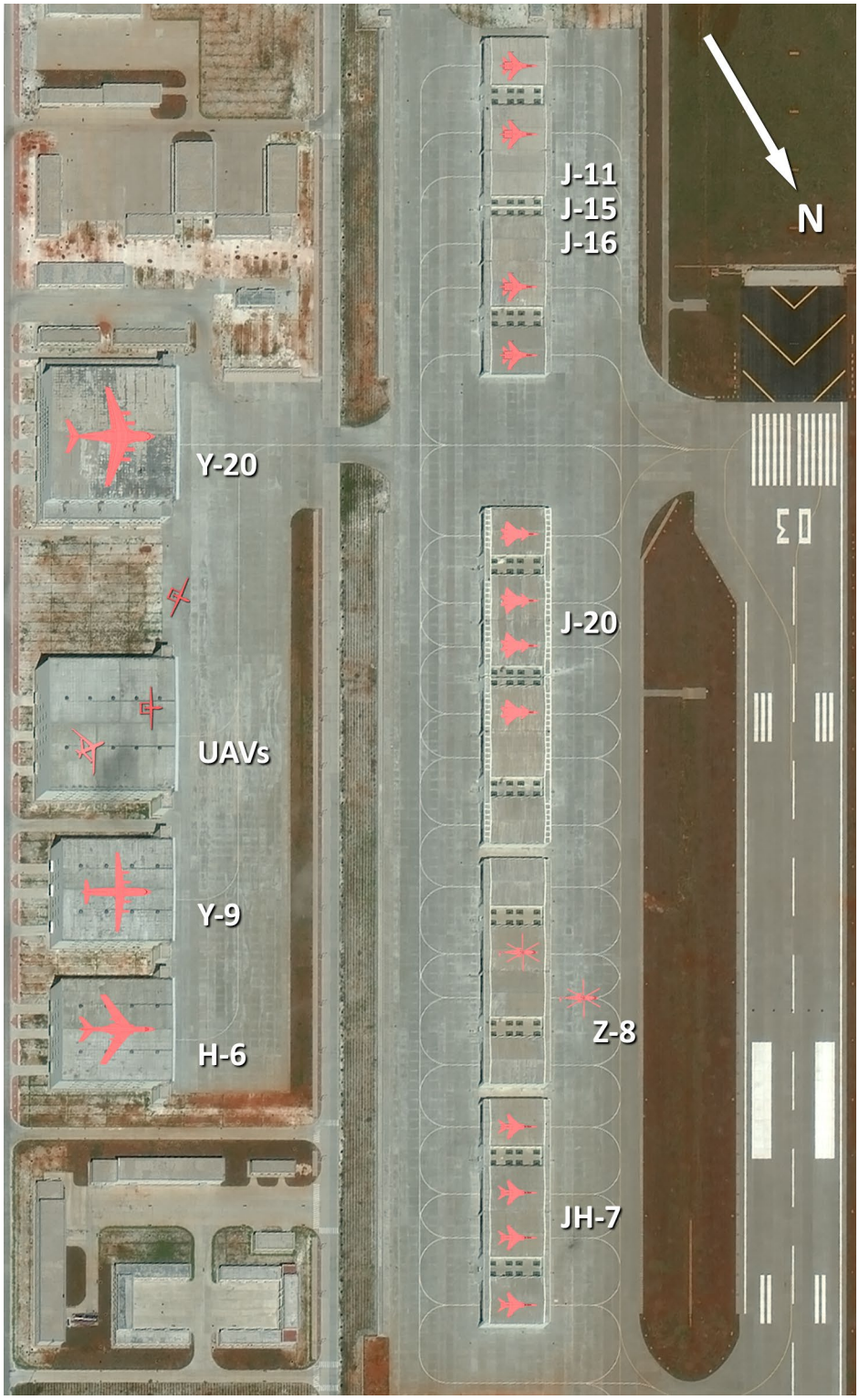
Airfield Infrastructure. Runways on China's three largest island-reefs can accommodate virtually any Chinese aircraft, including PLAAF or PLANAF H-6 bombers. Fiery Cross Reef and Subi Reef have 3,000-meter (~10,000-foot) runways, while Mischief Reef has a 2,700-meter (~9,000-foot) runway.

Bomber deployments to the outposts cannot be ruled out; however, as a practical matter, such long-range aircraft with heavy weapons loads would probably be sortied from bases on China's Hainan Island or the mainland. As a matter of geopolitical influence, bomber deployments to the island-reefs may be used to send a strong message to would-be adversaries. A practical limitation on large numbers of bombers deploying to the SCS is simply the lack of large aircraft parking space at each of the airfields. A better use of the small numbers of hangers and open parking areas is for transport aircraft performing rapid resupply to the outposts or for special mission aircraft or UAVs providing overhead C4ISR or ASW capabilities during a conflict. For additional information on PLA special mission aircraft and UAVs, see the SCS MILCAP study, "Special Mission Aircraft and Unmanned Systems."

Combat aircraft more likely to deploy to the island-reefs include shorter range fighter bombers or air superiority aircraft. Twenty-four fighter-size hangars are at each of the Chinese island-reef airfields. Typically, each PLAAF or PLANAF fighter or fighter-bomber regiment has twenty-four aircraft. In terms of logistics and aircraft maintenance personnel, it would be practical to maintain a single-type regiment on each of the island outposts (e.g., all JH-7s at one airfield, all J-11s at another). However, aircraft could be mixed and matched across the three airfields depending on operational needs. The combined seventy-two hangers could also be employed in a "shell game," moving a handful of aircraft among the dozens of hangers, complicating enemy targeting (see Figure 9).

Basing smaller aircraft with limited ranges on the island outposts affords them longer on-station times in the SCS and mitigates the need for air-to-air refueling. If heavy bombers were launched from the mainland, having fighters forward-deployed on the island-reefs allows them to escort the bombers deeper into the SCS, Southeast Asia, or the Pacific. The smaller hangers could also be used to house transport or attack helicopters that may be instrumental in a PLA offensive campaign to seize SCS island-reefs. See the section in this study, "Assault and Attack Helicopters."

Offensive and Defensive Strike



(Image © 2021 Maxar/DigitalGlobe, Inc.)

Figure 9. Subi Reef Hanger Allocation Examples

Fighters. Deployments to the SCS outposts may include PLAAF or PLANAF multi-role fighters like the fourth-generation J-10. The most likely island-reef deployers are Chinese-manufactured versions of Russian Su-27 Flankers, the J-11 or J-16, or the aircraft carrier-based J-15. The island-reefs could also host PLAAF air superiority fighters like the stealthy, fifth-generation J-20 (see Figure 10).

(JHU/APL Photo) (U.S. Navy Photo)[4] (JHU/APL Photo)

Figure 10. J-10 (Left) and J-11 (Center) Multi-Role Fighters and J-20 Stealth Fighters (Right)

Fighter-sized combat aircraft can perform a variety of offensive and defensive missions, including strikes against enemy ships or attacking forces on nearby island-reefs or other ground targets in Southeast Asia. Fighters may also conduct defensive counter-air (DCA) patrols, defending against attacking enemy aircraft or offensive counter-air (OCA) missions, targeting enemy aircraft as part of an offensive action.

AAMs. In a DCA role, fighter-borne AAMs complement SAM defenses by extending engagements against enemy aircraft well beyond the range of ground-based SAM sites, providing a low-altitude engagement capability (i.e., "look-down, shoot-down" from altitude, unconstrained by the horizon limitations of a ground-based radar). In an OCA role, long-range AAMs may be used to attrite enemy DCA or to attack command, control, and radar aircraft as well as intelligence, surveillance, and reconnaissance (ISR) or maritime patrol aircraft. Threatening these large, non-maneuverable, high-value air assets (HVAAs) using long-range missiles may drive enemy ISR aircraft far enough from PLA bases and ship formations that they will be unable to provide any meaningful information about PLA operations or intentions.

The PL-12 AAM is slightly larger than the U.S. AIM-120 advanced medium-range air-to-air missile (AMRAAM) and reportedly offers similar ranges, 100 kilometers (54 nautical miles) (see Figure 11).[5] The PL-15 AAM is China's newest and longest-range AAM that may be carried by most PLAAF/PLANAF fighters. The J-20 appears to

[4] U.S. Navy photo, "140819-N-ZZ999-113," August 19, 2014.

[5] Later versions of the U.S. Block-C AMRAAM extend ranges to 105 kilometers (57 nautical miles).

have been purpose-built to carry up to four long-range PL-15 AAMs in its internal weapons bay. The PL-15 has a purported range of 150 kilometers (81 nautical miles) and possibly as far as 200 kilometers (108 nautical miles). The threat from these long-range Chinese AAMs elicited comments in 2015 from then-head of the U.S. Air Combat Command, General Herbert J. "Hawk" Carlisle, who stated that developing capabilities to outrange the PL-15 was among the highest priorities for the U.S. Air Force.[6]

(JHU/APL Photo)

Figure 11. PL-12 on a J-10B Fighter

Bombers/Fighter-Bombers. Deployments of PLAAF or PLANAF heavy bombers to the island-reefs are possible but, again, may be more of a move to influence regional actors than an attempt to extend the operational reach of already long-range aircraft. While constrained by limited hanger and parking space that may be required for other large aircraft, bombers that might deploy to the island-reef airfields include the PLANAF H-6G maritime strike bomber or the improved PLAAF H-6K (see Figure 12). The PLANAF's maritime strike version of the H-6K is reportedly the H-6J.[7]

(Japan Self Defense Force (JSDF) Photo)

Figure 12. PLANAF H-6G (Left) and PLAAF H-6K (Right)[8]

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[6] Douglas Barrie, "It's Not your Father's PLAAF: China's Push to Develop Domestic Air-to-Air Missiles," *War on the Rocks*, February 21, 2018, https://warontherocks.com/2018/02/not-fathers-plaaf-chinas-push-develop-domestic-air-air-missiles/. See also James Drew, "USAF Seeks 'Interim' CHAMP, Longer-Range Air-to-Air Missiles," *FlightGlobal*, September 16, 2015, https://www.flightglobal.com/news/articles/usaf-seeks-interim-champ-longer-range-air-to-air-416828/.

[7] Franz-Stefan Gady, "China's Navy Deploys New H-6J Anti-Ship Cruise Missile Carrying Bombers," *Diplomat*, October 18, 2018, https://thediplomat.com/2018/10/chinas-navy-deploys-new-h-6j-anti-ship-cruise-missile-carrying-bombers/.

[8] Joint Staff, 中国機の東シナ海及び日本海における飛行について [Chinese aircraft flying in the East China Sea and Sea of Japan], press release (Tokyo: Japanese Ministry of Defense, January 9, 2017), https://www.mod.go.jp/js/Press/press2017/press_pdf/p20170109_01.pdf; Joint Staff, 中国機及びロシア機の東シ

Fighter bombers or strike-fighter aircraft that may deploy to the SCS island-reef airfields include the JH-7 carrying ground attack or anti-ship weapons or the newer, all-weather, multi-role J-16 strike fighter, modeled on the Russian Su-30 Flanker (see Figure 13). J-16s are capable of carrying air-to-ground ordnance, ASCMs, and long-range AAMs. These aircraft will likely replace the aging PLAAF and PLANAF JH-7s, as well as the PLANAF's Russian-made Su-30MKKs. For additional information on air-launched ASCMs that may be carried by bombers or strike-fighter aircraft, see the section in this study, "Anti-Surface Warfare."

(JHU/APL Photo)

Figure 13. JH-7 Fighter Bomber

Air-Refueling Tankers. Island-reef based tanker aircraft may extend the range and patrol times of island-reef-based fighter aircraft, provide tanker support for aircraft-carrier-based fighters operating in the SCS, or increase the on-station time for C4ISR aircraft, such as the KJ-500 AEW&C aircraft.[9] As of 2020, the PLA had relatively few air-refueling aircraft available, including several Russian-built Il-78 tankers, as well as twenty bombers converted to tankers, designated the H-6U. Recent reports indicate some of the PLA's newest transport aircraft, such as the Y-20, may have been converted for aerial refueling.[10] In December 2020, a Y-20 was seen on the runway at Fiery Cross Reef, the first flight of a Y-20 to an SCS outpost detected by commercial satellite imagery.[11] The unrefueled combat radius of different PLAAF/PLANAF aircraft appears in Table 1. These figures are estimates based on internal fuel capacity (no external tanks) and a moderate weapon load. A heavy weapons load can easily reduce a fighter's maximum, unarmed range by 50 percent.

ナ海及び日本海における飛行について [Chinese and Russian Aircraft Flying in the East China Sea and Sea of Japan], press release (Tokyo: Japanese Ministry of Defense, December 22, 2020), https://www.mod.go.jp/js/Press/press2020/press_pdf/p20201222_02.pdf.

[9] Gabriel Dominguez, "Image Suggests KJ-500 Variant with IFR Probe Still Undergoing Testing," *Jane's Defence News*, September 9, 2020, https://www.janes.com/defence-news/news-detail/image-suggests-kj-500-variant-with-ifr-probe-still-undergoing-testing.

[10] Andrew Tate, "Y-20 Tanker and AEW&C Variants in the Pipeline, Senior PLAAF Officer Confirms," *Jane's Defense Weekly*, February 26, 2020, https://customer.janes.com/Janes/Display/FG_2716114-JDW; Liu Xuanzun, "China's Y-20 Tanker Variant Spotted Conducting Aerial Refueling for J-20 Fighter Jet," *Global Times*, November 17, 2020. https://www.globaltimes.cn/content/1207114.shtml.

[11] Kristin Huang, "South China Sea: Why Did the PLA Land its Massive Y-20 Warplane on Fiery Cross Reef?" *South China Morning Post*, January 1, 2021, https://www.scmp.com/news/china/military/article/3116028/south-china-sea-why-did-pla-land-its-massive-y-20-warplane.

Table 1. Missions, Ranges, and Weapons of Select PLA Combat Aircraft[12]

Aircraft	Mission	Unrefueled Combat Radius	Example Air-Surface Weapons	Air-Air Missiles
J-10	Multi-Role	350 km (189 NM)	YJ-8K, laser-guided bombs (LGBs)	PL-8, -12, -15
J-11/J-15	Multi-Role	700 km (378 NM)	KD-88; YJ-83, -91	PL-8, -12, -15
J-16	Multi-Role	720 km (389 NM)	YJ-12, -62, -83, -91; LGBs	PL-10, -12, -15
JH-7	Fighter Bomber	750 km (405 NM)	YJ-8, -12, -81, -82, -83, -91; LGBs	PL-8, -12
J-20	Air Superiority	800 km (432 NM)	N/A	PL-10, -15
H-6	Bomber	2,400 km (1,300 NM)	YJ-12, -81, -83, YJ/CJ-100	N/A

Anti-Submarine Warfare

Operational and technical hurdles associated with ASW will continue to challenge the PLAN and PLANAF in the near term. Detecting, targeting, and engaging enemy submarines in a complex underwater environment is among the most complicated and vexing military tasks. The PLAN has arguably made more progress in anti-air warfare and anti-surface warfare, although there are indications that steady progress has been made in ASW over the past several years.[13]

China is currently engaged in a concerted effort to increase the PLAN's capabilities in the undersea environment and perform acoustic reconnaissance from fixed arrays, ASW aircraft, and surface ships. However, even if the PLAN can detect an enemy submarine at long range, underwater weapons, such as torpedoes or depth charges, have very short ranges. Generally, once detected through acoustic or non-acoustic means, a submarine must still be localized by another submarine, a ship, or an ASW aircraft before that platform can prosecute the target with short-range underwater weapons.

[12] Combat radius reflects approximately 66% of maximum ranges to account for combat flight and weapons load. Ranges derived from various sources including aircraft manufacturer promotional brochures and authoritative references such as IHS Janes, *All the Worlds Aircraft (online)*.

[13] See, for example, Rick Joe, "The Chinese Navy's Growing Anti-Submarine Warfare Capabilities," *Diplomat*, September 12, 2018, https://thediplomat.com/2018/09/the-chinese-surface-fleets-growing-anti-submarine-warfare-capabilities/.

Local battlespace information control—the kind afforded by the island-reef C4ISR capabilities—combined with long-range anti-air warfare and anti-surface warfare capabilities, may counterbalance the PLA's shortcomings in ASW and inherent challenges in prosecuting underwater targets. Information superiority that enables air and surface superiority sets conditions for ASW operations and yields space and time to PLA ASW forces. Air and maritime superiority in a constrained area like the SCS would also exclude adversary ASW aircraft and ships, thus protecting Chinese submarines from prosecution by all but enemy submarines.

ASW Aircraft. Operating from the island-reef airfields, instead of the Chinese mainland or Hainan Island, allows PLAN fixed-wing ASW aircraft to conduct longer patrols in the southern reaches of the SCS. Helicopters that may operate from the island-reefs will also lend themselves to ASW search and prosecution in the immediate vicinity of the island-reefs.

The KQ-200, also known as the Y-9Q or GX-6, is the PLANAF's ASW/maritime patrol (MARPAT) aircraft (see Figure 14). The KQ-200 has an internal weapons bay for torpedoes and depth charges to attack enemy submarines. This ASW/MARPAT aircraft is purported to carry ASCMs, either internally or on wing-mounted hard points, but this has not been confirmed.[14] For more information about the KQ-200, see the SCS MILCAP study, "Special Mission Aircraft and Unmanned Systems."

(JSDF Photo)

Figure 14. KQ-200 ASW/MARPAT Aircraft[15]

[14] Xavier Vavasseur, "New Details on China's KQ-200 Maritime Patrol Aircraft," *Naval News*, April 29, 2019, https://www.navalnews.com/naval-news/2019/04/new-details-on-chinas-kq-200-maritime-patrol-aircraft/.

[15] Joint Staff, 中国機の東シナ海における飛行について [Chinese aircraft flying in the East China Sea], press release (Tokyo: Japanese Ministry of Defense, March 20, 2019), https://www.mod.go.jp/js/Press/press2019/press_pdf/p20190320_01.pdf.

ASW helicopters that might operate from the island-reefs include the Z-9C, but more likely would be the Z-18F based on the Z-8 medium-lift transport helicopter. The Z-18F is too large to operate from most PLAN combatants but would be ideal for conducting ASW operations several hundred kilometers from the island-reefs. The Z-18F has a surface search radar and a dipping sonar and carries lightweight Yu-7 torpedoes to attack underwater targets.[16] In April 2020, a KQ-200 ASW/MARPAT aircraft and what appeared to be either a Z-8 or Z-18 helicopter, both likely belonging to the PLANAF, were seen in commercial satellite imagery at the airfield on Fiery Cross Reef in their first SCS deployment.[17] Future ASW helicopters that may operate from the island-reefs include the Z-20F, a new Chinese military helicopter that appears to be a copy of the U.S. MH-60 *Seahawk* helicopter.[18]

Anti-Surface Warfare

Anti-Ship Cruise Missile Infrastructure. Two probable SSM facilities are located on each of the major Chinese outposts. A large concrete pad is also located in southwest Subi Reef that may be useful for missile launches (see Figure 15). The eastern SSM facility on Mischief Reef and the southeastern SSM facility on Fiery Cross Reef are co-located with SAM facilities. The SSM facilities likely house the YJ-12 ASCM TELs allegedly deployed to the island-reefs. However, these facilities could also accommodate other surface-to-surface weapons, such as LACMs.

