航 空 航 天

CHINA AEROSPACE STUDIES INSTITUTE

PLA Aerospace Power:

A Primer on Trends in China's Military Air, Space, and Missile Forces

2nd Edition

Printed in the United States of America by the China Aerospace Studies Institute

ISBN: 978-1-082790-56-0

To request additional copies, please direct inquiries to:
Director, China Aerospace Studies Institute,
Air University, 55 Lemay Plaza, Montgomery, AL 36112

Graphic Design by Heisey-Grove Design

E-mail: Director@CASI-Research.ORG
Web: http://www.airuniversity.af.mil/casi
https://twitter.com/CASI_Research @CASI_Research
https://www.facebook.com/CASI.Research.Org
https://www.linkedin.com/company/11049011

Preface

The Chinese People's Liberation Army (PLA) continues to develop rapidly across all aspects, hardware, technology, personnel, and organizational structure, etc. The PLA's aerospace forces are, in many ways, leading that change. These include the PLA Air Force (PLAAF), PLA Naval Aviation, PLA Rocket Force (PLARF), and space and cyber assets affiliated with the PLA Strategic Support Force (PLASSF). This second edition from the China Aerospace Studies Institute (CASI), seeks to provide a brief primer on the trends affecting these forces and provide basic information about their composition and role today.

This publication outlines the roles and missions of China's aerospace forces, the PLAAF and its five branches, the PLARF, and the PLASSF. It also identifies trends in PLA aerospace training and operational proficiency for these forces and discusses the near-term outlook. This publication is intended to serve as foundational work, capturing a snapshot of capabilities, and an outline of organizations and key personnel, while identifying trends underway at the time of its writing in early 2019.

CASI supports the United States Defense Department and the China research community writ-large by providing high quality, unclassified research on Chinese aerospace developments in the context of U.S. strategic imperatives in the Indo-Pacific region. Primarily focused on China's Military Air, Space, and Missile Forces, CASI capitalizes on publicly available native language resources to gain insights as to how the Chinese speak to and among one another on these topics.

With this second edition, CASI continues to describe the fundamentals in the field. Further research projects will expand on the framework laid out in this primer and will both expand and deepen public knowledge of developments in Chinese aerospace. While primarily focused on developments related to the

services and branches of the PLA's aerospace assets and forces, CASI also explores topics and areas related to the support infrastructure, industrial base, and military-civil fusion, that combines together to form the overall China aerospace field.

CASI would like to acknowledge the work and effort of its Research Director, Ken Allen, and the many CASI Associates who contributed to the compilation of data, research, and writing, of this volume, including Henry Boyd, MSGT Eric Griffin, Rick Gunnell, Andreas Rupprecht, Mark Stokes, TSGT Jennifer Thurman, MAJ Catherine Tobin, Sid Trevethan, Jess Woo, and others.

We hope you will find this volume useful and timely, and welcome any feedback on its contents, or suggestions for further or future research in this field.

Dr. Brendan S. Mulvaney
Director, China Aerospace Studies Institute

Table of Contents

1. Introduction

Over the last two and a half decades, the People's Republic of China (PRC) has invested heavily in the modernization of its military forces. These efforts have yielded dramatic improvements in the personnel, organizational structure, equipment, training, doctrine, and overall proficiency of the People's Liberation Army (PLA). China's air, space, and missile forces in particular, collectively referred to here as the PLA's "aerospace forces", have transformed rapidly from a comparatively low base of capabilities in the 1990s into forces that today could pose significant challenges to any opponent. China's military leaders have observed the evolution of other nations' forces and have taken lessons from recent conflicts. They have sought to rebuild their own aerospace capabilities with these changes in mind. China seeks to modernize its aerospace forces, including weapons, equipment, personnel, and organizational structure, to support an increasingly ambitious regional security strategy that involves deterring any adversary, and, should deterrence fail, prevailing in combat.

At the start of 2016, Chinese President Xi Jinping, in his role as Chairman of the Chinese Communist Party (CCP) Central Military Commission (CMC), announced the 11th major structural reform to the PLA since 1949. Notably, Xi elevated the PLA's Second Artillery Force (PLASAF), once an independent branch of the PLA, to service-level stature on par with the three other services (Army, Navy, and Air Force) and renamed it the "PLA Rocket Force" (PLARF).[1] The PLARF has historically been charged with developing nuclear strike and counterstrike options, but its mission and capabilities have grown since the early 1990s to include carrying out conventional ballistic and cruise missile strikes.

In December 2015, Xi also established the PLA's Strategic Support Force (PLASSF), which is not its own service, to provide the PLA with cyber, aerospace,

and electronic warfare (EW) capabilities which enables cross-domain synergy in "strategic frontiers."[2] The PLASSF forms the core of China's information warfare force, supports the entire PLA, and reports directly to the CMC. According to a Ministry of National Defense[3] spokesman, "The PLASSF will integrate reconnaissance, early warning, communications, command, control, [and] navigation…and will provide strong support for joint operations for each military service and branch."[4] The PLASSF may also be responsible for research, development, testing, and fielding of certain "new concept" weapons, such as directed energy and kinetic energy weapons. The PLASSF's space function is primarily focused on satellite launch and operation to support PLA reconnaissance,navigation, and communication requirements. The PLASSF may also be charged with developing counter-space capabilities.