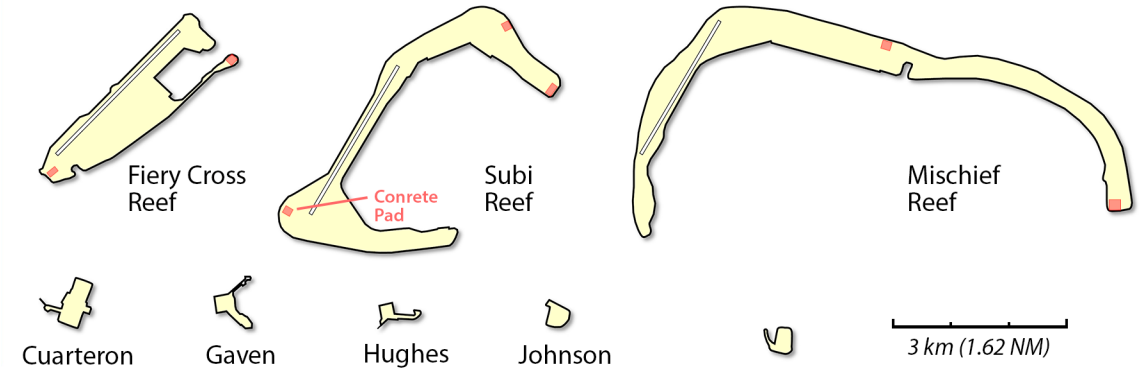


Figure 15. Locations of SSM Facilities

[16] Rick Joe, "Chinese Anti-Submarine Warfare: Aviation Platforms, Strategy, and Doctrine," *Diplomat*, October 16, 2018, https://thediplomat.com/2018/10/chinese-anti-submarine-warfare-aviation-platforms-strategy-and-doctrine/.

[17] "Fiery Cross Reef: Permanent Base for ISR Aircraft in the South China Sea," ImageSat International, June 14, 2020, https://storymaps.arcgis.com/stories/476d0c84a9f84046b9866db8f9405f72.

[18] Liu Xuanzun, "China's Z-20 Helicopter Variations for Anti-Submarine Warfare, Assault Spotted," *Global Times*, January 7, 2021, https://www.globaltimes.cn/page/202101/1212172.shtml.

Each suspected SSM facility consists of a four-bay TEL garage (42 × 22 meters, 138 × 72 feet). Like the SAM TEL garages, each SSM TEL garage has a small garage door where a TEL may enter (see Figure 16). Opposite the entry, the building has very large doors that open to allow the SSM TEL to fire its missiles at an elevated angle from within the building. These ground-to-ceiling doors all face the water and can be seen in oblique commercial satellite images (see Figure 17).

(Photo Courtesy of Philippine Daily Inquirer)

Figure 16. Subi Reef SSM Facility

Figure 17. Mischief Reef SAM/SSM Facility[19]

[19] Google Earth Pro 7.3.3.7786, (December 13, 2018) Mischief Reef, 9°55'37"N 115°32'28"E, Maxar Technologies 2021.

YJ-12 ASCM. YJ-12 (鹰击-12) ASCMs are supersonic, sea-skimming cruise missiles that may be launched from ships, aircraft, or truck-based TELs. The YJ-12E, also known by the export designator CM-302, was first shown being launched from a TEL in images displayed at the 2016 China Air Show (see Figure 18). The YJ-12E/CM-302 ASCM has an advertised maximum range of 290 kilometers (157 nautical miles). According to some Chinese sources, the export version of this missile is purposely range-limited to under 300 kilometers to comply with export restrictions set by the international Missile Technology Control Regime (MTCR). A PLA version of the YJ-12 is larger, 7 meters (23 feet), and may have a much longer range, over 500 kilometers (270 nautical miles).[20]

(JHU/APL Photo/CASIC)

Figure 18. YJ-12E ASCM

Anti-Ship Ballistic Missiles (ASBMs). The CM-401 ASBM is advertised by the state-owned China Aerospace Science and Industry Corporation (CASIC) as a maneuverable, hypersonic ASBM. The previously unknown missile first appeared at the 2018 China Air Show. Ranges for the export version of this compact ballistic missile are relatively modest, given as 290 kilometers (157 nautical miles), again, probably to comply with MTCR export restrictions. A cutaway of the missile's nose cone showed a phased-array antenna described as an active seeker for terminal guidance. The ASBM's dual canisters were displayed on a horizontally launched, road-mobile TEL and also on a deck-mount for shipboard use. Short-range ASBMs, such as the CM-401, could be deployed to China's SCS outposts with ranges probably in excess of 300 kilometers. ASBMs, whether launched from ships or from the island-reefs, may represent another layer of complex threats facing ships operating in the SCS.

Other Anti-Surface Missiles. In addition to weapons like the YJ-12 and the CM-401, the PLA invested in a number of other anti-ship weapons that might be employed in an SCS scenario. These weapons may be launched from ships in the SCS or aircraft operating from the island-reefs, enabled by the ISR, targeting, and command and control that the Chinese outposts provide. Notable ASCMs that may be launched from ships and aircraft include the YJ-62, YJ-82, and YJ-83. The newest class of Chinese

[20] Lan Jian, "中国海军'深圳'舰升级改装后之评说" [Comments of the Upgrade of the Chinese Navy Ship Shenzhen], *兵器知识 [Ordnance Knowledge]*, December 2018, 27.

destroyer, the Type-052D *Luyang III*, and the Type-055 *Renhai* cruiser also carry the vertically launched YJ-18 long-range ASCM that features subsonic cruise with a supersonic-sprint vehicle for terminal flight.[21] The YJ-18 is also likely deployed on some classes of Chinese submarines, replacing the older YJ-82s. Ranges and other details for Chinese ASCMs appear in Table 2.

Table 2. Ranges and Characteristics of Chinese ASCMs and Short-Range ASBMs

PLA Designator	Export Designator	Firing Platform	Range	Flight Profile (Altitude, Speed)
YJ-62	C-602	Ship, aircraft, or ground TEL	222 km (120 NM)[22]	Low-low, subsonic
YJ-82	C-802 *(CM-708UNB)*	Ship, aircraft *(submarine)*	120 km (65 NM) *(290 km (156 NM)*[23]	Low-low, subsonic
YJ-83	C-802A	Ship, aircraft, or ground TEL	180 km (97 NM)[21]	Low-low, subsonic
YJ-91	N/A	Aircraft	120 km (65 NM)	(Anti-radiation missile) High-low, supersonic
YJ-12	CM-302	Ship, aircraft, or ground TEL	546 km (295 NM)[24]	Low-low or high-low, supersonic
YJ-18	N/A	Ship or submarine	537 km (290 NM)[21]	Low-low, subsonic then supersonic
Unknown	CM-401	Ship or ground TEL	290 km (156 NM)[23]	High, hypersonic then supersonic

Complex Integrated Attacks. China's array of diverse anti-ship weapons systems launched from ships, aircraft, and the island-reefs affords the PLA operational flexibility and also presents increasingly complex challenges for adversary air and missile defenses. This PLA anti-ship system-of-systems incorporates a number of different types of missiles that together are designed to overwhelm an adversary's

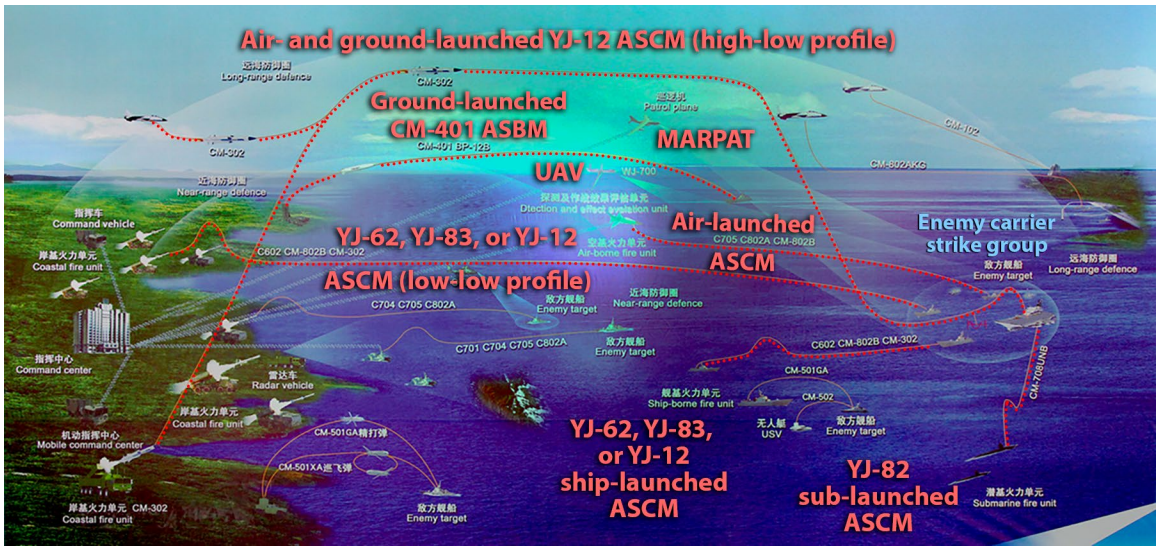
[21] Daniel Caldwell, Joseph Freda, and Lyle Goldstein, *China's Dreadnought? The PLA Navy's Type 055 Cruiser and Its Implications for the Future Maritime Security Environment*, China Maritime Report No. 5 (Newport, RI: U.S. Naval War College, 2020), 12-13.

[22] Range from Office of the Secretary of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2018* (Washington, DC: U.S. DoD, 2018), 30, https://media.defense.gov/2018/Aug/16/2001955282/-1/-1/1/2018-CHINA-MILITARY-POWER-REPORT.PDF.

[23] Range advertised by Chinese weapon manufacturers at Air Show China 2018.

[24] YJ-12 range from Macias, "China Quietly Installed Missile Systems on Strategic Spratly Islands in Hotly Contested South China Sea."

surveillance and information systems that might otherwise detect, track, and engage incoming missile salvos. In Figure 19, YJ-12s, YJ-62s, YJ-82s, YJ-83s, and CM-401s converge on an enemy carrier strike group in a simultaneous, multi-axis attack from different altitudes and at different speeds to effectively overwhelm the ships' anti-missile defenses. In a SCS military scenario, the capabilities depicted will likely be combined with even longer range, ship-based YJ-18s or mainland-based ASBMs, such as the DF-21D, to further complicate anti-missile defense.



(JHU/APL Photo/CASIC, red annotations and ASCM flight path highlights added)

Figure 19. Overview Graphic Showing Complex Integrated Attack on Surface Ships

Long-Range Artillery and Rockets

PLA artillery and rockets could play a significant role in in a military assault against foreign-held island-reefs. These potent weapons are not often considered when assessing the military balance of power in the SCS. However, it is worth noting that the first report of PLA weapons deployed to the SCS in 2015 was of two motorized artillery pieces on a Chinese-held island-reef. According to reports at the time, the artillery was capable of ranging nearby Vietnamese outposts.[25] In 2016, unnamed Western government sources indicated that Vietnam deployed long-range rocket artillery to five of its SCS outposts as a counter to China's military build-up. The Vietnamese government responded to the allegations, saying only that the

[25] Julian E. Barnes and Gordon Lubold, "U.S. Surveillance on Island in South China Sea Reveals Chinese Arms," *Wall Street Journal*, May 28, 2015, https://www.wsj.com/articles/u-s-surveillance-on-island-reveals-chinese-arms-1432864632.

information about the weapons was "inaccurate." [26] The reports nevertheless highlight the potential for long-range, land-based artillery duels among SCS outposts.

Several foreign-held island-reefs are within range of long-range artillery from the Chinese outposts. Major foreign outposts such as the Philippines' Thitu Island or Taiwan's Itu Aba are within 25 kilometers (13.5 nautical miles) of Subi Reef and Gaven Reef, respectively. At these distances, long-range artillery or rockets could rain down dense patterns of different types of shells—high-explosive, fragmentary armor piercing or incendiary—with potentially devastating effects. Rockets could also disperse hundreds of anti-personnel/anti-tank sub-munitions. In such barrages, a number of the sub-munitions usually remain undetonated, which could turn targeted island-reefs into minefields that would need to be cleared before the outposts could be re-occupied. Figure 20 depicts ranges for rocket artillery from Chinese island-reefs.

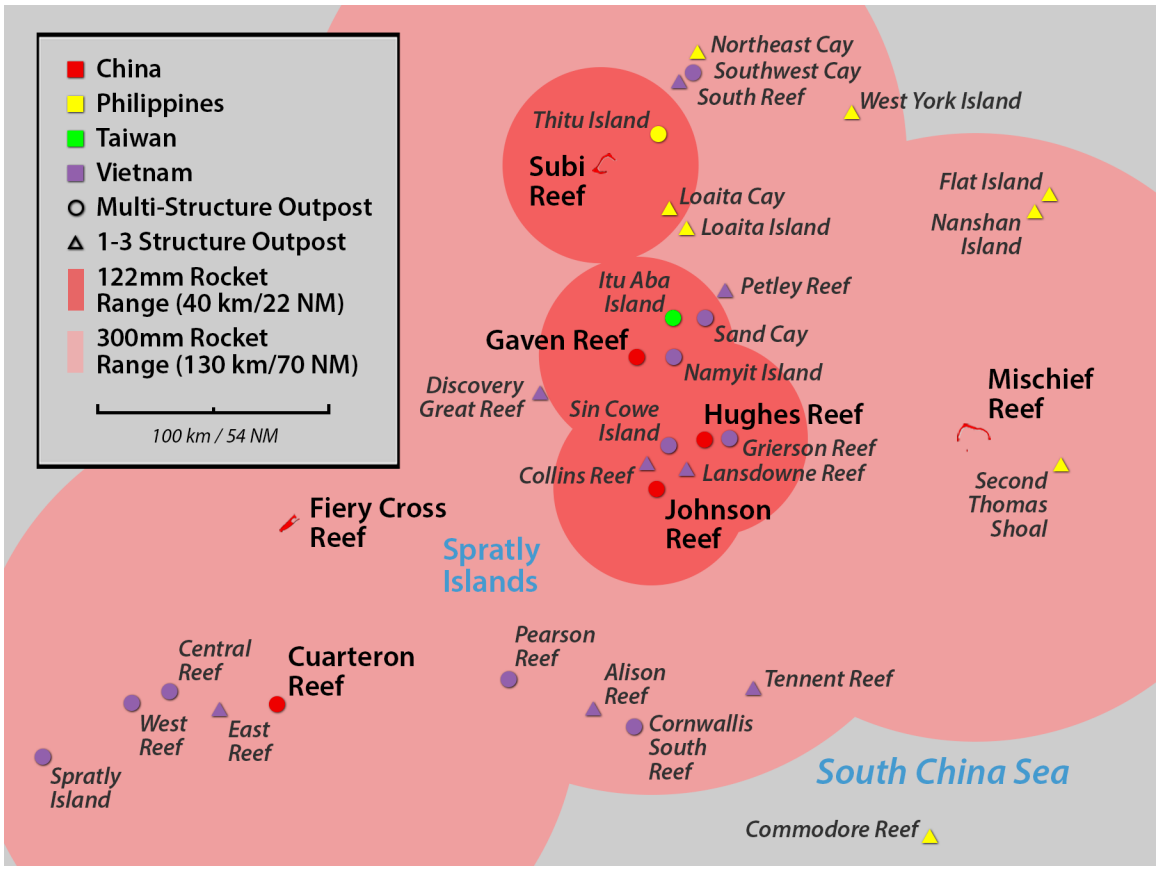


Figure 20. 122-millimeter and 300-millimeter Rocket Artillery Ranges

[26] Greg Torode, "Vietnam Moves New Rocket Launchers into Disputed South China Sea – Sources," *Reuters*, August 10, 2016, https://www.reuters.com/article/us-southchinasea-vietnam-idUSKCN10K2NE.

Examples of PLA rocket artillery include 122-millimeter rockets, such as the Fire Dragon 40, with a maximum range of 40 kilometers (22 nautical miles) (see Figure 21). The Fire Dragon series of rockets uses an inertial guidance system updated by satellite navigation, such as Beidou or GPS, to achieve advertised sub-20-meter accuracies. The 300-millimeter version of this rocket, the Fire Dragon 70 or Fire Dragon 140, has a claimed maximum range of 130 kilometers (70 nautical miles). Employing larger, longer range artillery rockets would likely be impractical in the SCS. Rocket artillery is typically fired from a truck-mounted multiple-launch rocket system (MLRS). There are no outward indications that the PLA has deployed such weapons in the SCS. However, an MLRS would be relatively easy to conceal in outpost buildings or garages. With little or no warning, an MLRS could emerge and launch a barrage of rockets against a foreign outpost as punishment during a crisis or as suppression fire prior to an island-seizure operation.

(JHU/APL Photo)

Figure 21. Fire Dragon 40 Artillery Rocket

Assault and Attack Helicopters

China's outposts are within 100 kilometers (54 nautical miles) of most foreign-held island-reefs in the SCS. This proximity makes PLA airfields ideal staging areas for assault or attack helicopters that may be used in an island-reef seizure operation. Helicopters could be launched from PLAN amphibious ships deployed from the Chinese mainland. However, staging and launching a helicopter-borne assault from the island-reef airfields would allow the PLA to conceal Chinese intentions until the assault was well underway. In under an hour, PLAN marines could be transported from a Chinese outpost to a foreign-held island-reef on helicopters such as the Z-8, a Chinese-manufactured copy of the French SA 321 *Super Frelon*. Each of these medium-lift transport helicopters are capable of carrying up to 27 fully armed troops.

A helicopter-borne assault might be accompanied by attack helicopters such as the Z-10 or Z-19 to provide precision fire-support (see Figure 22). The Z-10 may be armed with a 23-millimeter cannon, anti-tank missiles, and the PL-90 AAM, a heat-seeking missile designed to target other helicopters, small airplanes, or UAVs. Currently, dedicated attack helicopters are only in service with the PLAA. However,

in early 2021, Internet images suggested that the Chinese Z-20 helicopter, a copy of the U.S. H-60-series *Blackhawk/Seahawk*, may be under development for use by the PLAN Marine Corps.[27] The photographed Z-20 was noted with anti-tank weapons but can also reportedly transport 10 combat troops. Beyond land-attack capabilities, attack helicopters may use short-range weapons to engage and destroy boats operating near the island-reefs that are too small to be targeted by larger ASCMs.