President Xi has also stressed the importance of continuing to modernize the PLA Air Force. Xi seeks to "accelerate the construction of a powerful people's air force that integrates air and space and is simultaneously prepared for offensive and defensive operations."[5] The PLAAF, accordingly, is now expected to undertake an expanded set of missions beyond defending Chinese territorial airspace to include

CMC Chairman Xi Jinping chairs ceremony creating the 5 Theater Commands in Beijing in February 2016[6]

launching offensive operations against enemy assets at distances beyond the first island chain. The PLAAF also fields a robust surface-to-air missile (SAM) capability to defend Chinese airspace. In addition, the PLAAF is expected to improve its capabilities to participate in military operations other than war (MOOTW), such as humanitarian assistance and disaster relief (HA/DR) and non-combatant evacuation operations (NEOs). As a result, according to the PLAAF's spokesperson, "In recent years, advanced fighters, large transport aircraft, airborne early warning aircraft, tankers, advanced SAMs and other high-tech weapons and equipment with world-class advanced levels have been installed, and the capabilities of expeditionary operations and information systems-based systems have been significantly enhanced."[7]

In short, as China's interest and capabilities in power projection grow, PLA aerospace power will play an increasingly important role in fulfilling PLA efforts to protect increasingly expansive Chinese interests abroad.

2. Roles and Missions of China's Aerospace Forces

China's Security Objectives

According to the PRC's 2002 Defense White Paper, China defines "armed forces" as including the PLA (which is the armed wing of the Chinese Communist Party (CCP)), the People's Armed Police (PAP) (which was recently subordinated to the CCP's CMC), and reserves and militia. Like most armed forces, those of the CCP and PRC are charged with the responsibility for protecting China's sovereignty and territorial integrity, in the face of potential external threats. The collapse of the Soviet Union in 1991 prompted the CCP's military leaders to turn their focus to the United States as the greatest potential military foe facing China in the future. The performance of United States (U.S.) forces in Operation Desert Storm (1991), the Taiwan Strait Crisis (1996), Operation Allied Force (1999), and other large-scale operations, convinced Chinese planners that the challenges posed by the U.S. were serious and that meeting them would require substantial and sustained investments. The CMC has focused its efforts on modern air, space, and missile forces; advanced command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) assets with a heavy emphasis on coordination at the same level among the services and branches; sophisticated training and doctrine; and an educated and well-trained enlisted force and officer corps.

As a result, China has been rapidly developing military capabilities that are designed to deter, deny, and ultimately defeat U.S. and other military forces in any security dispute that might occur in its region. Chief among these is Taiwan, which has been a key driver of Chinese military modernization generally and aerospace forces in particular for more than two decades, but China also considers conflicts that might arise out of sovereignty disputes in the East China Sea and South China Sea in its military calculations.[8]

China is increasing its capabilities to operate in the East China Sea or "first island chain" and the South China Sea

China also looks to its growing military capabilities to be agents of influence in East Asia and beyond. China's leaders have vowed to build "powerful armed forces that are commensurate with China's international standing."[9] This entails military forces with strategic and power projection capabilities, stretching well beyond China's immediate neighborhood. China has been employing these expanding capabilities in missions that include protection of China's sea lines of communication (SLOCs) as well as counter-piracy and HA/DR activities around the world.

Chinese Military Strategy and Doctrine

Chinese warfighting doctrine has remained remarkably consistent in some ways since the establishment of the PLA in 1949, even as it has evolved to keep pace with changes in military technology, an evolving security environment, and China's expanding interests. This is because every Chinese leader has been faced with the same basic challenge of defending China against formidable opponents on its periphery. Indeed, China has long had to find ways to overcome its "inferiority in the material means of war"[10] when competing with the likes of U.S., Russian, or Japanese military forces. As a result, Chinese leaders starting with Mao Zedong have consistently endorsed a defensive approach to conflict prevention. To be sure, China emphasizes that it retains the right to respond with offensive operations if

attacked. Mao, in fact, first coined the term "Active Defense (积极防御)" in 1936, a concept that has maintained relevance today as evidenced by China's defense white paper in 2015 which dedicated an entire section to this approach.[11]

Another critical aspect of Chinese warfighting doctrine is China's perception of technology and the role it plays in military capabilities. Beginning in 1979 during the reform and opening up period under Deng Xiaoping's leadership, China moved away from Mao's concept of "People's War (人民战争)," which emphasized manpower over mechanization, toward a greater appreciation of the need to develop modern combat capabilities. The revised concept, "People's War under Modern Conditions (现代条件下的人民战争)," remained the PLA's guiding principle until the early 1990s when China witnessed advanced capabilities on display by the U.S. military during Operation Desert Storm, in particular, the use of superior information about the battlespace and precision-guided munitions (PGMs) as key components of modern warfare. These concerns over superior U.S. warfighting capabilities prompted China's military leaders to shift Chinese military strategy again.