(JHU/APL Photos)

Figure 22. Z-8KA Combat Search and Rescue Helicopter (Left) and Z-10K Attack Helicopter (Right)

Combat Search and Rescue

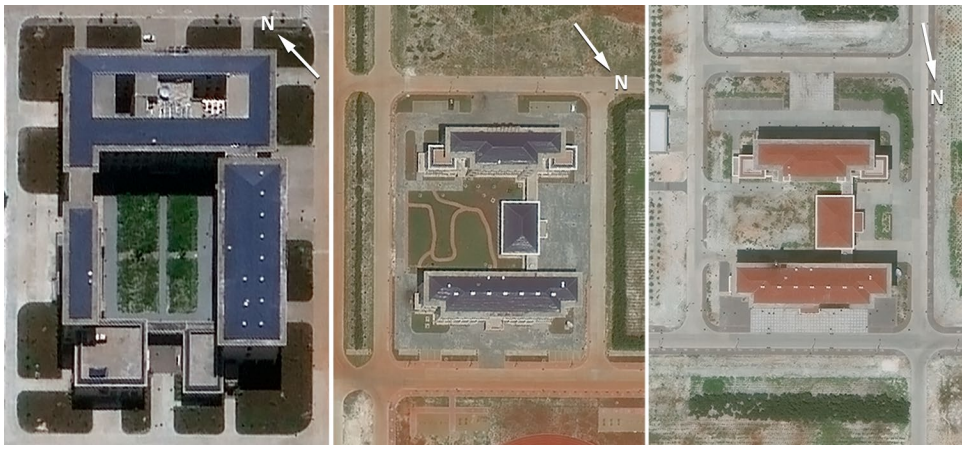
Helicopters stationed at island-reef airfields, such as the Z-8KA, specifically outfitted for combat search and rescue (see Figure 22), will likely be used for search and rescue missions in combat scenarios, in response to a natural disaster, or evacuation of personnel needing medical attention from nearby ships or even from a foreign-held island-reef. The Chinese government has long touted the humanitarian potential of the SCS outposts and their capacity for search and rescue. One of the first flights of a PLA transport aircraft to Fiery Cross Reef in 2016 was ostensibly for a medical evacuation.[28] MARPAT aircraft, such as the KQ-200, may also be used to search large areas of the SCS and provide command and control for at-sea rescue operations.

Military hospitals or clinics are located on each of the major island-reefs to serve outpost personnel and treat casualties during military operations (see Figure 23). According to commercial satellite imagery, as of mid-2020, red crosses were painted

[27] Andrew Tate, "Variant of Z-20 Helicopter may be Under Development for PLAN Marine Corps," *Jane's Defence News*, January 14, 2020, https://www.janes.com/defence-news/news-detail/variant-of-z-20-helicopter-may-be-under-development-for-plan-marine-corps.

[28] "永暑礁医院解决官兵'看病难,'" [Yongshu (Fiery Cross) Reef Hospital Solves the "Difficult to See Doctor" Problem], *央视网 [CCTV Network]*, video, November 26, 2016, http://news.cctv.com/2016/11/26/ARTIL3H7g6gJf6QrKADvhZS4161126.shtml. The Z-20 bears a stunning resemblance to the U.S. *Blackhawk* and may be a reverse-engineered copy of H-60s that were sold to China by the United States in the 1980s.

adjacent to each building, signifying their status as medical facilities. In 2016, the Fiery Cross Reef hospital was profiled in a Chinese television program. It boasts an impressive array of capabilities, including fully equipped operating rooms, an intensive care unit, and a walk-in hyperbaric chamber. The 4-meter (13-foot) roof-mounted satellite dish noted on the Fiery Cross hospital likely supports a telemedicine capability, referred to by the *PLA Daily* newspaper as a "high-definition remote consultation system." The telemedicine capability allows for a broad range of specialty care at the remote SCS medical facilities.[29]



(Images © 2021 Maxar/DigitalGlobe, Inc.)

Figure 23. Hospitals/Clinics at Fiery Cross (Left), Subi (Center), and Mischief Reefs (Right)

Outpost Support to Aircraft Carrier Operations

Chinese island-reef airfields will likely play a key role in PLAN aircraft carrier operations in the SCS. The airfields are a backup for carrier aircraft unable to return to their ships. They also provide a base for large aircraft conducting airborne ISR and control functions that PLAN aircraft carriers cannot currently accommodate.

Combat damage, mechanical failure, and bad weather are among the reasons why an aircraft may not be able to return to an aircraft carrier. "Blue water" operations, flying without a divert airfield that can be reached using reserve fuel, risk losing aircraft that cannot land back on the ship. The U.S. Navy addressed its need for divert airfields with overseas bases and agreements with friendly nations to use airfields when the need arises. However, in the SCS, China has been feuding with other claimants over territorial issues. The Philippines, Vietnam, Malaysia, and Indonesia are very unlikely

[29] "南沙永暑礁医院全面形成卫勤保障能力" [Nansha (Spratly) Yongshu (Fiery Cross) Reef Hospital Comprehensively Forms Medical Support Capability], *中国军网 [China Military Online]*, May 1, 2017, http://www.81.cn/jfjbmap/content/2017-05/01/content_176157.htm.

to offer assistance to a disabled Chinese naval aircraft, especially during a military crisis. Brunei or U.S. allies Thailand and Singapore would also likely deny use of their airfields. SCS divert airfields are limited to China's three outposts and Cambodia, where China financed and built an airport on the Gulf of Thailand that could be used to support military aircraft.[30] Figure 24 depicts likely PLAN aircraft carrier operating areas based on a 750 kilometer (~400 nautical mile) divert range for carrier-borne aircraft to a friendly airfield.

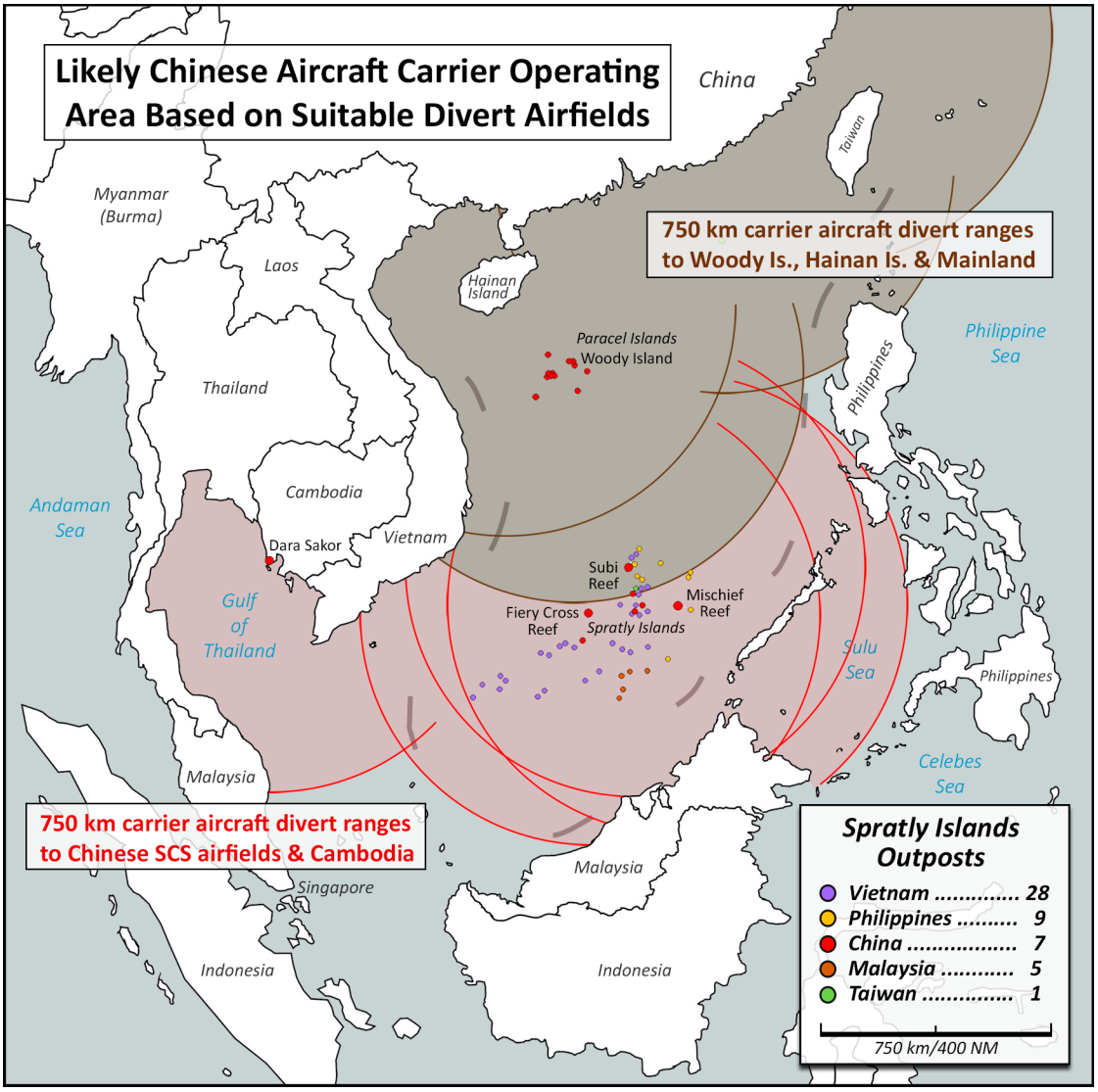


Figure 24. Likely Chinese Aircraft Carrier Operating Areas Based on Suitable Divert Airfields

[30] Hannah Beech, "A Jungle Airstrip Stirs Suspicions About China's Plans for Cambodia," *New York Times*, December 22, 2019, https://www.nytimes.com/2019/12/22/world/asia/cambodia-china-military-bases.html.

Large aircraft, such as the KJ-500 AEW&C aircraft, operating from China's SCS airfields will be critical to SCS carrier operations, especially in the near term. Fighter-aircraft radars have narrow fields of view and rely on the 360-degree radar coverage from a ship's radar or AEW&C aircraft to search the sky and sea for threats and targets. Ship-borne radar line-of-sight is limited by the horizon. However, an AEW&C aircraft at altitude can look down on the water for low-flying aircraft and surface ships. In the example shown in Figure 25, a KJ-500 launched from an outpost airfield orbits ahead of a carrier task force for 6-8 hours, providing battlespace awareness for the carrier task force, as well as radar coverage and control for carrier-based fighters operating hundreds of kilometers downrange. The notional operating areas depicted in Figure 25 demonstrate the necessary information-control relationship between AEW&C aircraft and carrier-based fighters.

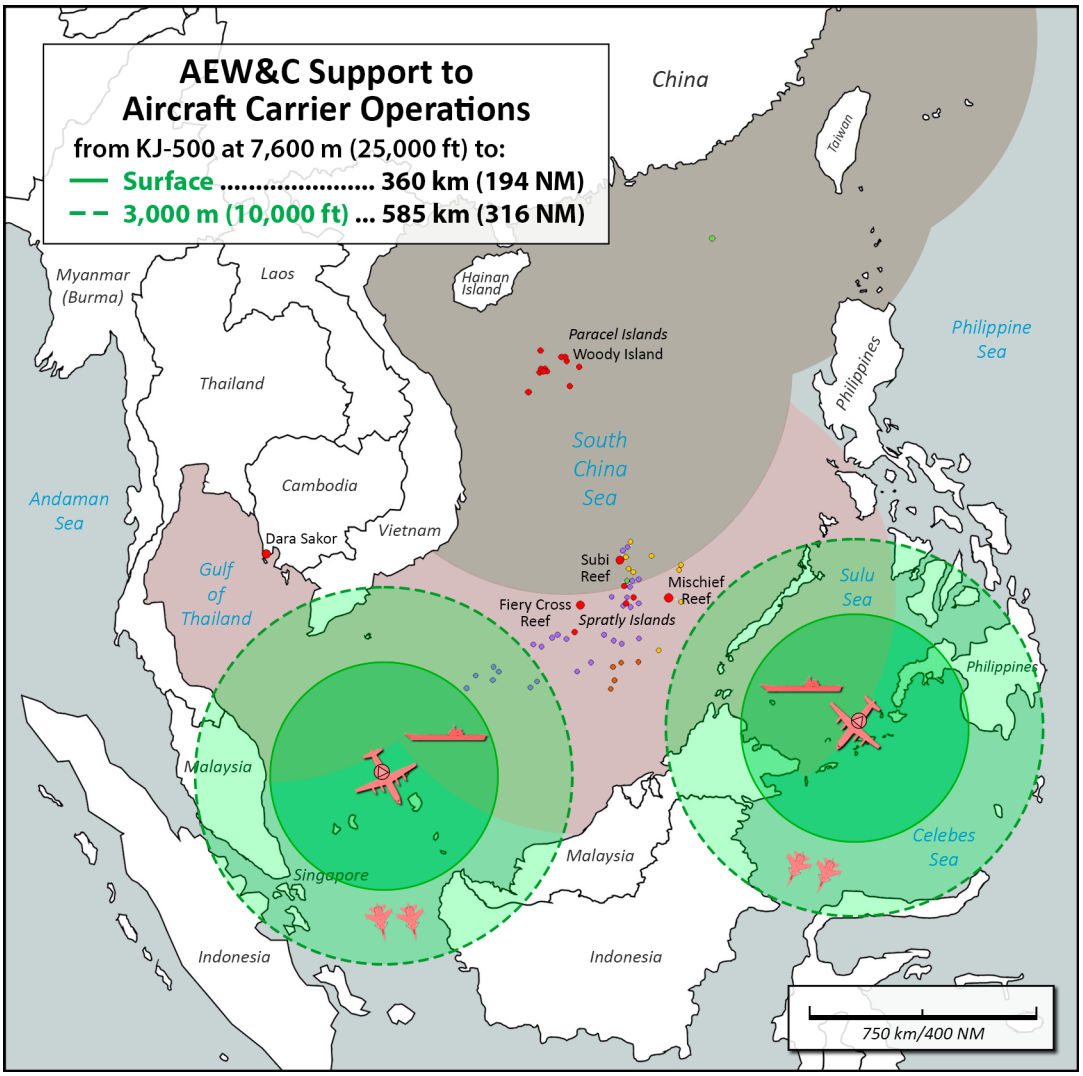


Figure 25. Outpost-Based AEW&C Support to Aircraft Carrier Operations

The PLANAF has a number of KJ-500s, independent of air force KJ-500 units, to control naval aircraft in overwater missions. The PLANAF also reportedly developed a smaller AEW&C aircraft, the KJ-600, which is similar in appearance to the U.S. Navy E-2 *Hawkeye*.[31] China's current generation of carriers with ramps on the bow to launch aircraft probably cannot accommodate the KJ-600. This aircraft is almost certainly intended for a future Chinese carrier equipped with catapults. Chinese carriers currently operate with an AEW helicopter, the Z-18J.[32] Helicopter-borne radar aloft can provide radar coverage similar to AEW&C aircraft, but helicopters are limited in speed, altitude, and endurance, compared to fixed-wing aircraft.

Until China's third generation of carriers are operational, PLAN carrier task forces will likely need to be supplemented by island-reef-based AEW&C aircraft to support long-range, over-the-horizon operations in the SCS. The PLANAF may work to integrate KJ-600s flying from island-reef-based airfields before ultimately integrating them with a carrier-based air wing. For additional information on AEW&C aircraft, see the SCS MILCAP study, "Special Mission Aircraft and Unmanned Systems."

Island-Reef Capabilities Versus Naval Capabilities

Offensive and defensive strike capabilities generated on the PLA outposts will be complementary to, not independent of, other PLA strike capabilities in and around the SCS. In terms of sheer numbers, China's naval combatants can generate significantly more instantaneous firepower than the island-reefs. This study's examination of outpost infrastructure indicates the probable deployment of eight ASCM TELs and eight SAM TELs on each outpost—likely 72 ASCMs and 96 SAMs available for immediate use. Additional TELs could be kept in reserve until needed, and land-based systems may be reloaded relatively quickly, even if reloading must be accomplished during an enemy attack. PLAN ships with significantly more vertical launch system (VLS) missile tubes cannot reload at sea and would have to return to port or stop at a Chinese SCS island-reef to reload quay-side.

Still, as shown in Figure 26, the instantaneous firepower available from just three PLAN ships—216 missiles total—exceeds that of all missile TELs combined that might be housed in the outpost's TEL garages (168 missiles total). The PLAN's newest combatant, the Type 055 *Renhai* guided-missile cruiser (CG), has 112 VLS tubes that

[31] The KJ-600 was first noted in commercial satellite imagery in August 2020. H. I. Sutton, "First Image of China's New Carrier-Based AEW Plane," *Forbes*, August 29, 2020, https://www.forbes.com/sites/hisutton/2020/08/29/first-image-of-chinas-new-carrier-based-aew-plane/.

[32] Hui Tong, "Z-18J," *Chinese Military Aviation* (blog), July 2, 2020, http://chinese-military-aviation.blogspot.com/p/helicopters-iii.html.

can carry a mix of ASCMs and SAMs, in addition to other ordnance, like anti-submarine rockets or LACMs. There is also speculation that the CG's oversized VLS tubes, some 60 percent larger than those on U.S. Navy combatants, may allow the Type 055 to carry ship-launched ASBMs.[33] The PLAN's Type 052D DDG has 64 VLS tubes, which, again, may carry a mix of different weapons. The Type 054A guided-missile frigate (FFG) features shorter range weapons, such as YJ-62 ASCMs, that are launched from deck-mounted canisters and medium-range HHQ-16 SAMs that are launched from 32 VLS tubes. Equal proportions of ship-based ASCMs and SAMs are depicted in Figure 26, but, again, the VLS tubes may house different load-outs of weapons, depending on each ship's mission.