Starting in 1993, Chinese President and CMC Chairman Jiang Zemin advocated that the PLA "prepare for military struggle and winning local wars that might occur under modern, especially high-technology conditions."[12] This was a major change that prioritized advanced weaponry and recognized the importance of "winning" rather than just "fighting" in any conflict that might occur near China's border. Jiang's statement was modified further in 2004, under President and CMC Chairman Hu Jintao's leadership, to read: "we must clearly place the basis of preparations for military struggle on winning local wars under the conditions of informatization."[13] With this statement, China affirmed that network-centric warfare, i.e. "informatization," had become a central feature of modern military operations and asserted that China's military forces must account for informatized war in future conflict scenarios.

The latest revision to Chinese doctrine goes a step further by dropping "… under the conditions of informatization" to emphasize that China must focus on "winning informatized local wars." This change suggests that China now views information dominance as essential to victory in modern warfare. This is particularly true for operations in the air and space domains due to the rapid pace of such operations and their information-intensive nature.[14]

PLA Concepts of Operations

Understanding how China's military leaders intend to fight a future conflict is key to appreciating what motivates the development of China's military forces. This section highlights the manner in which it is believed the PLA would plan to employ its aerospace forces in future military campaigns.[15] These include the Joint Firepower Strike, Air Defense, Air Offensive, Air Blockade, Airborne, and Nuclear Counterstrike Campaigns. Notably, although the PLA does not have an officially codified "counter-intervention" campaign, it emphasizes the ability of PLA aerospace forces to quickly seize the initiative and strike at the enemy's forces from a distance in order to ensure the enemy will be unable to prevent the PLA from achieving its objectives.

Joint Fire Strike Campaign

The PLA's concept of a Joint Fire Strike Campaign, which is the cornerstone of Chinese military planning for future war, centers on a Taiwan scenario, calls for large-scale air and missile strikes against Taiwan and against U.S. forces and bases in the region.[16] The objective is to weaken defenses, either to create favorable conditions for subsequent campaigns, or in preparation for an amphibious invasion of the island. Chinese military academics have described the Joint Fire Strike Campaign as being comprised of an "integrated fire assault offensive campaign undertaken against key enemy targets…to destroy, sabotage key enemy targets, paralyze enemy's operations system, undermine the enemy's will to resist, and weaken the enemy's capacity for war."[17] It is notable that in recent years, the PLA seems to have reduced its level of public commentary on this campaign, perhaps due to its sensitive nature.

PLA air and missile assets provide the bulk of the long-range precision strike capabilities needed to carry out the Joint Fire Strike Campaign. Chinese military commentators have noted that conventionally-armed ballistic and cruise missiles would be employed to strike targets that other types of weapons are unable to reach. They state that conventional ballistic missile attacks, carried out by the PLARF, would primarily be aimed at "the enemy's surveillance/early warning systems, electronic warfare systems, air defense/ anti-missile formations, air troop bases and other targets."[18] PLA commentators have noted that the PLARF "serves as an important force for the PLA's implementation of long-range conventional strikes, possessing special functions for which there are no substitutes."[19] China is developing and fielding systems to hold at risk enemy platforms and bases as far away as Guam, or approximately 3,000 kilometers from China's shores.[20]

PLA writings emphasize the need for "joint strikes by multiple services and aircraft types, long-range air raids, and beyond-defense-area ('standoff") strikes."[21] Missile strikes such as these can have a crippling effect on the ability of an opposing force to deploy to a region of conflict, perhaps creating a "window" of opportunity in which Chinese forces could accomplish their mission relatively free of interference.

"Informatization" is another essential component of the Joint Fire Strike Campaign.[22] The PLA seeks to use intelligence derived from space-based assets to enhance the effectiveness of joint warfare capabilities at the strategic, campaign, and tactical levels.[23] The PLA's emphasis on informatization is also leading to investments in command and control (C2) systems that enable secure and reliable communications even when under attack.

Air Defense Campaign

The mission most familiar to the PLAAF is the air defense campaign, a primary focus since the service's establishment in 1949. Indeed, because of Chinese perceptions of military inferiority dating back to the Mao era, air defense has taken on an outsized role within PLA military strategy.[24] As mentioned above, Chinese doctrine increasingly advocates an Active Defense-style approach, whereby the PLAAF not only protects Chinese territorial airspace but also targets and destroys enemy aircraft on the ground as well as the facilities and support infrastructure needed for conducting air operations. PLAAF planning appears to give special priority to protecting the Beijing region, as well as coastal areas, from enemy air attacks.[25] As currently conceived, air defense campaigns are typically organized geographically and employ layered defenses of fighterinterceptor aircraft, as well as long- and shorter-range SAM systems to provide defense in-depth. In the past, the PLAAF had a robust antiaircraft artillery (AAA) component, but this appears to be gradually being abolished.

Air Offensive Campaign

Alternatively known as the "air strike" or "air raid" campaign, the PLAAF's conceptualization of an air offensive campaign mainly entails air-to-ground attacks against military formations, supply and transportation lines, and political, economic, or other military targets.[26] Such a campaign can occur either independently or jointly as part of a larger military operation. China is increasingly pursuing capabilities tailored to a "strategic air force" that would allow it to conduct offensive operations "over longer distances using intensive firepower against an enemy in strikes deep in its territory."[27]

Air Blockade Campaign

Designed specifically with the goal of coercing Taiwan, an air blockade campaign would seek to attack Taiwan's airfields and interdict air and maritime traffic to and from the island. Air blockades are described as "often carried out simultaneously with ground and maritime blockade missions," as part of the canonical Joint Blockade Campaign or as part of a larger Joint Island Landing Campaign.[28] These operations may include bombings, strikes, laying mines, and air combat.[29] The PLARF would also have a role in weakening Taiwan's air defenses to create the more permissive air environment needed for sustained PLAAF patrols.

Airborne Campaign

Airborne campaigns seek to parachute troops in behind enemy lines, either in support of joint operations or on independent missions.[30] Once inserted, airborne forces, which are subordinate to part of the PLA Air Force, could be directed to sabotage key enemy military and economic infrastructure. PLA doctrine seems to recognize that these campaigns can be extremely difficult to carry out successfully. Airborne campaigns would require the PLAAF, for example, to carry out suppression of enemy air defenses (SEAD) before bringing in large, low-flying transport aircraft. Once on the ground, airborne forces would likely need air cover, tactical mobility, supplies, and perhaps aerial firepower support to accomplish their mission.[31]

Nuclear Counterstrike Campaign

The PLARF is responsible for Nuclear Counterstrike Campaign planning. China has for decades maintained a policy of "No First Use" of nuclear weapons, stating publicly that China would only use nuclear weapons if attacked first with nuclear weapons, though this policy could change as China's assessment of its security environment continues to evolve.[32] If China were attacked with nuclear weapons, the objective would be "to conduct a nuclear counter-attack, striking the enemy's strategic targets and weakening its war potential and strategic attack forces."[33] Overall, China's leaders appear to regard China's nuclear forces as a primary means of deterring an adversary from attacking it first and reducing the potential for conflict escalation.

3. PLA Air Force

Established as a separate service within the PLA in 1949, the PLAAF has struggled for most of its history to carve out a role and mission distinct from that of China's ground forces. In recent years, the PLAAF has embarked on a major modernization program, which includes not only weapons, but also personnel, missions, and organizational structure, due in part to China's growing ambitions and capabilities to extend China's influence abroad. Chinese leaders since the early 2000s have directed the PLAAF to transform itself into a "strategic air force" capable of undertaking operations beyond territorial point and area air defense to encompass all-weather, day/night offensive operations, including air-to-air combat, surface attack, transport, intelligence, C4ISR, and electronic warfare (EW). By honing these capabilities, China seeks to train and equip a modern air force that can deter, coerce, delay, and defeat any adversary within the first island chain. The PLAAF currently has about 395,000 personnel.[34]

PLAAF Reforms

In late November 2015, at the CMC's Work Conference on Reform, Xi Jinping announced changes to the organizational structure of the PLA, including changes to the PLAAF.[35] These changes, which were formally implemented in January 2016, included reforms at the service's Headquarters (HQ), the shift from seven Military Regions (MRs) (Shenyang, Beijing, Lanzhou, Jinan, Nanjing, Guangzhou, and Chengdu) to five Theater Commands (TCs) (Eastern, Southern, Western, Northern, and Central), and their accompanying Theater Command Air Forces (TCAF), and many other organizational changes from the corps- to regiment-level. The focus during 2016 was on "above the neck", i.e. above the corps level, organizations, while 2017 focused on "below the neck", i.e. corps and

below. For the PLAAF, there was particular focus in 2017 on the formation of new fighter, fighter-bomber, and ground attack air brigades. These changes took place at the same time the PLA reduced its overall force by 300,000 personnel, half of which were officers.

In addition, Xi declared that a three-tier combat command system from the CMC to the 5 TC HQ to the units (e.g., corps, divisions, brigades, and regiments) would be created.[36] But this system would be separate from the administrative chain of command which now runs from the CMC to the four service headquarters, i.e. PLA Army (PLAA), PLA Navy (PLAN), PLAAF, and PLARF, to the units. Under this new system, service headquarters are responsible for "force building" functions, such as organizing, manning, and equipping units, while the TCs are responsible for operational command. However, the PLAAF HQ still has command over directly subordinate units, such as special mission (intelligence, surveillance, and reconnaissance) aviation units, one transport division, one transport and search and rescue brigade, and the airborne corps. Furthermore, the CMC itself has been reorganized, and, since the 19th Party Congress in October 2017, no longer includes any of the service commanders as members, who were first added as members in 2004.

One of the driving goals of this reorganization and reform was to make the PLA more "joint", which refers to two or more services. The PRC has realized that the key to having a modern military and winning battles in today's world is having the ability to operate all of its forces together in a cohesive manner. The drive toward jointness includes personnel from each service, organizations, and relationships, as well as physical and technical capabilities. This is the start of a long and challenging process, and there is a lot of ground for the PLA to cover when compared to advanced western militaries, but we have already seen the outlines of plans and training which will underpin this effort.

Organizationally, this means a focus on less stove-piping of organizations, and services more capable of interoperability during combat operations. The PLA created a Theater Command Army (TCA) HQ in each TC, a TC Navy (TCN) HQ in the three relevant TCs, and a TC Air Force (TCAF) HQ in each TC; however, at this time there are no TC Rocket Force HQ, since all PLARF units are still directly subordinate to the CMC, largely because of the PLARF's nuclear mission. Nor at this point are there Theater Command Strategic Support Force HQ, likely because the PLASSF is directly subordinate to the CMC. There are indications that both the PLASSF and PLARF maintain permanent positions within the TC structure, and that during operations the TC's may exercise some

command and/or control over at least the conventional assets within their theater.