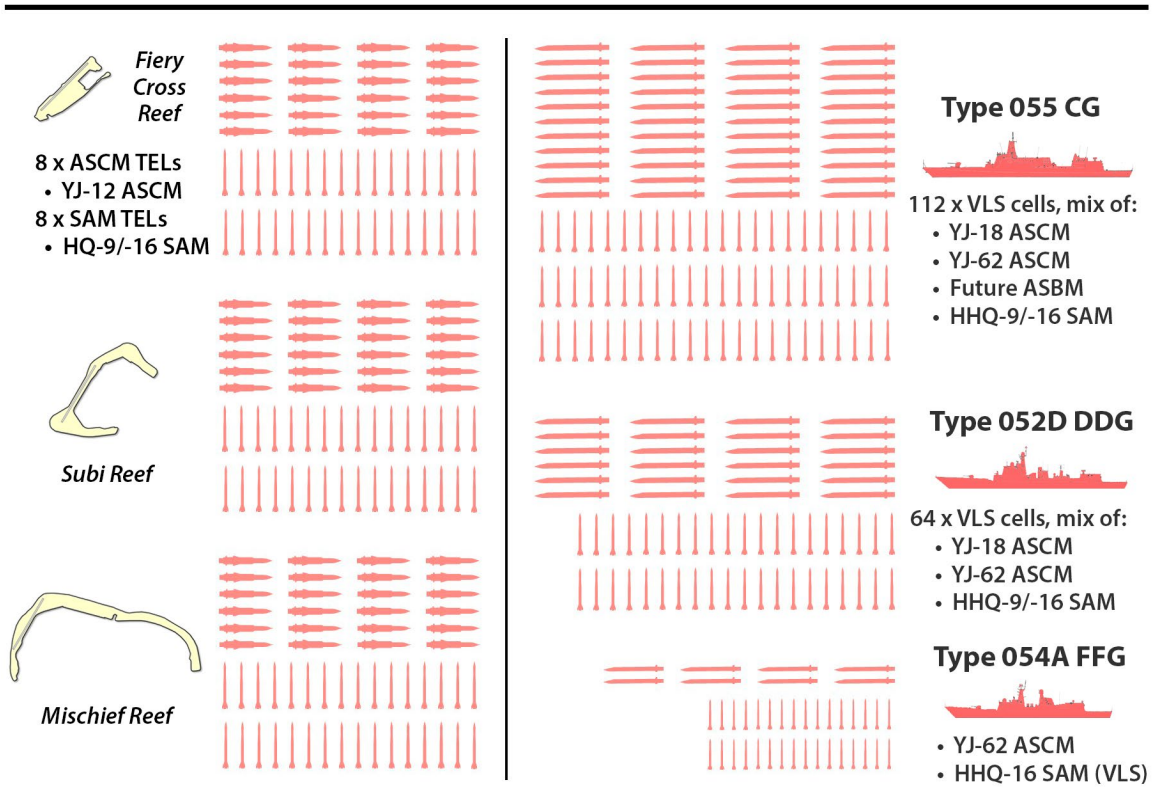


Figure 26. Island-Reef Missile Capacities Versus Naval Task Group Missile Capacities

Outpost missile capacities pale in comparison to those of multiple PLAN task groups that may deploy to the SCS. Figure 27 shows notional PLAN formations consisting of seventeen surface combatants, an aircraft carrier, and submarines that could bring over 1,000 missiles to the SCS battlespace. Twenty-four carrier strike fighters provide additional anti-surface and anti-air capacity with air-launched ASCMs and AAMs.

[33] Caldwell, Freda, and Goldstein, *China's Dreadnought?*, 11-12.

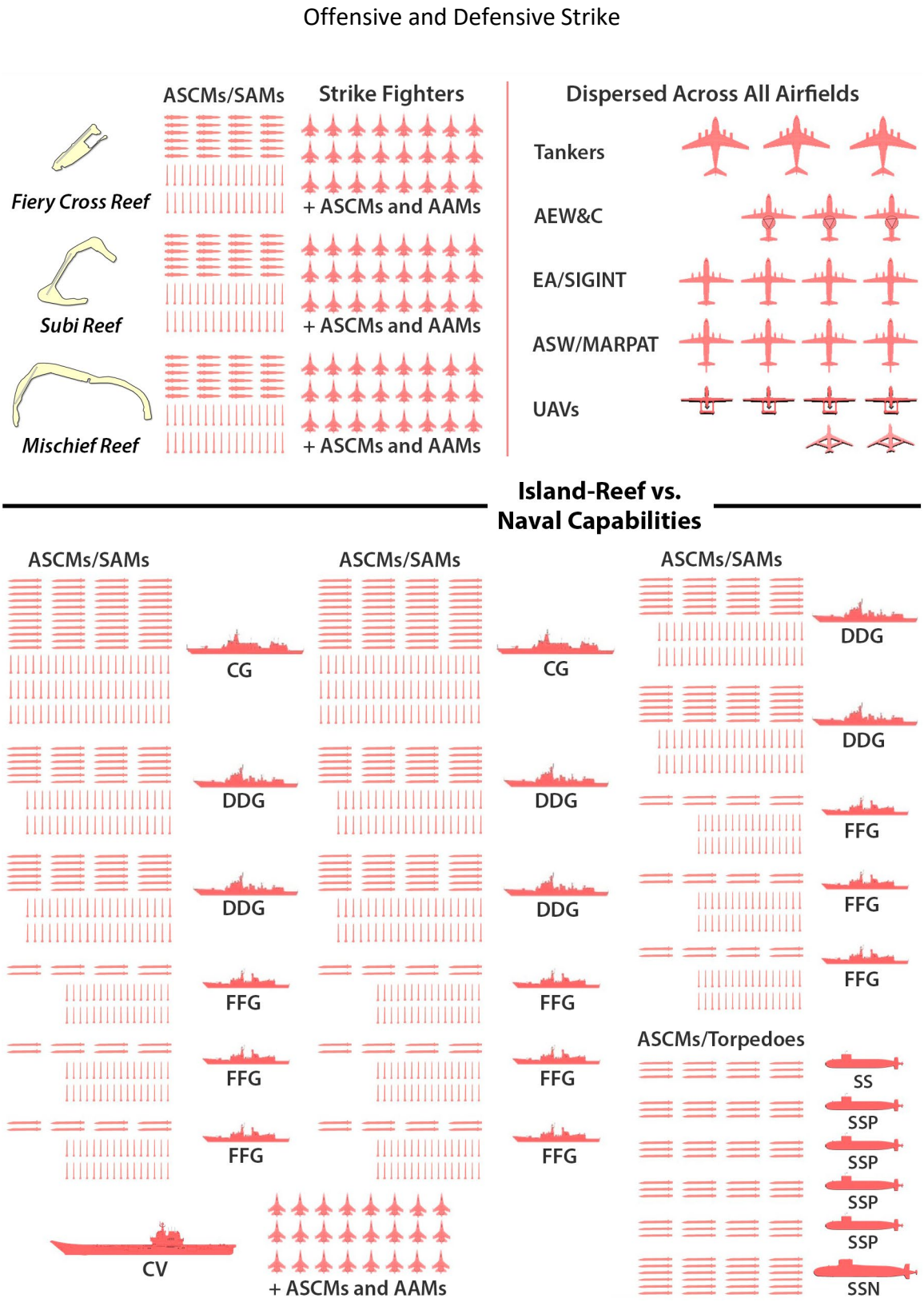


Figure 27. Island-Reef Capabilities Versus Naval Capabilities

The island-reefs' most significant offensive and defensive strike capabilities are likely the 72 combat aircraft that may deploy to the island-reef airfields. These aircraft, housed in the 24 fighter-sized hangers on each of the outposts, would probably be armed with AAMs to provide long-range air defense for the island-reefs or air cover for PLAN surface ships operating in the region. Alternatively, these aircraft would be armed with ASCMs or LACMs to conduct long-range strikes.

Island-reef-based special mission aircraft depicted on the upper-right side of Figure 27 may be the greatest enabler for any PLA strike- or air-defense mission. In many cases, sea-based or airborne-firing platforms are unable to sense the battlespace and find targets out to the maximum range of the weapons they carry. Airborne radar, command and control, electronic attack, or signals intelligence (SIGINT) platforms launched from the island-reef airfields can effectively search a much greater volume of air and waterspace; relay targeting data, including space-based ISR data; and coordinate combat action over most of the SCS. The dynamics of battlespace information control and how they manifest with outpost-based capabilities are examined in the final section of this study, "Executing an SCS Military Operation."

SCS Campaign Requirements

In an SCS military conflict, China's information power capabilities on its island-reefs may be the most significant contribution to realize the PLA's informationized warfare strategy. The information control that the island-reefs offer shape and define virtually all PLA operations in the SCS. Information and other capabilities that China's SCS island-reefs provide are not for a singular purpose; they could support a broad range of military operations. Certainly, the logistics support that these seven fortified PLA bases provide deep in the SCS is significant. Logistics support for Chinese Coast Guard vessels and smaller PLAN ships is especially useful in any protracted, low-intensity conflict in the region. Bomber and strike aircraft deployed to the island-reefs may also extend PLA power projection deep into Oceania, Southeast Asia, or toward Australia. However, the persistent C4ISR and counter-C4ISR that the outposts deliver are core capabilities for any PLA military operation in the SCS, especially as it relates to asserting China's territorial claims in the disputed body of water.

The Chinese Academy of Military Science's 2006 *Science of Campaigns* provides a compendium of characteristics and requirements for different types of military operations. This text is not necessarily a template for military operations. The *Science of Campaigns* provides a classification of operations and offers a study of the considerations and actions necessary for the successful execution of certain

operations. Written some seven years before China's SCS island-reef construction began, the *Science of Campaigns* offers a generic approach to PLA operational-level planning and provides insights into the elemental factors that the PLA believes it must address in any given operation.[34]

Naval campaigns are divided into two categories (类型)—offensive and defensive—that may be further subdivided into different types (样式). The main types of offensive naval campaigns include a naval blockade, attacks on enemy naval forces, interdiction of sea lines of communication (SLOCs), and an "offensive campaign against coral island-reefs" (对珊瑚岛礁进攻战役). Types of defensive naval campaigns include a counter-blockade, SLOC defense, and naval base defense.[35]

According to this PLA doctrine, under informationized conditions, naval campaigns must necessarily integrate traditional surface, subsurface, and air domains with land and space domains, as well as the network electromagnetic space and cognitive domains. Per the text, improvements in ISR, especially space-based ISR, significantly increased the transparency of the maritime battlespace for both Chinese and enemy forces. This increase in ISR capabilities, combined with advances in the range and accuracy of weapons, leads the PLA to a presumption that "the discovery of a target means it will be annihilated" (目标被发现就意味被消灭). Targeting processes, which include the ability to find and track enemy forces, communicate targeting data to platforms and weapon systems, and control execution of kinetic and non-kinetic combat activities sets the course of operations. If the PLA enjoys superior battlespace awareness, Chinese forces are able to maintain operational initiative and dictate operational tempo.[36]

In contrast to the generic description and characterization of other naval campaigns, the "offensive campaign against coral island-reefs" outlined in the *Science of Campaigns* is relatively specific and represents a scenario in which the PLA's SCS outposts probably have their most direct application. The objectives for this type of operation include recapturing an "enemy occupied" island-reef, promoting national territorial sovereignty, and defending China's maritime rights and interests. The AMS text describes the island-reef campaign as occurring in a complex battlespace distant from the Chinese mainland, circumstances that exacerbate challenges in C4ISR, and logistics.[37] The expansion of China's Spratly outposts into artificial islands, eight

[34] Chinese Academy of Military Sciences (AMS), 战役学 [Science of Campaigns], ed. Zhang Yuliang et al. (Beijing: National Defense University Press, 2006), 2–6.

[35] Ibid., 501.

[36] Ibid., 506.

[37] Ibid., 535-536.

years after this campaign was codified, addresses virtually all the shortcomings and challenges related to C4ISR and logistics described in the *Science of Campaigns*.

Concurrent with an island-reef offensive campaign, the PLA will likely execute a "naval base defense campaign," especially in any scenario that might invite foreign military intervention. This campaign includes executing a predetermined camouflage, concealment, and dispersal plan for critical assets on PLA naval bases. The naval base defense campaign outlined in the *Science of Campaigns* anticipates that an enemy will likely attack naval bases with sudden, multi-axis strikes on key nodes, employing secrecy, camouflage, and feints and attacking with a wide variety of weapons. The enemy objectives listed include paralyzing PLA defenses, destroying critical base facilities, and eliminating operational forces stationed on the bases.[38]

In keeping with the PLA's philosophy of "active defense"—being strategically defensive while operationally offensive—proactive defensive operations, often referred to in Western analyses as a "counter-intervention campaign," may have a decidedly offensive character. Counter-intervention may involve the elimination of intervening enemy naval forces, often in a preemptive attack. The objectives of such an offensive war-at-sea campaign are to destroy enemy capabilities, alter the military balance in the area of operations, and establish maritime dominance in key areas to create favorable conditions for the primary offensive campaign.[39]

According to PLA writings, operations against enemy air and naval forces requires enhanced C4ISR to enable battlespace situational awareness.[40] Underscoring the Chinese military emphasis on information superiority, priority targets for counterattack in this campaign include enemy forces that may lend themselves to enemy battlespace information control—ISR capabilities, command and control aircraft, EW forces, and forward-positioned radar picket ships.[41]

Achieving information superiority—maintaining Chinese C4ISR while denying an adversary C4ISR—is an overarching priority for the PLA in both offensive and defensive naval campaigns. Outlines for all of the naval campaigns emphasize the importance of information-power capabilities related to C4ISR, EW, navigation, and weather. The offensive campaign against coral island-reefs specifically directs the PLA to establish a "comprehensive intelligence and reconnaissance system-of-systems" (完善的情报侦察体系); establish a single, integrated communications

[38] Ibid., 548-553.

[39] Ibid., 523.

[40] Ibid., 524.

[41] Ibid., 548-553.

network among ships, aircraft, island-reefs, and the mainland; produce accurate forecasts of hydrological and meteorological conditions; and provide for the safe and secure navigation of military platforms and weapons.[42]

The information power capabilities resident on China's SCS island-reefs satisfy a majority of the campaign requirements outlined in PLA doctrinal texts. The outposts provide a strong foundation for the "comprehensive intelligence and reconnaissance system-of-systems" required for both the offensive campaign against coral island-reefs and the accompanying offensive and defensive campaigns directed at potential intervening enemy air and maritime forces. The PLA bases and their layered, redundant communications establish a survivable, integrated network among ships, aircraft, the island-reef outposts, and the mainland. The permanent presence of meteorological capabilities on the Chinese island-reefs produces accurate forecasts of hydrological and weather conditions that enhance PLA use of the electromagnetic spectrum and the maritime environment. Island-reef navigation aids, as well as outpost-based enhancements to space-based navigation, ensure positioning, navigation, and timing for military platforms and weapons in the SCS, even in the face of significant enemy disruptions. For additional information on navigation and weather forecasting capabilities, see the SCS MILCAP study, "Hardened Infrastructure Counter-Reconnaissance, and Battlespace Environment Management"

Assessments of offensive and defensive strike capabilities described in this study should be considered in the context of China's informationized warfare strategy to appreciate the integral relationship between PLA battlespace information control and kinetic action. In addition to their potential to host combat forces, the island-reefs function principally as information hubs, providing C4ISR to enable air and maritime operations throughout the SCS and deeper into Southeast Asia. SAMs, ASCMs, and many of the fighter aircraft deployed to the outposts will be employed to defend China's island-reefs from attack, with a secondary mission of power projection. Again, however, what might be an "offensive" or "defensive" PLA action is subjective. The PLA may characterize an attack against foreign naval or air forces hundreds of miles from the Chinese outposts as a preemptive "defensive" action.

As the range and sophistication of modern weapons increase, the PLA asserts that virtually all weapons are informationized weapon systems. Modern weapons, like warfare itself, have been transformed by information. Increasingly long-range and precise weapons cannot function without a networked information system-of-systems. Therefore, the critical, limiting factor in the employment of long-range precision weapons is, in many cases, the availability of information for surveillance,

[42] Ibid., 536-537.

targeting, command and control, navigation, and guidance outlined in this SCS MILCAP series. The Chinese island-reefs have been optimized for many of these functions to extend PLA information control and enable strike capabilities in the SCS and deeper into Southeast Asia.

Executing an SCS Military Operation

The battlespace information generated by and through the Chinese island-reefs are critical to the success of PLA operations in the SCS. The outposts provide persistent ISR giving the PLA detailed knowledge of military and civilian activity in the SCS.

Chinese information dominance in the battlespace environment enables peacetime or low-intensity conflict operations, often referred to in the West as "grey zone" conflict. Grey zone operations may involve maritime militia, essentially fishermen conscripted into part-time military service, as well as law-enforcement or even regular military forces in engagements regarded as below the threshold of military conflict. Grey zone operations include driving foreign fleets out of fishing grounds or harassing and discouraging foreign oil exploration in the SCS. The SCS outposts provide reconnaissance and communications services to Chinese civil and military forces, in addition to command and control of any coordinated operation. The island-reef bases also provide critical logistics support to sustain the smaller ships of the maritime militia and Chinese Coast Guard on lengthy deployments.

The Chinese island-reefs and their information-related capabilities will also have significant utility in high-intensity military conflict. The PLA outposts provide superior battlespace awareness in advance of any operations. Capabilities to monitor military movements, adversary-held island-reef resupply activity, civilian and commercial activity, and even minute changes in weather allows the PLA to shape the battlespace, position forces, and select times and locations for operations to provide Chinese forces with potentially overwhelming advantages in a conflict.

Offensive Campaign against Coral Island-Reefs

As outlined in the previous section on campaign requirements, China's SCS outposts address a majority of the challenges and shortcomings identified in an "offensive campaign against coral island-reefs." Chinese island-reef information-related capabilities described in this SCS military capabilities series allow the PLA to collect vast amounts of intelligence and battlespace data and move information between the Chinese mainland and the seven PLA outposts, as well as among ships, aircraft, and unmanned systems operating in the SCS.

A permanently stationed or rapidly deployed military force on China's SCS outposts supported by the all-encompassing information control offered by the island-reefs will allow the PLA to quickly generate mass from its SCS bases and conduct rapidly unfolding operations with little or no warning. Such decisive, fast-moving actions will likely serve to surprise foreign island-reef defenders but will also make it extremely challenging for foreign reinforcements or a third-party military force to intervene before Chinese offensive operations are substantially complete.

Coral Island-Reef Targets. Other than moving troops overwater to their objective, PLA amphibious operations against foreign-held island-reefs will likely bear little resemblance to what might be considered a traditional amphibious landing. Even the smallest amphibious landings on remote Pacific Islands during the Second World War involved large troop formations assaulting islands hundreds of square kilometers in size. Island-reef features in the SCS are miniscule by comparison. The largest non-Chinese island-reef in the SCS is Itu Aba Island, occupied by Taiwan, with an area of 0.46 square kilometers (114 acres) and a population of approximately 220 military personnel. Several occupied features in the Spratly archipelago are barely above water or entirely submerged. Foreign structures on these features are built atop stilts or concrete platforms like the Philippines' outposts on Commodore Reef or Loaita Cay. The Philippines-claimed Second Thomas Shoal is occupied by a handful of Philippine marines living in a derelict tank landing ship (LST) permanently beached on the shoal (see Figure 28).

(Philippines Navy, Naval Forces West Photos)

Figure 28. Commodore Reef (Left), Loaita Cay (Center), and Second Thomas Shoal (Right)[43]

Most of Vietnam's twenty-eight occupied SCS features have undergone significant development, especially since 2013, with substantial buildings, weapons emplacements, and defensive fortifications. Small Vietnamese platforms elevated above submerged reefs have been hardened into concrete pill-box-like fortresses to

[43] Naval Forces West PN, "Know your PHILIPPINE FEATURES at the Kalayaan Island Group (KIG)," December 2020-January 2021, https://www.facebook.com/pg/navalforceswest/photos/.

repel direct gunfire and assault.[44] By comparison, eight of the nine Philippine-claimed features have few, if any, defensive fortifications. These outposts are each occupied by approximately a dozen military personnel (see Figure 29).

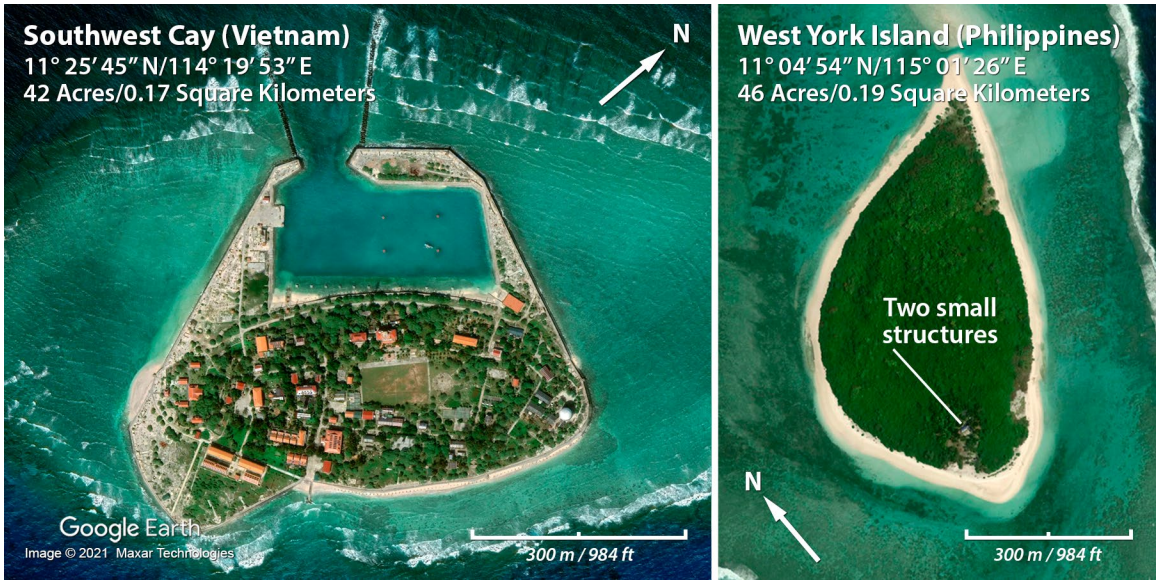


Figure 29. Vietnam-Claimed Southwest Cay and Philippines-Claimed West York Island[45]

The one substantial Philippines-claimed SCS feature is Thitu Island, also known as Pag-asa Island in Fillipino. This island-reef has a natural and reclaimed land area of approximately 0.4 square kilometers (100 acres). Thitu has a population of over 100 civilians and a handful of military personnel. The island features a 1,100-meter (3,609-foot) dirt runway. In 2020, the Philippine government constructed a small harbor and a beaching ramp on the west end of the island's runway extension. The beaching ramp is essentially a concrete pier that allows roll-on-roll-off ships like ferries and amphibious landing ships to pull up to the end of the ramp and discharge vehicles and heavy equipment. The beaching ramp allows for infrastructure improvements on Thitu, including stated plans to pave the runway (see Figure 30).[46]

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[44] "Vietnam Shores Up its Spratly Defenses," *Asia Maritime Transparency Initiative,* February 19, 2021, https://amti.csis.org/vietnam-shores-up-its-spratly-defenses/; see also, "Vietnam Builds Up its Remote Outposts, *Asia Maritime Transparency Initiative,* August 4, 2017, https://amti.csis.org/vietnam-builds-remote-outposts/.

[45] Google Earth Pro 7.3.3.7786, (December 7, 2018) Southwest Cay, 11°25'45"N 114°19'53"E, Maxar Technologies 2021 and Google Earth Pro 7.3.3.7786, (October 25, 2018) West York Island, 11°04'54"N 115°01'26"E, Maxar Technologies 2021.

[46] David Santos, "Govt. Inaugurates Pag-asa Island Seaport," *CNN Philippines*, June 10, 2020, https://www.cnn.ph/videos/2020/6/10/Govt.-inaugurates-Pag-asa-island-seaport.html.

Figure 30. Philippines-Claimed Thitu (Pag-asa) Island[47]

An offensive to seize or remove military personnel from the nine Philippine-claimed features would be a relatively straight-forward operation for the PLA. An offensive to achieve the same objective against even one-third of the twenty-eight Vietnamese outposts would be a much more substantial undertaking, complicated by Vietnamese military fortifications and defenses, as well as the larger Vietnamese populations on each island-reef. A campaign against Vietnamese-held island-reefs may also require a lengthy naval blockade to interdict resupply and erode Vietnamese military resistance. Therefore, for the purposes of this case study, the less complex PLA seizure of Philippines-held island-reefs was selected to demonstrate the utility of China's SCS outposts in such an operation. A Philippines scenario is also more likely to invite U.S. military intervention in the conflict allowing for an examination of concurrent Chinese counter-intervention operations.

[47] Google Earth Pro 7.3.3.7786, (April 15, 2019) Thitu Island, 11°03'07"N 114°17'05"E, Maxar Technologies 2021. Outline of new construction and annotations added.

Mission Orders. There are any number of circumstances that might precipitate a Chinese seizure of Philippine island-reefs. These might include land reclamation or new construction, a military deployment, or some other Philippine action interpreted as an affront to Chinese sovereignty claims in the SCS. Alternatively, Beijing may simply wish to send a strong message to other SCS regional actors.

Whatever the underlying geopolitical context, in this example, the PLA is ordered to remove military personnel and civilians from the nine Philippine outposts (see Figure 31). Notional PLA rules of engagement include authorization to eliminate military forces that do not surrender. The handful of Philippine structures at Loaita Cay, Flat Island, and Commodore Reef shall be permanently removed, and the LST at Second Thomas Shoal shall be towed off the reef and sunk. A small PLA occupation force may initially remain on Northeast Cay, West York Island, and Nansha Island. Philippine re-occupation of their outposts will be prevented primarily through PLA Navy and Chinese Coast Guard enforcement of a maritime exclusion zone around the seized island-reefs. In this fictitious example, the PLA is required to minimize civilian casualties on Thitu Island and shall be prepared to repatriate civilian and military personnel to the Philippines.

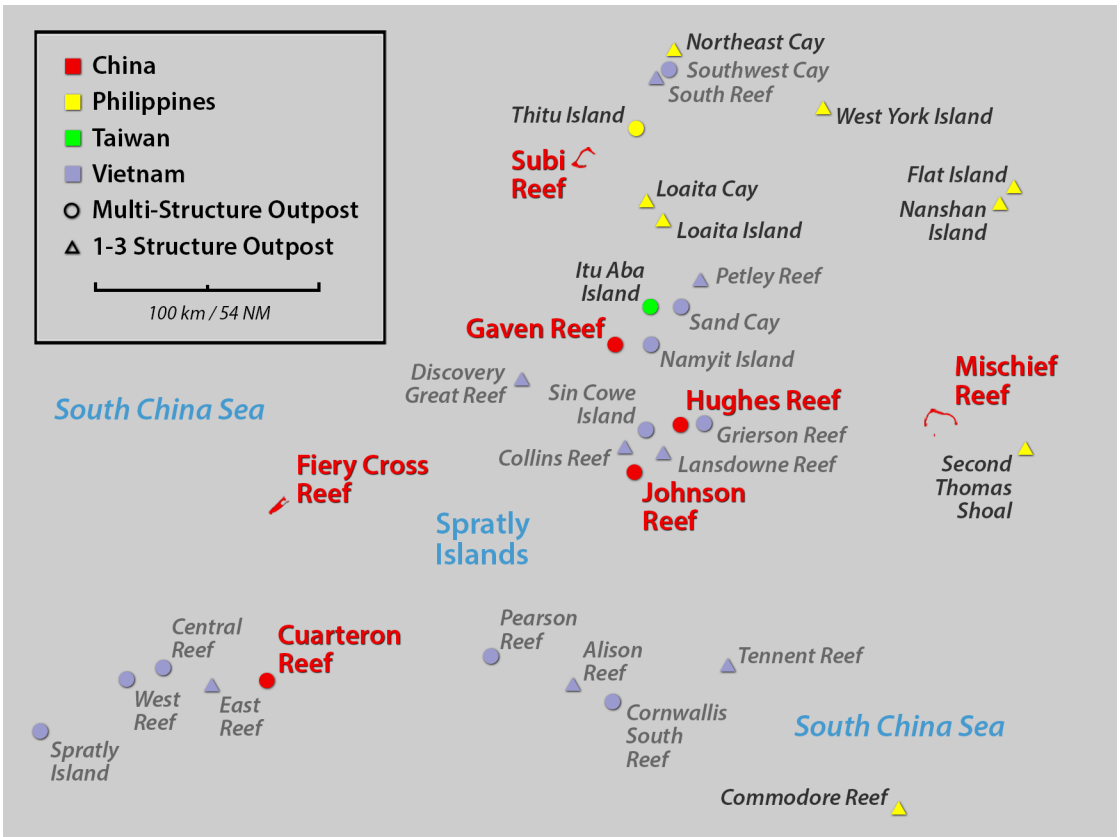


Figure 31. Chinese and Philippine-Claimed Island-Reefs in Central SCS

Information Blockade. Any military operation in the SCS would likely be preceded by an information blockade. While not necessarily a Chinese term of military art, an information blockade describes the combined effects of operations security, emission control (EMCON), camouflage, and deception the PLA would likely employ to contain and control the information environment in advance of any SCS offensive. In addition to regulating its own signals and signatures, PLA EW forces will prevent foreign electromagnetic signals and information from escaping the SCS battlespace. Years of high-fidelity signals intelligence collection in the region allow PLA EW forces to discretely target foreign computers, radio transmissions, data links, satellite communications, and radar. The PLA will effectively disconnect foreign forces from the electromagnetic spectrum, each other, and their home countries, preventing anyone other than the PLA from generating or sharing battlespace information.

Communications that might otherwise reveal Chinese intentions will likely be restricted to PLA fiber-optic cables, troposcatter communications, or other low probability of intercept (LPI) communications. Mission orders, intelligence, and satellite data, for example, may be transmitted from the Chinese mainland to the island-reefs over undersea fiber-optic cables or a secure satellite communications link. Local commanders will distribute orders and intelligence to local SCS forces either in person or using LPI communications, providing no outward indication of military preparations. Island-reef infrastructure also allows outpost-based forces to plan, stage, fuel, and arm with few, if any, visible signatures for adversary ISR to exploit. Chinese commanders may execute military operations on cloudy days simply to prevent electro-optic satellite imagery collection. China's island-reef capabilities offer the PLA a high degree of insight and battlespace awareness while targeted foreign outposts and those who might come to its aid are kept in the dark.

Rapid Execution. In a Philippine island-reef seizure campaign, the PLA would likely execute an operation to take all nine features in a matter of hours. Again, depending on geopolitical circumstances, a crisis in the SCS might build over time. In such a "slow-burn" scenario, foreign forces, including U.S. military forces, may take up positions in and around the SCS. This could seriously compromise PLA advantages in any offensive to seize foreign-held island-reefs. In the scenario presented here, the PLA create a situation in which substantial PLA forces are already present on China's SCS outposts as part of established, routine deployments. The PLA closely monitors foreign activity and waits for the optimal time to execute offensive operations when foreign forces are out of position to effectively intervene.

When operational conditions, including weather and sea conditions, are acceptable, deployed PLA forces conduct a rapidly unfolding offensive operation to seize the nine Philippine-held island-reefs. Opposition on eight of the nine outposts consists of a

dozen Philippine troops at each outpost armed with individual or crew-served weapons and little in the way of defensive fortifications. PLA command centers on the major Chinese outposts synchronize and direct simultaneous assaults of these outposts.

PLA special forces or marines are inserted by helicopters launched from either the island-reefs or nearby ships. Two fully loaded Z-8/Z-18 transport helicopters, each carrying 24 combat-equipped troops (48 total), provide the PLA assault force with a 4:1 ratio over Philippine troops. Small boats launched from a PLAN ship or a Chinese Coast Guard ship may accompany the helicopter-borne assault or replace the air assault entirely. Air cover for these smaller amphibious operations is provided by attack helicopters, armed UAVs, or aircraft launched from Chinese airfields. If the PLA assault force is repelled, precision air strikes, naval gunfire, or artillery barrages eliminate the few Philippine outpost structures and defensive emplacements. Philippine personnel are taken into custody and transported to a major Chinese island-reef where they are treated for injuries at Chinese medical facilities. They are eventually flown to the Chinese mainland and then repatriated to the Philippines.

Less the required ship transit time between a major Chinese island-reef and Philippine outposts (2-3 hours each way in some cases), the entire operation from assault force launch to securing the outposts is probably complete within 1-2 hours. If the PLA decides to occupy substantial island-reefs like Northeast Cay, West York Island, or Nansha Island, this could be accomplished using hovercraft—landing craft, air cushion (LCACs)—to lift substantial military equipment over the shallow reefs.

Limitations on Swimming Armored Vehicles. Landing operations against small SCS island-reefs will likely be limited to helicopters, small boats, or LCACs. All of the Philippine-held sites and many of the other foreign-held island-reefs are surrounded by very shallow, but substantial coral ledges that extend hundreds of meters from the tiny sprigs of land in the center of the reef. Amphibious armored vehicles that swim to shore and drive up on beaches may be seriously challenged to move through shallow water and traverse steep inclines or drop-offs that are higher than 1 meter (~3 feet). An amphibious vehicle traversing the top of a coral ledge may be especially hazardous if the reef collapses under the weight of the heavy armored vehicle, and it is then unable to climb or swim out of the hole.[48] Given these hazards, it is unlikely that amphibious armored vehicles will be used in assaults on small coral island-reefs. Similarly, flat-bottomed amphibious landing ships, LSTs, or landing ships, medium (LSMs) that are designed to push their hulls up onto a beach to discharge troops or

[48] For a discussion of natural hazards to amphibious vehicles, see U.S. Marine Corps, "Employment of Amphibious Assault Vehicles (AAVs)," MCWP 3-13C, 2016, 3-5.

armored vehicles probably cannot push across the hundreds of meters of coral to reach a suitable off-load point. Even then, a beached amphibious ship would be unable to extricate itself from the reef in water depths typically less than 1-2 meters.

Multi-Axis Assault on Thitu Island. The PLA assault on Thitu Island is the most complex undertaking in this notional campaign. Such a multi-faceted operation is similar to what would be required for assaults on Taiwan-held Itu Aba or many of the larger Vietnamese-held island-reefs. An assault on Thitu, however, is less complicated in that the entire operation can be staged and commanded from Subi Reef, which is only 24 kilometers (13 nautical miles) from the large Philippine island. Figure 32 depicts the likely elements of an amphibious assault on Thitu.

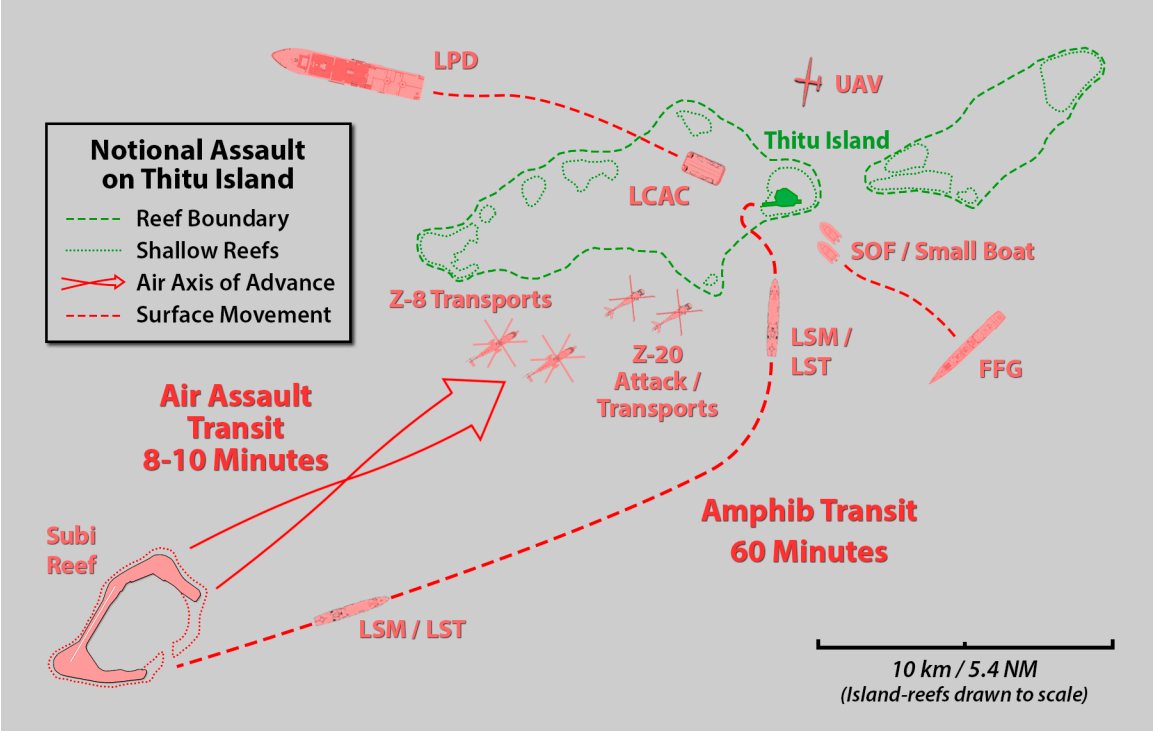


Figure 32. Notional Assault on Thitu Island

One or more UAVs fly near Thitu throughout the operation to closely monitor activity on the island. Philippine communications and radar are jammed by EW forces on Subi Reef, by airborne EW assets such as the Y-9G, or by an EW pod on the previously mentioned ISR UAV. Special operations forces launched from a nearby combatant or maritime militia fishing vessels land covertly to spot or neutralize Philippine military forces and direct PLA landings. Attack helicopters or UAVs armed with air-to-ground missiles may eliminate threats to make way for transport helicopters. Helicopter

flight time from Subi Reef to Thitu is under 10 minutes. Thitu's airfield provides an ideal helicopter landing zone.

One of the helicopter landing force's primary objectives is to secure the beaching ramp at the west end of the airstrip. Having gotten underway from Subi Reef before the helicopters launched, amphibious ships, such as LSTs or LSMs, pull up to the Thitu beaching ramp and discharge PLA Marine Corps armored vehicles, such as 4 x 4 wheeled armored vehicles, or a PLA air defense system, such as the HQ-6D, which consists of short-range missile system (range: 18 kilometers/10 nautical miles) integrated with a LD2000 Gatling gun CIWS (see Figure 33). Air defense systems on Thitu protect against a foreign counter-attack, especially from cruise missiles or a helicopter-borne assault to retake the island. Heavy equipment could also be delivered to Thitu using LCACs deployed from PLAN amphibious ships (e.g., landing platform docks). LCACs can traverse the shallow reef shelf to off-load on beaches near the newly constructed Thitu fishing boat harbor.