The five Theater Command HQs have become truly jointly staffed organizations, such that, of the five TC commanders, there are three from the PLAA (Eastern, Western, and Northern TC), one from the PLAN (Southern TC), and one from the PLAAF (Central TC). In addition, each TC HQ has one permanent PLAA, PLAN, and PLAAF Deputy Commander. To add further to this drive toward jointness, the Joint Operations Command Centers now have permanent staff officers from all four services, including PLARF. Additionally, each TC Army, TC Navy, and TC Air Force Commander serves as a concurrent TC Deputy Commander and each TC Army, TC Navy, and TC Air Force Political Commissar (PC) serves as a concurrent TC Deputy PC.

Another component of the downsizing is that, at least in some of the TCs, one of the Deputy Commanders now also serves as a concurrent Chief of Staff, and one of the Deputy PCs is the concurrent director of the Political Work Department (PWD). This is not a new phenomenon, as this has happened in the past, because the Deputy Commanders, Deputy PCs, Chief of Staff, and Director of the PWD all have the same grade[i], but it is a way to reduce manning requirements. This is the PLA's first step in attempting to meet the challenges of transforming from a ground force-dominated military, to a more modern joint force. While the PLA lacks much practical experience, we can expect that it will continue to learn from other militaries which have been actively engaged in combat operations and continue to produce a slew of documents that detail the benefits and challenges of operating in a joint, and indeed combined, environment. In the future one would expect to see an increasing degree of jointness, interoperability, and integration, which will likely, though not necessarily, portend a relative decrease in the ground forces.

However, challenges and institutional inertia remain. Prior to the reorganization, the CMC's Four General Departments (General Staff Department, General Political Department, General Logistics Department, and General Armament Department) served primarily as the Army HQ and secondarily as the Joint HQ and were dominated by Army officers;[37] however, as part of the reorganization, the CMC created a new PLA Army (PLAA) HQ that took over all pure Army-related responsibilities for manning, equipping, and training the ground forces. It also created 15 CMC organizations[ii] to replace the former Four

i In the PLA, the grade determines the level of responsibility and authority, not the rank. For further details see: Appendix 1.

ii Organizations are listed below in protocol order but they range in grade from CMC Member (JSD and PWD) to corps leader (Audit Office)

General Departments, and are responsible for all joint operations; however, they are still dominated by Army officers.

1. General Office (办公厅)
2. Joint Staff Department (联合参谋部)
3. Political Work Department (政治工作部/ 政工部)
4. Logistic Support Department (后勤保障部)
5. Equipment Development Department (装备发展部)
6. Training Management Department (aka Training and Administration Department) (训练管理部)
7. National Defense Mobilization Department (国防动员部)
8. Discipline Inspection Commission (纪律检查委员会)
9. Politics and Law Commission (政法委员会)
10. Science and Technology Commission (科学技术委员会)
11. Office for Strategic Planning (战略规划办公室)
12. Office for Reform and Organizational Structure (军委改革和编制办公室)
13. Office for International Military Cooperation (国际军事合作办公室)
14. Audit Office (审计署)
15. Agency for Offices Administration (机关事务管理总局).

Across all 15 CMC organizations, the only two PLAAF officers to hold any leadership billets include Lieutenant General An Zhaoqing, who is the Political Commissar of the Equipment Development Department and Lieutenant General Chang Dingqiu, who is one of the Deputy Chiefs of the Joint Staff Department.[iii] The pace at which these positions begin to change hands, reflecting the push toward jointness, will be a telling signal for just how serious the senior PLA leadership is. Until the CMC and the very top echelons of the PLA reform their mindset and accept the fundamental requirements of jointness, we can expect that lower echelons of command will continue to progress slowly and cautiously.

As for the PLAAF specifically, many of the current changes are being driven by the PLAAF's 2004 strategy, "Integrated Air and Space and Simultaneously Prepare for Offensive and Defensive Operations", and its goal of creating a "strategic air force".[38] According to the 2013 edition of the Science of Military Strategy, "in line with the strategic requirement of building air-space capabilities

iii Although the PLA began assigning a permanent PLAAF officer as a Deputy Chief of the General Staff in 2004 and then as a Deputy Chief of the Joint Staff Department in 2016, that billet was empty from the time that General Yi Xiaoguang became the Commander of the Central Theater Command in October 2017 until Chang Dingqiu assumed the billet in July 2018.

and conducting offensive and defensive operations, the PLAAF will endeavor to shift its focus from territorial air defense to both defense and offense, and build an air-space defense force structure that can meet the requirements of informationized operations. The PLAAF will boost its capabilities for strategic early warning, air strike, air and missile defense, information countermeasures, airborne operations, strategic projection and comprehensive support."[39] This will continue to serve as a guiding direction for the foreseeable future, and we can expect the PLAAF to focus on these goals as it continues to change not only its organizational structure, but also its training and exercise program, and its technology and equipment acquisition process. Already, we see early evidence of this in the PLAAF in its development of the "Four Key Training Brands" and the pursuit of advanced technologies such as in unmanned aerial vehicles (UAVs), artificial intelligence (AI), and hypersonics, to name a few.[40]