(JHU/APL Photos)

Figure 33. 4 x 4 Armored Vehicle (Left), HQ-6 Missile TEL (Center), and HQ-6/LD2000 CIWS (Right)

Thitu's civilian residents may be evacuated by ship to Subi Reef. Alternatively, Philippine civilians may stay on the island with the PLA occupation force, at least for a time. Again, depending on geopolitical circumstances, Beijing may be satisfied to remove Philippine military forces from the outposts as a sign of Chinese sovereignty and administration over the seized Philippine island-reefs.

Because of the proximity of China's island-reefs and the density of naval, air, and coast guard forces that China can generate in the SCS, establishing additional bases on seized Philippine island-reefs does not provide the PLA with any significant operational advantage. Simply denying Philippine occupation may be more geopolitically palatable than a Chinese military occupation of the tiny land masses. If China constructed hardened bunkers on Northeast Cay, West York Island, and Nansha Island, the PLA could marginally extend low-altitude and surface-radar coverage to the north and east. Establishing a PLA outpost on Commodore Reef would extend Chinese defensive lines and information control 200 kilometers (108 nautical miles)

to the southeast, providing air defense and ASCM coverage of the Balabac Strait and southwestern approaches to the Sulu Sea. Occupying Commodore Reef also brings China's span of military control closer to Malaysia's five island-reefs (see Figure 34).

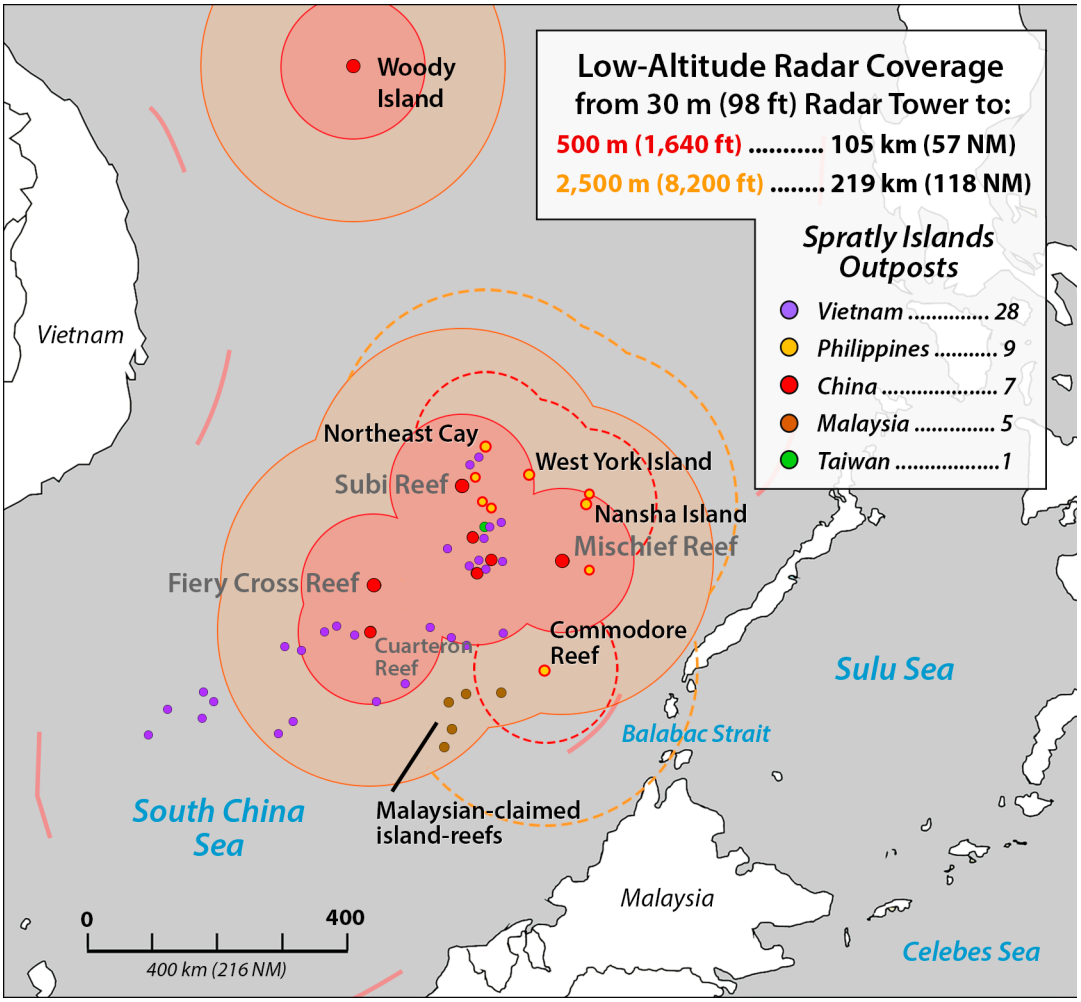


Figure 34. Potential Radar Coverage Extension from Seized Philippine Reefs

Significance of Information Control. The Chinese island-reefs generate critical battlespace information and awareness to enable successful PLA operations in the southern reaches of the SCS. The PLA bases allow and enable both defensive and offensive information actions. Defensively, the outpost's robust, redundant command, control, communications, and computing (C4) capabilities provides the PLA with secure conduits to preserve Chinese access to information while effectively denying indications and warnings to its adversaries. Offensively, outpost-generated ISR provides persistent intelligence about virtually all activity in the SCS. Superior battlespace awareness in advance of any conflict gives the PLA a detailed understanding of enemy disposition, the electromagnetic environment, and weather.

According to PLA informationized warfare theory and doctrine, this information control and the ability to gain and maintain information superiority is critical to offensive operations against foreign-held island-reefs. Information superiority allows the PLA to deploy, position, and take decisive action, driving rapidly unfolding operations instead of reacting to circumstances. The PLA will leverage its capabilities for battlespace information control to deny forces on foreign-held island-reefs and intervening forces' situational awareness or the ability to coordinate any response to PLA action. Again, according to informationized warfare theory, information superiority is a prerequisite to gaining and maintaining air and maritime superiority—key superiorities necessary to prevent foreign intervention from derailing PLA island-seizure operations.

Attacks on Enemy Air and Naval Forces

Concurrent with a Chinese offensive campaign against coral island-reefs, the PLA must be prepared for the possibility of foreign intervention. In the case study outlined in the previous section, a seizure of Philippine-held island-reefs, a reaction from the Philippine armed forces or the U.S. military is anticipated. The PLA must also guard against Vietnamese or Malaysian military reactions should they believe the Philippine outpost seizures are the first step in a larger Chinese island-reef seizure campaign.

The amphibious and helicopter-borne task force that the PLA employs to seize foreign-held island-reefs will probably be modest compared to the forces assigned to create and secure space and time for the offensive operation. This type of PLA operation against an intervening force is often called a "counter-intervention campaign" by Western analysts. This gives the mistaken impression that Chinese forces will merely be arrayed in a defensive phalanx around Chinese territory or, in this case, an off-shore military operation. However, informationized warfare is a decidedly "offensive" operational concept. In executing operations to prevent foreign intervention, the PLA will conduct offensive actions that seize and maintain operational initiative, as opposed to falling into a defensive, reactive mode.

PLA doctrine outlines a joint campaign called an "anti-air raid campaign" that bears some resemblance to a "counter-intervention campaign" described by many Western analysts. While the anti-air raid campaign is initially described in the *Science of Campaigns* as an "integrated offensive-defensive campaign to defeat enemy air-raids," the text makes clear that the anti-air raid campaign is only defensive to the extent that enemy intent is the trigger to initiate offensive operations. [49] Per the *Science of Campaigns*, going on the offensive is essential to defeating a sophisticated enemy's air

[49] AMS, 战役学 [Science of Campaigns], 331, 335-6.

raid plan. While long-range strikes and actions against enemy bases and assets outside of the SCS will likely occur as part of this effort, this study focuses on how the PLA island-reefs contribute to gaining and maintaining information, air, and maritime superiority in the SCS.

Information Superiority. PLA operational concepts mandate achieving information superiority early in a conflict. The information power capabilities resident on China's SCS outposts mean that PLA forces will likely start from a position of information overmatch, if not superiority, against any intervening force, such as the Philippines or U.S. military. Assuming the PLA perpetually enjoys information superiority in the SCS, the PLA will be in the advantageous position of defending its claim to information control, rather than having to wrest it from an adversary's control in a military crisis.

Chinese operational concepts also call on the PLA to actively degrade, deny, and destroy enemy C4ISR by striking or affecting critical nodes within an adversary's C4ISR system-of-systems. PLA kinetic and non-kinetic fires (e.g., missiles or cyber/EW, respectively) will initially target an intervening force's critical C4ISR capabilities. Again, these actions may be directed against C4ISR nodes well outside the SCS, possibly against enemy bases in East Asia or space-based assets. Priority targets for PLA strike and electronic attack forces include enemy command and control aircraft, manned and unmanned airborne ISR, EW forces, ships providing forward-deployed radar coverage, and submarines conducting covert reconnaissance. The threat of kinetic, lethal capabilities, such as those from an ASCM, create synergies with island-reef generated ISR. Capabilities to geolocate enemy ship communications or radar signals means enemy ships broadcasting those signals can be easily targeted by the PLA. This threat will likely drive enemy ship into EMCON, suppressing communications and radar activity, which causes the enemy to self-limit its access to battlespace information.

PLA ships and aircraft operating in the SCS are also subject to geolocation and targeting by intervening enemy forces. Therefore, PLA ships and aircraft will also likely practice EMCON and limit communications and radar activity. In this case, the PLA outposts provide a decided information advantage. As mentioned in the previous section on SCS campaign requirements, the capabilities on or flying from the island-reef bases provide the PLA with a "comprehensive intelligence and reconnaissance system-of-systems" in the SCS and establish a single, integrated communications network among ships, aircraft and the island-reefs. PLA ships and aircraft operating in the SCS can remain largely in EMCON as they receive orders and information collected by and broadcast from the island-reefs. The strength of the PLA's C4ISR system-of-systems built on the island-reef platforms establishes battlespace

information superiority, which, according to PLA doctrine, enables and then perpetuates air and maritime superiority.

Air Superiority. In executing attacks on enemy air and naval forces in the SCS, the most important capabilities in terms of air superiority are probably airborne information-related capabilities. C4ISR aircraft, such as the KJ-500 AEW&C aircraft or ISR UAVs, provide "look-down" low-altitude radar coverage that significantly enhances battlespace awareness and targeting. Detachments of strike fighter aircraft, such as the J-11 or J-16 deployed to the Chinese island-reefs, significantly enhance air defense and provide maritime strike options. However, even in the absence of air-to-air intercept fighters, airborne C4ISR assets can network together SAMs from surface ships possessing radars that have limited line of sight against low flying threats. This integration will be significantly enhanced by a future PLA cooperative engagement capability that allows ISR assets to pass targeting data directly to firing platforms. Island-reef-based radar, as well as AEW&C and signals intelligence aircraft flying from the SCS outpost airfields, offer the PLA both "look up" and "look down" reconnaissance capabilities and critical capabilities to manage and deconflict airborne and ship-borne DCA and OCA capabilities. Figure 35 illustrates the relationship between PLA information-power capabilities and kinetic weapons systems. In many cases, long-range air-defense weapons are only effective in the context of targeting information generated from the Chinese island-reefs or the aircraft they support. This simple two-dimensional representation is limited in its ability to display the variety of overlapping land-, maritime-, and air-based active and passive ISR outlined in other publications in this SCS MILCAP series. See, for example, the SCS MILCAP studies on "Air and Surface Radar," "Counter-Stealth Radar," and "Special Mission Aircraft and Unmanned Systems."

AEW&C aircraft, such as the KJ-500 or KJ-600, providing command, control, and communication (C3) will likely fly well within a bastion of PLA air defenses to provide low-altitude radar coverage over a large swath of the SCS. AEW&C aircraft or UAVs may also patrol farther forward, beyond SAM engagement ranges, to support forward operating naval forces and aircraft. Long-range SAMs, such as the land-based HQ-9B or ship-based HHQ-9B, receive cuing and targeting from these airborne assets, as well as electronic-intelligence systems on the island-reef outposts. Fighters are shown operating beyond or between SAM engagement zones conducting DCA combat air patrols. Electronic attack aircraft are not depicted in the figure, but would enjoy line of sight ranges similar to the radar rings shown for C4ISR aircraft. This notional air-defense force laydown represents a small fraction of the island-reef-based capabilities, air forces, and naval forces that may participate in an actual SCS combat scenario.

Offensive and Defensive Strike

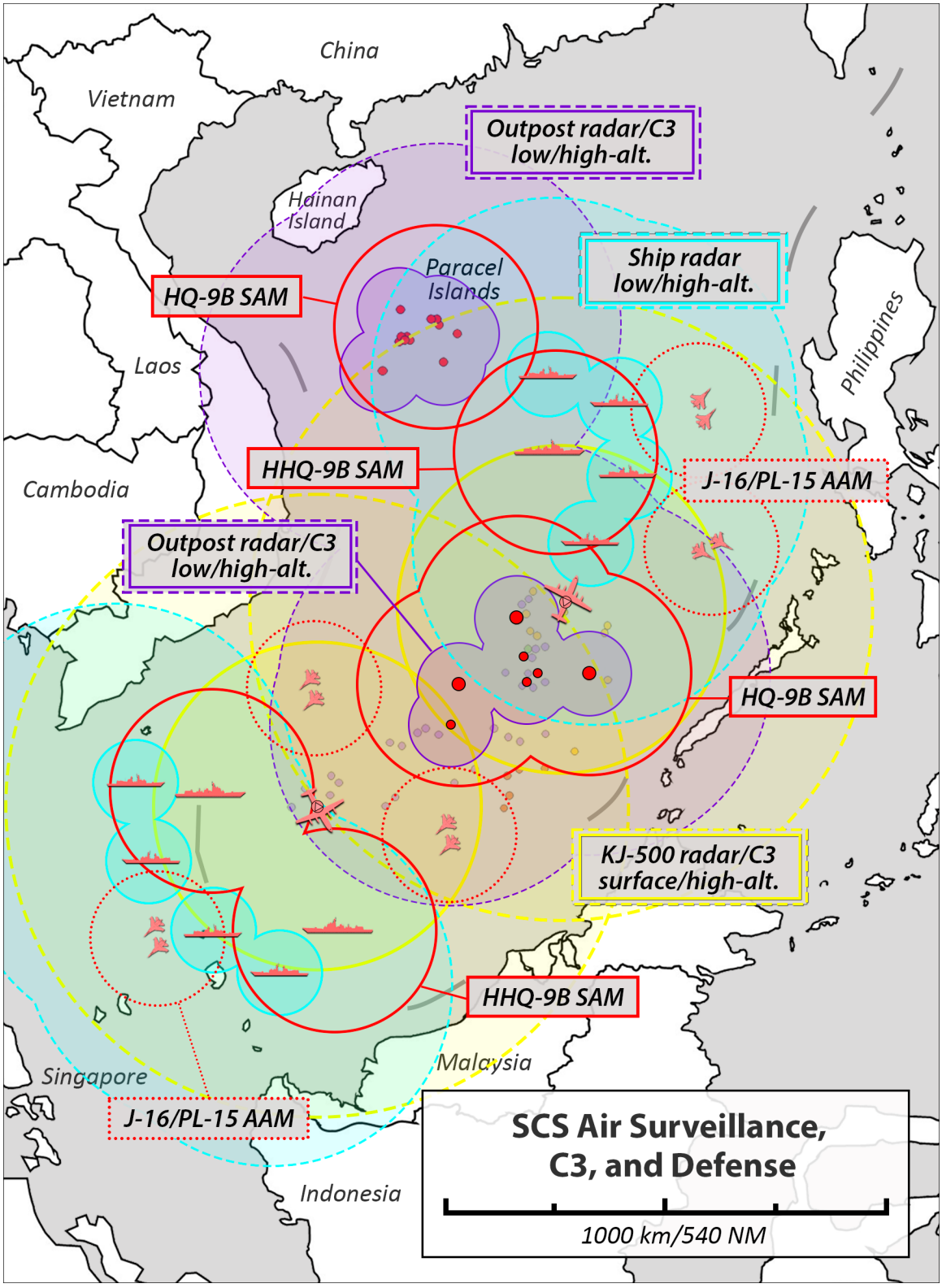


Figure 35. SCS Air Surveillance, C3, and Defense

These air-defense graphics depict surface-/ground-based radar line-of-sight ranges to targets at low altitude (300 meters/984 feet out to 93 kilometers/50 nautical miles) and high altitude (10,000 meters/32,808 feet out to 400 kilometers/ 216 nautical miles). AEW&C aircraft flying at 7,600 meters (25,000 feet) have radar line of sight to surface contacts or low-flying targets out to 360 kilometers (194 nautical miles). These line-of-sight calculations are representative of potential ISR coverage and do not account for factors such as radar power, attenuation, or the low-observable properties of targets. HQ-9B high-altitude engagement ranges are depicted at 225 kilometers (121 nautical miles), 75 percent of advertised maximum range. PL-15 AAM ranges are shown at 150 kilometers (81 nautical miles).

Networking the Chinese outposts with naval forces deployed from mainland bases significantly enhances the PLA's air-defense capabilities in the SCS. Figure 35 also depicts a relatively small number of PLAN ships. These task forces are centered on a larger, air-defense-capable combatant, such as the Type-052 (*Luyang*) DDG or Type-055 (*Renhai*) CG, carrying the HHQ-9B. This valuable air-defense asset is depicted operating in EMCON without illuminating its radar but is accompanied by a mix of Type-054 (*Jiangkai*) FFGs and Type-056 (*Jiangdao*) light frigates, each with air-surveillance radars and short-range air-defense weapon systems. There would likely be several surface task forces operating in the SCS contributing to a layered air defense. The graphic's complexity provides some indication of the significance of island-reef C4ISR to managing battlespace information for PLA forces across the SCS.

Maritime Superiority. Similar to the air superiority scenario, the most significant contribution to gaining and maintaining maritime superiority is from C4ISR assets deployed to China's SCS island-reefs. KJ-500s provide airborne C3 for maritime operations. KQ-200 MARPAT/ASW aircraft provide reconnaissance and targeting capabilities against ships and submarines and can also act as a communication and data-link relays. These fixed-wing ASW assets may drop torpedoes on suspected enemy submarine contacts or pass the contacts to PLAN ships or helicopters for target localization and prosecution. The air-defense umbrella provided by SAMs and fighters creates time and space for MARPAT and ASW missions.

Similar to the air-defense graphics, Figure 36 illustrates the relationship between PLA information-power capabilities and anti-surface kinetic weapons systems. Chinese H/LJQ-366/Mineral-ME-type over-the-horizon radar ranges will be heavily dependent on weather and surface ducting. This radar is depicted with its maximum passive detection range of 450 kilometers (243 nautical miles). MARPAT/ASW aircraft, operating at lower altitudes than the AEW&C aircraft, are depicted with surface radar ranges to 250 kilometers (130 nautical miles). Again, this graphic depicts a fraction of PLA forces that would likely be involved in an SCS conflict.