Structurally, to support the 2004 strategy and the 2016 reforms, the PLAAF has reorganized and downsized its service headquarters, along with each TCAF HQ. The PLAAF has also upgraded several more air regiments to brigades; abolished several air division headquarters; upgraded all of its airborne regiments to brigades; and abolished the airborne division headquarters.[41] In late 2011, the PLAAF abolished at least four air-division headquarters, created four corps deputy-leader-grade Bases[iv] (Dalian, Nanning, Shanghai and Urumqi) from existing Command Posts, and upgraded about 15 regiments to brigades and subordinated them under the four Bases.[42] Each Base is responsible for C2 of the air brigades, SAM, AAA, and radar units in their AOR. They also coordinate with PLAA and PLAN units in their AOR for joint training. This situation did not change until early 2017 when the PLAAF created several more fighter, fighter-bomber, and ground attack brigades from existing regiments, such that no more fighter, fighter-bomber, and ground attack regiments exist. The PLAAF also abolished the relevant air division headquarters, and created at least seven more corps deputy leader-grade Bases from existing corps deputy leader- and divisions leader-grade Command Posts and two former MRAF HQ.[43] Specifically, the former Lanzhou and Jinan MRAF HQ were downgraded and renamed Bases, and the former Wuhan, Lhasa, Kunming, Datong, and Fuzhou command posts were renamed Bases. Each Base is now subordinate to their respective TCAF HQ.[44] In addition, in late 2017, at least two of the Bases – Lhasa and Fuzhou—were renamed Air Defense Bases (空防基地)[v] and participated in the Red Sword

iv The PLA uses the term "Base" and "Command Post" to denote an actual command organization, not simply a physical location. For the purposes of this paper, when the term Base and Command Post are capitalized, it refers to an organizational structure; when it is not capitalized, it refers to a physical location.

v They have also been identified as regional air defense bases (区域空防基地).

2017 and 2018 exercises.[45] The new Air Defense Bases have also been given the responsibility for conducting direct C2 for each subordinate unit, which implies that previously the C2 went directly from the TCAF/MRAF HQ to the relevant units.[46] As such, the PLAAF will most likely rename the remaining Bases as well in the near future.

The PLAAF is the largest air force in the region and the third largest in the world, with more than 2,500 total aircraft (not including UAVs or trainers) and 1,700 combat aircraft including fighters, fighter-bombers, strategic bombers, tactical bombers, and multi-mission tactical and ground attack aircraft.[47]

According to the International Institute for Strategic Studies" (IISS) 2019 Military Balance report, the PLAAF has the following types and numbers of aircraft, as well as 53 helicopters:[48]

- Fighters: 759
- Fighter-bomber/ground attack: 702
- Bombers: 172
- Transports: 335
- Tankers: 13

Concerning the first three types (combat aircraft), 47% are modern and 53% are legacy models.

Though numerically impressive, only approximately one-third of the PLAAF's total aircraft, and only 20 percent of its fighter aircraft, today are considered fully modern by Western standards.[vi] The PLAAF, however, has embarked on an ambitious effort to systematically replace obsolescent second- and third-generation fighter-interceptors that lack beyond-visual-range (BVR) capability, advanced radars, and EW with fourth- and 4.5-generation multi-role fighters and fighter-bombers.[49] The PLAAF is closing the gap with Western air forces across a broad spectrum of capabilities, such as aircraft performance, C2, and electronic warfare.

vi The Primer uses the term "generation" here as understood in the U.S. system. The Chinese use a different definition of generation for aircraft and recognize only three generations (first-generation (deployed in 1950s and 1960s), second-generation (deployed in 1970s and 1980s), and third-generation (deployed in 1990s and 2000s). Thus, for instance, U.S. third generation aircraft equals the PRC's second generation. U.S. second generation equals the PRC's first generation, etc.

DIA China Military Power, p. 86

Fourth-generation fighter aircraft*—which include the Chinese J-10B/C, J-11B, and J-16—are generally characterized by the following:

- Electronically or mechanically scanned multimode radars, passive infrared search and track systems.
- "Glass" cockpits with multifunction displays (MFDs), improved heads-up display (HUD), and helmet-mounted sight (HMS).
- High-bandwidth communications and datalinks and identification, friend or foe (IFF).
- Advanced electronic warfare (EW) avionics, including digital jamming system, radar warning receiver, chaff/flare dispensers, and adaptive countermeasures.
- Engines with increased thrust and service life; advanced weapons, including long-range air-to-air missiles (AAMs), off-boresight short-range AAMs, LACMs, ASCMs, and precision-guided munitions (PGMs).
- Passive electronically scanned array or active electronically scanned array (AESA) radars. These radars provide long-range radar detection and electronically scanned radar beams that enable automatic target acquisition, tracking of multiple targets, and highly accurate targeting data for air-to-air and precision air-to-ground engagements.
- Digital radiofrequency memory (DRFM) jammers enabling instantaneous smart jamming responses by automatically selecting jamming waveforms to counter a specific radar threat—significantly improving fighter aircraft survivability.

DIA China Military Power, p. 86

Fifth-generation fighter aircraft*, including the developmental Chinese J-20 and FC-31/J-31, are commonly defined by the following state-of-the-art technologies:

- Stealthy aircraft designs with significantly reduced radar and infrared signatures.
- AESA radars.
- Long-range, multiband EO targeting systems.
- Sensor fusion.
- Advanced glass cockpits with large MFDs and HMSs.
- Advanced datalinks fusing data from air and ground networks.
- Internal carriage of off-boresight and long-range AAMs, LACMs, ASCMs, and PGMs.
- Sophisticated EW suites with advanced DRFM jammers and EO defensive systems.
- Super maneuverability and/or super cruise capability (ability to fly above Mach 1 without use of afterburner).
- Designed with network-centric warfare technology; will have potent air-to-air lethality and standoff attack capabilities in sensor-to-shooter operations.

**U.S.- defined fourth and fifth generation fighter aircraft in China.*

In addition to its fighter, fighter-bomber, and bomber force, the PLAAF fields transport aircraft, most of which are medium-sized turboprop models.[50] The PLAAF also possesses special mission aircraft capable of reconnaissance, EW, and electronic intelligence (ELINT) operations, as well as slowly transforming at least some of its airborne early warning (AEW) aircraft so that they can conduct airborne early warning and control (AEW&C) operations.[51] Separate

from fixed-wing aircraft, the PLAAF maintains and operates its own integrated air defense system (IADS). The PLAAF has one of the largest forces of advanced long-range SAM systems in the world, made up of a combination of Russian-made SA-20 (S-300PMU1/2) battalions and domestically produced CSA-9 (HQ-9) battalions.[52] In early 2018, Russia began delivering to China the S-400/ Triumf SAM system, which Beijing will use to improve its strategic air defense systems as a follow-on to the SA-20. The PLAAF may simultaneously develop its domestically produced CSA-X-19 (HQ-19) to provide the basis for a ballistic missile defense capability.

From the early 1990s until 2013, the PLAAF was organized into five branches, including aviation (航空兵), SAM (地空导弹兵), AAA (高射炮兵), radar (雷达兵), and airborne troops (空降兵), as well as five specialty units, including communications, radar, electronic countermeasures (ECM), chemical defense (nuclear, biological, and chemical), and technical reconnaissance units.[53] In 2013, the PLAAF merged its SAM and AAA branch into a single ground air defense branch (地面防空兵) and added an ECM (电子对抗) branch, for a total of five branches, including aviation, radar, and airborne.[54] While the radar branch includes over-the-horizon (OTH) radars along the eastern coast and radar stations located throughout China, the radar specialty units focus on short-range radars that are linked to aviation units. For all practical purposes, the PLAAF's AAA branch has all but disappeared and the AAA are being replaced by short-range and shoulder-fired SAMs. Whereas every former Military Region Air Force (MRAF) previously had AAA regiments, only the Eastern TCAF today has a AAA brigade; however, the airborne corps still has some AAA battalions assigned to its forces.[55]

Aviation Branch

Commonly referred to as its "primary branch," the aviation branch dominates PLAAF planning and decision-making.[56] It is responsible for operating and maintaining the full spectrum of the PLAAF's fixed-wing aircraft, including its UAVs, and rotary-wing helicopters. There are six types of fixed-wing aircraft in its inventory: fighter/ multi-role aircraft (J-class), fighter-bombers (JH-class), bombers (H-class), ground attack aircraft (Q-class), transport aircraft (Y-class), and reconnaissance aircraft (JZ-class).[57]

Historically, the PLAAF had a total of 50 air divisions, each of which typically had two subordinate operational regiments and one training regiment. In the 1980s, the training regiments were removed and merged into one Transition Training

Base for each MRAF. By the end of 2015, that number had been reduced to 25, which included 14 fighter, three bomber, three ground attack/fighter-bomber, three special mission aviation, and three transport divisions.[58] However, by mid-2018, that number had been reduced even further to a total of nine, including three bomber, three transport, and three special mission aircraft divisions.[59]

Depending on the type of missions, an air division is typically comprised of two or three operational regiments of 18-24 aircraft, each of which has subordinate battalion-level flight groups and company-level flight squadrons.[60] The reason for the reduction in fighter and fighter-bomber divisions began in December 2011, when the PLAAF revealed that it had begun creating at least 14 air brigades in the Shenyang, Lanzhou, Nanjing, and Guangzhou MRAFs by abolishing several air divisions and upgrading existing air regiments to brigades.[61] Although there was a hiatus from 2012 until around May 2017, all remaining fighter, ground attack, and fighter-bomber air divisions were abolished and their subordinate regiments were either upgraded to brigades, merged as brigades, or abolished. Some of them even changed locations. Depending on the type of airframe, each brigade, which has more than 30 airframes, has from three to five subordinate flight groups, of which one or two are transition training flight groups. Each flight group, in turn, has two to three subordinate flight squadrons with about 3-5 airframes each.

Today, all of the fighter, fighter-bomber, and ground attack brigades are subordinate to a Base, which, in turn, is subordinate to their respective TCAF HQ. However, the remaining nine air divisions are either directly subordinate to PLAAF HQ or one of the TCAF HQ.