Offensive and Defensive Strike

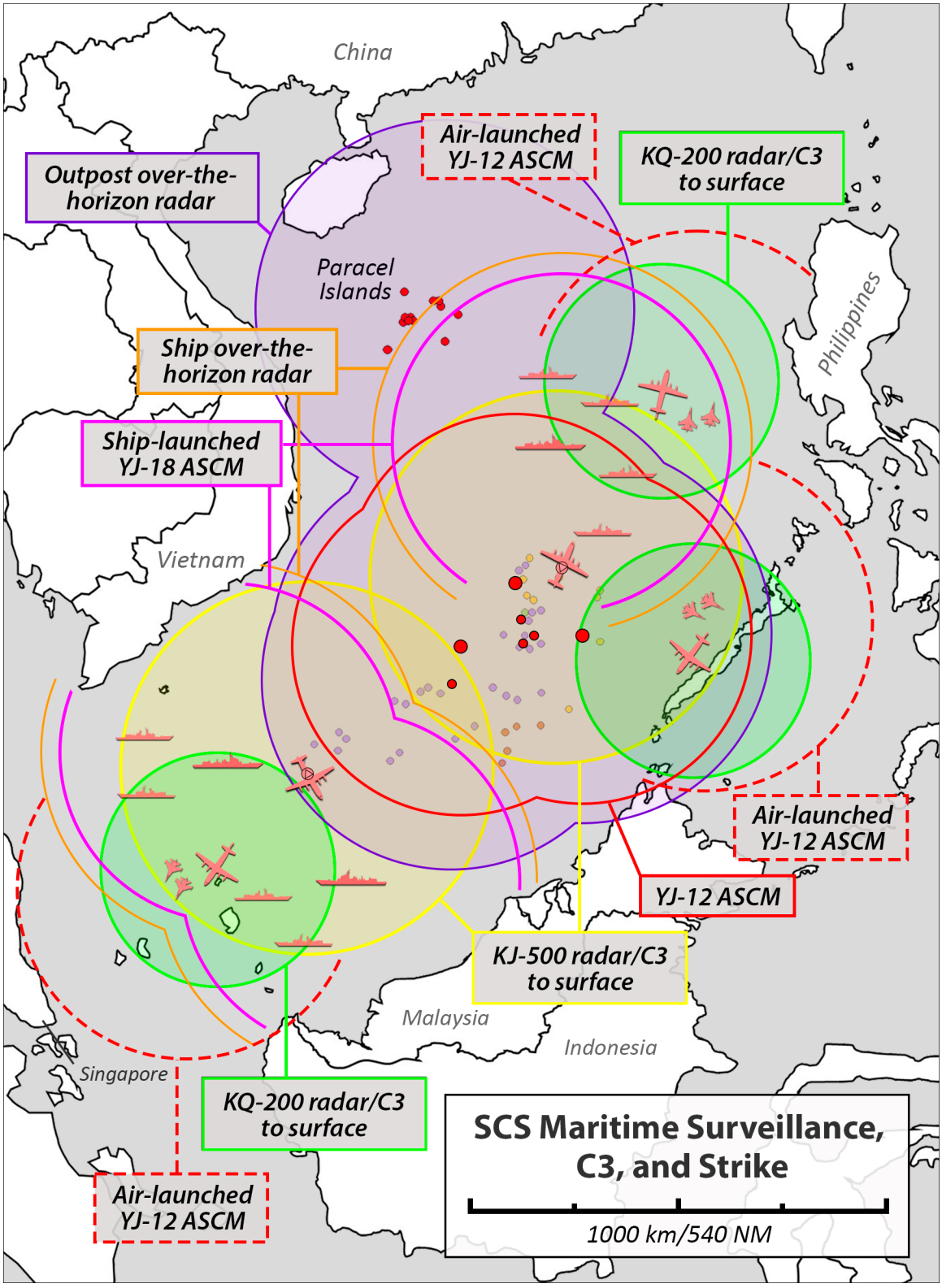


Figure 36. SCS Maritime Surveillance, C3, and Strike

While this study focused on the information-power capabilities on China's SCS island-reefs, space-based ISR will also play an important role in detecting and targeting foreign naval forces far from China's SCS outposts. The island-reefs' redundant, multipath communications capabilities ensure that space-based ISR data is integrated in the overall SCS intelligence plot. Enemy ship or submarine track data may be passed over a LPI data link or similar communications to firing platforms.

Land-based YJ-12 ASCMs reportedly deployed to China's Spratly island-reefs are depicted in Figure 36 with ranges out to 400 kilometers (216 nautical miles) or 75 percent of its reported 500-kilometer maximum range. Again, networking deployed naval forces may significantly enhance the PLA's maritime strike capabilities in the SCS. Figure 36 depicts the same naval task force shown in the air-defense graphic. The larger combatant at the center of the task force can fire long-range ASCMs, such as the YJ-18, depicted at 75 percent of maximum range (400 kilometers/216 nautical miles). The YJ-18 may also be launched from submarines operating in the SCS. Range rings for aircraft-launched YJ-12 ASCMs are also depicted at 75 percent of maximum range (400 kilometers/216 nautical miles).

Naval Base Defense

Island-reef base commanders will be responsible for executing a naval base defense campaign concurrent with the offensive campaigns to seize island-reefs and attacks on enemy air and naval forces. The infrastructure on the island-reefs is hardened and built to withstand an attack. At the most basic level of survivability, the large Chinese island-reefs provide triple redundancy, each replicating most of the capabilities of the other two. Hardening measures on each outpost include an underground bunker complex, buried fuel and water tanks, buried telecommunications lines, buried power cables, and an underground fuel distribution network. For more information, see the SCS MILCAP study, "Hardened Infrastructure, Counter-Reconnaissance, and Battle-space Environmental Management."

Even if many sensing and communications pathways are eliminated by enemy attacks, the SCS information system-of-systems will likely retain the C4ISR necessary to continue coordinated PLA operations. The Chinese island-reefs' ISR, EW, and communications networks adhere to the informationized warfare directive to build and operate diverse, redundant, and layered information-power capabilities. Survivable, multipath communications connect the Chinese island-reefs with the mainland; inter-island communications are even more diverse. Layers of both active and passive ISR exploit a range of phenomenologies to sense the battlespace, detect adversary forces, and guide PLA weapons systems. Redundant means of navigation,

combined with persistent metrology and hydrology, further enhance the PLA base's ability to operate with a defensible "home-field advantage" deep in the SCS.

The naval base defense campaign will include defending against enemy attacks by using short-range weapons systems, such as SAMs and CIWS, to shoot down missiles, manned and unmanned aircraft, and helicopters. Additionally, bases will likely execute a camouflage, concealment, and dispersal plan for critical PLA assets. Significant PLA camouflage, equipment dispersal, and the probable use of decoys moving around the massive artificial land masses will contribute to PLA battlespace information control, complicating adversary targeting and protecting PLA assets.

There is speculation about whether China can defend its territorial claims and sustain military offensive and defensive action in the SCS. Even Chinese state-owned media speculated that the SCS outposts are vulnerable to attack, seemingly downplaying their significance in supporting any SCS combat action.[50] This study demonstrated that PLA offensive actions against advancing enemy forces—attacks against enemy air and naval forces—combined with island-reef base defense capabilities appear to provide the Chinese outposts with a formidable, layered defense in depth.

Conclusions

China's informationized warfare strategy and information-centric operational concepts are central to how the PLA will generate combat power. According to Chinese military doctrine, information power—the ability to control information and deny its use to one's enemy—is more prominent than the industrial-age warfare elements of firepower or maneuver. The PLA's overarching focus on achieving battlespace information superiority as a tactical, operational, and strategic requirement cannot be overstated.

The kinetic, lethal capabilities outlined in this study are integral to PLA operational design. However, the critical, limiting factors for long-range precision weapons in the SCS are, in many cases, C4ISR enabled by the island-reefs. The combined information-power capabilities on China's SCS outposts, both kinetic and non-kinetic, will work synergistically prior to and throughout military operations to preserve the PLA's access to information in the SCS battlespace while simultaneously denying an adversary access to battlespace information.

[50] Kristin Huang, "Beijing's South China Sea Military Bases 'Are Vulnerable to Attack and Will Be of Little Use in a War,'" *South China Morning Post*, December 6, 2020, https://www.scmp.com/news/china/military/article/3112419/beijings-south-china-sea-military-bases-are-vulnerable-attack.

Offensive and Defensive Strike

The ten publications in this SCS military capabilities series reveal an emphasis on information-power capabilities and the role of China's island-reef bases as information hard points. Information-power capabilities include reliable, secure C4; robust, layered ISR; battlespace environmental monitoring; and counter-reconnaissance; in addition to the significant interference and destruction capabilities outlined in this study. These capabilities represent the terrestrial segment of an integrated information system-of-systems and reflect the PLA's informationized warfare strategy. Figure 37 conceptualizes the synergies created by capabilities on the PLA outposts to achieve information superiority. The operational effects generated by China's SCS outposts are greater than the sum of individual capabilities. The networked kinetic and non-kinetic capabilities generate synergies to preserve PLA access to information while creating compounding effects to deny an adversary access to information.

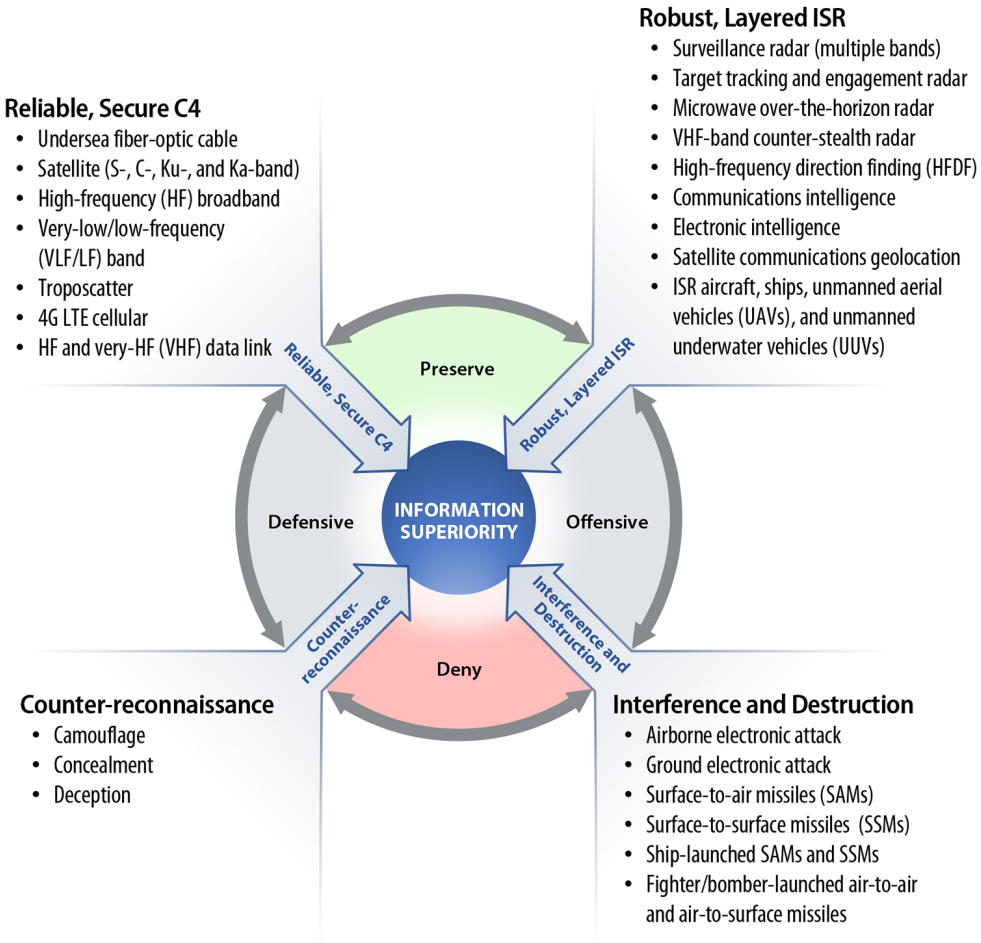


Figure 37. Synergies from Information Power Capabilities on China's SCS Outposts

An examination of infrastructure on the three largest PLA outposts reveals facilities for interference and destruction capabilities, including CIWS, SAMs, SSMs/ASCMs, large aircraft, fighter-sized aircraft, and helicopters. The PLA has a wide variety of road-mobile C4ISR, EW, and weapons systems. The island-reef bases are large enough that virtually any type of PLA mobile system could be quickly deployed to the Chinese outposts, depending on operational needs.

This study demonstrated that Island-reef-based offensive and defensive strike capabilities are complementary to, not independent of, other PLA strike capabilities in and around the SCS. A mass of PLA naval combatants can generate significantly more firepower than the island-reefs. The island-reefs function principally as information hubs, providing C4ISR to enable air and maritime operations throughout the SCS and deeper into Southeast Asia. SAMs, ASCMs, and many of the fighter aircraft deployed to the outposts will be employed to defend China's island-reefs from attack, with a secondary mission of power projection.

The island-reefs' most significant offensive and defensive strike capabilities are likely the aircraft deployed to the island-reef airfields. Fighter aircraft provide long-range air defense for the island-reefs and air cover for PLAN surface ships operating in the region. Chinese island-reef airfields will also likely play a key role in PLAN aircraft carrier operations in the SCS, especially in terms of providing a base for large C4ISR aircraft that cannot currently be accommodated by PLAN aircraft carriers. Special mission aircraft based on the island-reefs may be the greatest enabler for any strike or air-defense mission conducted by PLA aircraft or ships. Airborne C4ISR launched from outpost airfields can rapidly search, relay targeting data, and coordinate combat action over most of the SCS.

The information control that the island-reefs offer shape and define virtually all PLA operations in the SCS. The persistent C4ISR and counter-C4ISR that the outposts deliver are core capabilities for any PLA military operation in the SCS, especially as it relates to asserting China's territorial claims in the disputed body of water. This study demonstrated that the island-reefs' C4ISR, basing, and logistics capabilities address virtually all of the C4ISR shortcomings identified in Chinese military doctrine related to an offensive campaign to seize coral island-reefs. Assessments of offensive and defensive strike capabilities described in this study should be considered in the context of China's informationized warfare strategy to appreciate the integral relationship between PLA battlespace information control and kinetic action.

The island-reef seizure campaign used as an example in this study, the seizure of Philippine SCS outposts, highlights the importance of information control to the offensive campaign and its associated defensive campaigns. In any Chinese military

operation in the SCS, China will almost certainly start from a position of information superiority enabled by the island-reef outposts. A PLA island-reef seizure in the SCS will likely be preceded by an information blockade in which foreign military forces are prevented from collecting or transmitting information within the SCS battlespace. The PLA SCS bases' redundant, survivable C4 network enable rapidly unfolding offensive operations, with few outward indications of PLA intent. PLA command posts on the Chinese island-reefs coordinate air and naval forces in simultaneous, multi-axis attacks on foreign-held island-reefs. The entire island-reef seizure operation would likely be concluded within a matter of hours.

The PLA will anticipate foreign intervention, especially U.S. military intervention, in response to a seizure of Philippine island-reefs. Chinese operational concepts do not conceive of the PLA in a defensive crouch, waiting for intervening forces to attack. Instead, the PLA will act preemptively against foreign forces before they can launch strikes on the Chinese SCS bases or the island-reef seizure operation. These attacks on enemy air and naval forces will necessarily rely on long-range precision fires—air and missile strikes dependent on the long-range C4ISR capabilities generated by the island-reef outposts. Counter-C4ISR capabilities, including EW capabilities and multi-layered ISR that enable kinetic strikes, will simultaneously deny information to intervening enemy forces.

Persistent C4ISR and counter-C4ISR capabilities on the Chinese outposts give the PLA a decided information advantage over adversaries in the SCS, a design that likely reflects even more pronounced information-power capabilities on the Chinese mainland. Kinetic effects will remain an important component of PLA operational design. However, the critical factor in long-range precision weapons employment is, in many cases, the availability of information for surveillance, targeting, command and control, and navigation, as outlined in this SCS MILCAP series. The Chinese island-reefs extend PLA information control across the entire SCS, enabling and creating the potential for PLA offensive action in the SCS and deeper into Southeast Asia.

Appendix A. Sources and Methods

Observations and analysis of the Chinese SCS outposts in these MILCAP studies rely on commercial satellite imagery licensed to JHU/APL and collected by the Maxar/DigitalGlobe Inc. WorldView-3 satellite (see Table 3). WorldView-3 can collect images up to 30-centimeters resolution, which translates to image quality between 5.0 and 6.0 on the National Imagery Interpretation Rating Scale.[51] For these studies, software like Google Earth Pro and Adobe Photoshop were used to interpret imagery, measure features, and adjust image color and balance. These images were not subject to any special processing or proprietary enhancements.

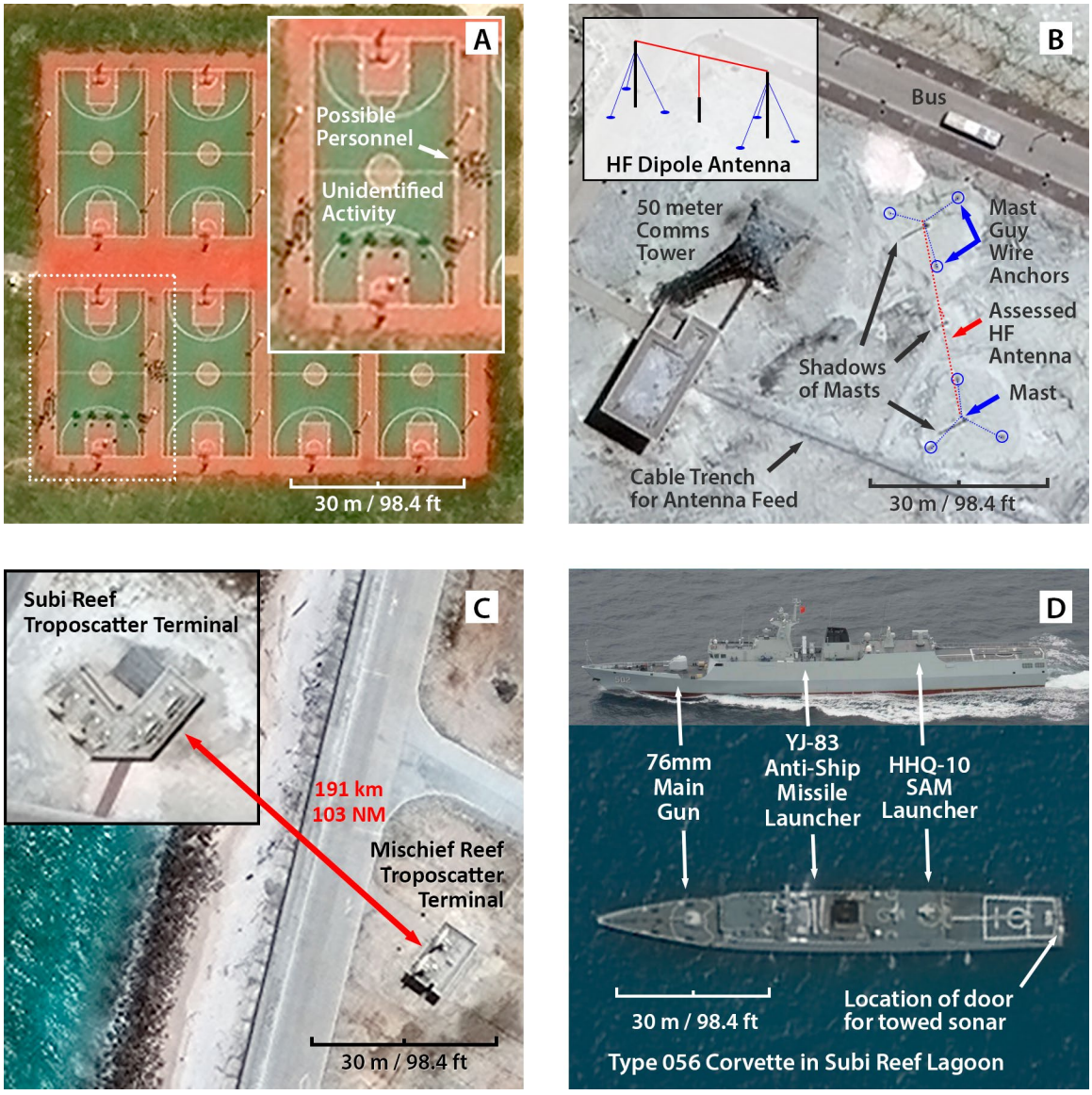
Table 3. DigitalGlobe Inc. WorldView-3 Satellite Imagery Details

Island-Reef	Location	Date	DigitalGlobe Image ID
Fiery Cross Reef	09°33′00″ N, 112°53′25″ E	June 14, 2018	104001003C49BB00
Subi Reef	10°55′22″ N, 114°05′04″ E	June 19, 2018	104001003E841300
Mischief Reef	09°54′10″ N, 115°32′13″ E	June 19, 2018	104001003D964F00

Reference images published in these studies cover hundreds of square meters, which necessarily obscures many specific features used in making assessments. Zoomed-in examples of details available in these satellite images are shown in Figure 38. The dots made up of only a few pixels in Figure 38(A) cannot be readily identified. However, their location on the basketball court leads to a conclusion that these may be personnel. As shown in Figure 38(B), observing shadows and other features may reveal structures such as a common high-frequency (HF) dipole antennae, even if the fine-gauge wires cannot be seen in the image. Shadow length may be translated into object height using satellite image metadata and simple trigonometry. Figure 38(C) is an example that indicates the likely connection between two widely separated troposcatter terminals based on antenna pointing angles. Figure 38(D) demonstrates that positive identification of detailed features may be possible with a much higher quality reference image. The PLAN Type 056 corvette in the satellite image may be an ASW variant (Type 056A) based on the light colored feature seen where the door for a towed sonar array should be located.[52]

[51] Leigh Harrington, David Blanchard, James Salacain, Stephen Smith, and Philip Amanik, *General Image Quality Equation; GIQE version 5*, (Washington, DC: National Geospatial-Intelligence Agency, 2015), https://gwg.nga.mil/ntb/baseline/docs/GIQE-5_for_Public_Release.pdf.

[52] See close-up images of the towed array door in "'Sanmenxia,' First Type 056A ASW Corvette (*Jiangdao* Class), Commissioned in Chinese Navy (PLAN)," *Navy Recognition*, November 19, 2014, accessed July 1, 2020, http://navyrecognition.com/index.php?option=com_content&view= article&id=2189.



(Images © 2021 Maxar/DigitalGlobe, Inc. Photograph of ship courtesy of Japan Self Defense Force)

Figure 38. Detailed Image Examples. (A) Mischief Reef Basketball Courts, (B) Mischief Reef HF Antenna, (C) Troposcatter Terminals, (D) Type 056 Frigate

Publicly accessible satellite imagery, available on Google Earth or from organizations like the Asia Maritime Transparency Initiative, provides historical images that may show changes to island-reef features over time. Official or semi-official Chinese sources discussing military capabilities on the SCS outposts complement imagery analysis and help qualify imagery observations. Where appropriate, these studies also reference secondary sources such as credible media reporting on China's SCS island-reefs or public U.S. government statements about PLA capabilities in the SCS.

Appendix B. South China Sea Maritime Territorial Claims

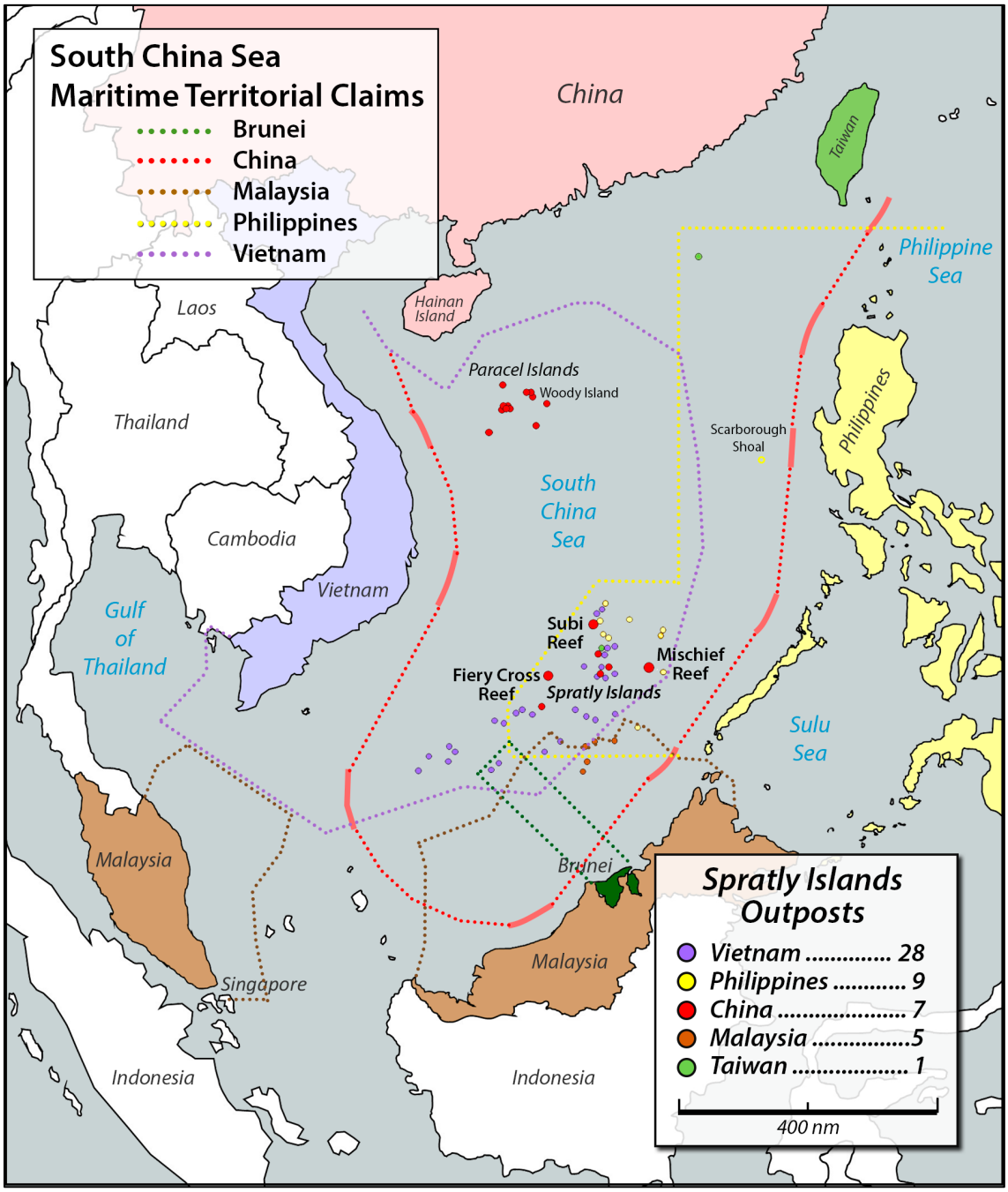
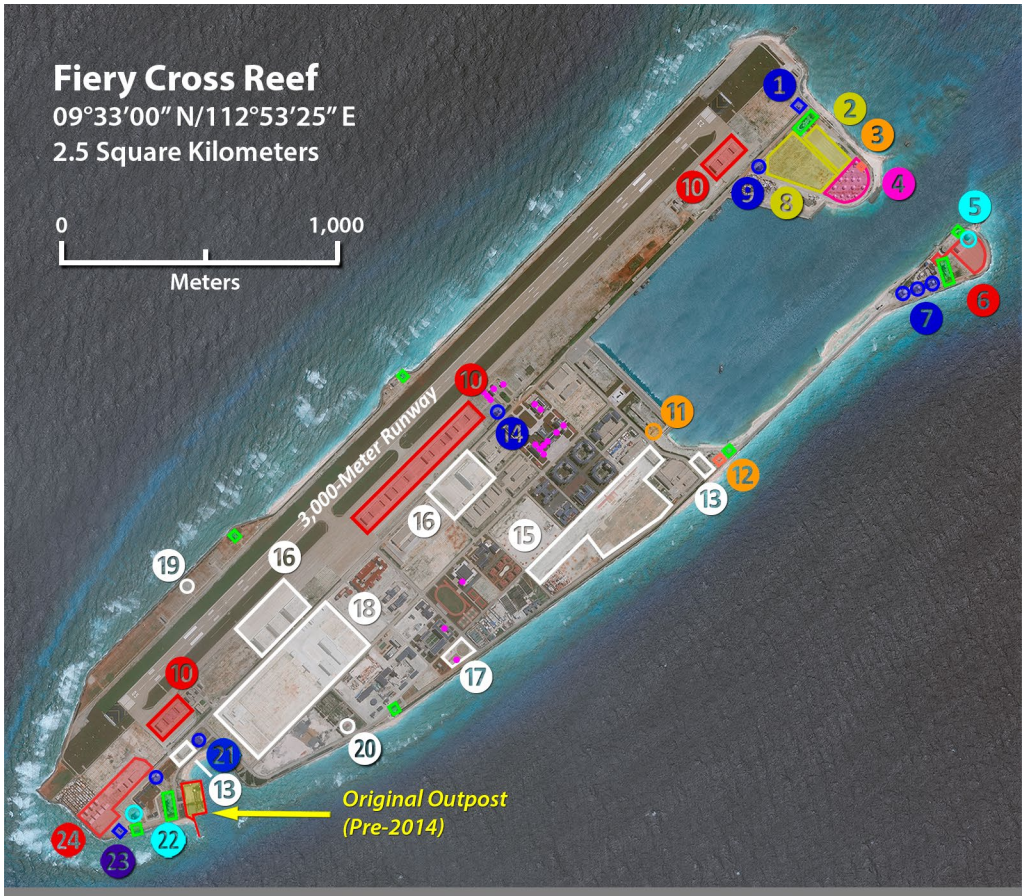


Figure 39. SCS Maritime Territorial Claims

Appendix C. Island-Reef Capabilities Overview Graphics



(Image © 2021 Maxar/DigitalGlobe, Inc.)

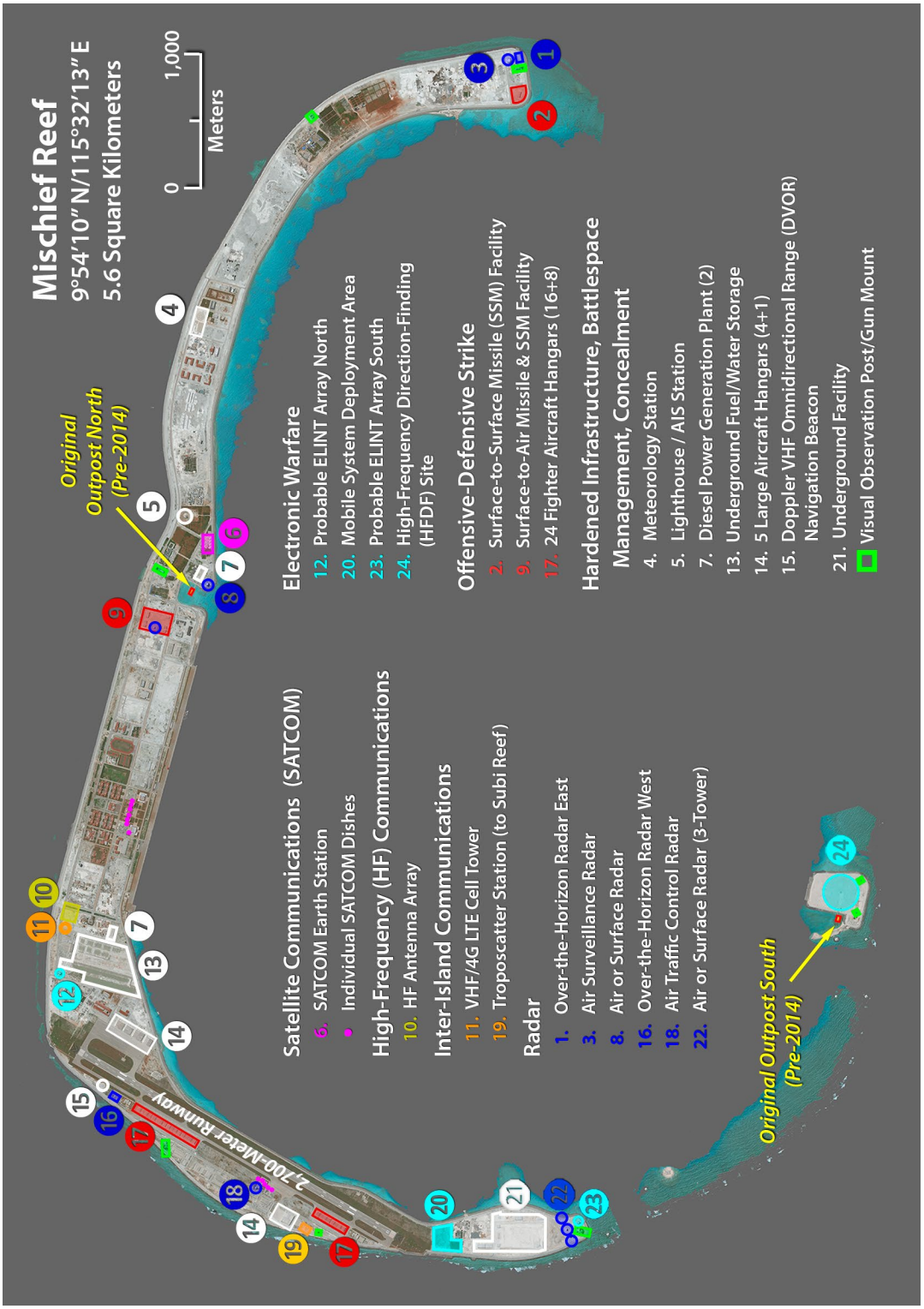
Figure 40. Fiery Cross Reef Overview

Offensive and Defensive Strike

(Image © 2021 Maxar/DigitalGlobe, Inc.)

Figure 41. Subi Reef Overview

Offensive and Defensive Strike



(Image © 2021 Maxar/DigitalGlobe, Inc.)

Figure 42. Mischief Reef Overview

Appendix D. Definitions and Abbreviations

AAM—Air-to-air missile

AEW&C—Airborne early warning and control

ASBM—Anti-ship ballistic missile

ASCM—Anti-ship cruise missile

ASW—Anti-submarine warfare

C4—Command, control, communications, and computers. Sometimes rendered C3, dropping "computers" or C2, "command and control"

C4ISR—Command, control, communications, computers, intelligence, surveillance, and reconnaissance. Sometimes C5ISR or C5ISRT, including "cyber" and "targeting"

CASIC—China Aerospace Science and Industry Corporation

CG—Guided missile cruiser

CIWS—Close-in weapon system

CV—Aircraft carrier

DCA—Defensive counter-air

DDG—Guided missile destroyer

ELINT—Electronic intelligence

EMCON—Emission control

EW—Electronic warfare

FFG—Guided missile frigate

HF—High-frequency (3-30 MHz)

HFDF—High-frequency direction finding

Information power—**信息力** (*xìnxī lì*)— A Chinese term referring to the capability of a military force to achieve information superiority, ensuring the use of information for friendly forces while simultaneously denying its use to adversary forces

Informationized warfare—**信息化作战** (*xìnxī huà zuòzhàn*)—The prevailing "form of war" (战争形态, *zhànzhēng xíngtài*) in Chinese military theory

Island-reef—岛礁 (*dǎo jiāo*)—A Chinese term for an islet or an island of sand that has built up on a reef. China's military outposts in the Spratly Island group were formerly rocks or high-tide features that do not have the international legal status of island that might otherwise define territorial waters or an exclusive economic zone

ISR—Intelligence, surveillance, and reconnaissance

LACM—Land-attack cruise missile

LCAC—Landing craft, air cushion

LPI—Low probability of intercept

LSM—Landing ship, medium

LST—Tank landing strip

MARPAT—Maritime patrol

MILCAP—Military capability

MLRS—Multiple-launch rocket system

OCA—Offensive counter-air

PLA—People's Liberation Army; Refers to the entire Chinese military

PLAA—People's Liberation Army Army (ground forces)

PLAAF—People's Liberation Army Air Force

PLAN—People's Liberation Army Navy

PLANAF—People's Liberation Army Navy Air Force

SAM—Surface-to-air missile

SIGINT—Signals Intelligence

SCS—South China Sea

SLOC—Sea line of communication

Southern Theater—One of five PLA theater commands created in the 2016 Chinese military reorganization. Area of responsibility includes southern China, Hainan Island, the SCS, and Paracel and Spratly island-reef bases

SSM—Surface-to-surface missile

TEL—Transporter-erector-launcher

Troposcatter—Troposcatter or tropospheric communications are microwave signals, generally above 500 megahertz, scattered by dust and water vapor in the atmosphere, allowing for over-the-horizon communication links

UAV—Unmanned aerial vehicle

VHF—Very-high frequency (30-300 MHz)

VLS—Vertical launch system

About the Author

J. Michael Dahm is a senior national security researcher at the Johns Hopkins University Applied Physics Laboratory where he focuses on foreign military capabilities, operational concepts, and technologies. Before joining JHU/APL, he served as a US naval intelligence officer for over 25 years. His most recent assignments included senior analyst in the USPACOM China Strategic Focus Group, assistant naval attaché at the US embassy in Beijing, China, and senior naval intelligence officer for China at the Office of Naval Intelligence.