Fighter Aircraft

The PLAAF is rapidly modernizing its fleet of fighter aircraft and retiring older, less capable aircraft. Historically, the PLAAF relied on variants of the 1950s era Soviet MiG-17 and MiG-19/J-6 aircraft as the core of its fighter aircraft fleet. In fact, up until 1995, nearly 80 percent of the PLAAF's combat aircraft were variants of these aircraft.[62] Since then, the PLAAF has retired nearly 3,500 obsolete fighter-interceptor aircraft and has systematically reduced the total number of air divisions from 50 in the 1980s to nine in 2018.

Today, despite its modernization efforts, the PLAAF remains mostly a second- and third-generation fighter aircraft force. Its J-7 and J-8 variant fighters, which are produced at Aviation Industry Corporation of China's (AVIC) Chengdu Aircraft Industry Corporation (CAC) and Shenyang Aircraft Corporation (SAC), respectively, comprise the majority of its fighter aircraft fleet. Although obsolescent

platforms by U.S. standards, the PLAAF has been incrementally updating cockpit avionics and other key components such as on-board radar systems and flight data recording systems. The PLAAF has recently added a particularly lethal capability to the J-8 by arming it with a new radar-guided "fire and forget" medium-range air-to-air missile (MRAAM).[63] Although the PLAAF still operates a large number of older second- and third-gen-eration fighters, it will probably become a majority fourth-generation force within the next several years.[64] For example, the PLAAF has fielded at least 600 fourth-generation fighters and is already developing fifth-generation fighters.

The J-7 and J-8 Fighters[65]

The PLAAF's newer multi-role fighter aircraft include the J-10, J-11A, J-11B, J-16, Su-27, and Su-30MKK. The domestically-produced single-seat J-10 is a single engine, fourth-generation multi-role fighter (i.e. air intercept and ground attack) that entered into service in 2003 and is produced at CAC. The J-10 is equipped with 11 weapon stations and appears to have navigation and targeting pods. In addition, the J-10 has an air-refueling probe which may allow the PLAAF to extend its operations beyond the first island chain. An upgraded version of the J-10, the J-10B, reportedly adds an electro-optical targeting system (EOTS), allowing pilots to detect and target enemy aircraft without using their radars.[66]

The J-10 and J-11 Fighters[67]

The PLAAF maintains several Russian Su-27SK/UBKs purchased in the early 1990s, though it has prioritized using the aircraft as the basis for its domestically-produced J-11A variant. Considered a fourth-generation air superiority aircraft, the J-11A is also outfitted with EOTS and MRAAMs. A variant of the J-11, the J-11B, appears to have entered service in 2007. It was developed to provide the J-11 with a ground attack capability. Some reports indicate the J-11B boasts a dramatically reduced radar cross-section, compared to the standard J-11.[68] In the early 2010s, SAC began producing the Shenyang J-16, which is a multi-role highly maneuverable variant based on the J-11BS with longer range and upgraded avionics.[69] The PLAAF received the first operational aircraft in 2014.

The two-seat Su-30MMK, purchased from Russia, has the potential to one day comprise the core of the PLAAF's fighter force. The Su-30MMK features advanced radar, aerial refueling, and improved air to ground strike capabilities with PGMs. Based on recent increases in procurement, the PLAAF may have instead decided to make the new J-11B/BS the core of its future fighter force.[70]

The Su-30 Fighter[71]

Su-35

The PLAAF recently received its first Russian Su-35s and Chinese produced J-20s. According to various reports, the PLAAF purchased 24 Su-35s from Russia in 2015; however, only 14 of them have been delivered so far (4 in 2016, 10 in 2017 in two batches of 5, and 10 more to be delivered in 2018). Based on media reports, they conducted their first combat mission over the South China Sea in early February 2018. They are apparently assigned to the PLAAF's 6th Air Brigade at Suixi, Guangdong Province, which was previously the 2nd Air Division's 6th Regiment and received the second batch of Su-27s in 1996. The air brigade is within the Southern Theater Command Air Force. In addition, in February 2018, the PLAAF announced that its first batch of J-20 stealth fighters were assigned to an operational base in Wuhu, Jiangsu Province, which is subordinate to the Eastern Theater Command Air Force.

Ground Attack Aircraft

The PLAAF operates only one dedicated ground attack aircraft, the Q-5, which has single-seat and two-seat variants. Considered a second-generation platform, the Q-5 is derived from the Russian-designed MiG-19.[72] It is produced at AVIC's Hongdu Aircraft Industry Group in Nanchang, Jiangxi Province. The PLAAF in recent years has upgraded the Q-5 with the ability to deliver laser-guided bombs.[73] The Q-5 is produced in limited numbers for domestic use and export. With the development of fourth-generation J-10B, J-11B, and Su-30MMK multi-role fighters, the number of aircraft in the PLAAF that are capable of ground attack has risen both in both absolute and relative terms in recent years.[74]

Fighter-Bomber Aircraft

The PLAAF's only known dedicated multi-role fighter-bomber, which has both a ground attack and intercept role, is the JH-7. However, it is important to note that the PLAAF rarely trains with Q-5s or JH-7s for the mission of close air support for ground troops. Originally flown only by PLA Naval Aviation, the JH-7 is produced by AVIC's Xi'an Aircraft Industry Corporation (XAC) and was acquired by the PLAAF in 2004. Unlike other multi-role aircraft, such as the Su-30MMK, the JH-7 is indigenously designed and produced. The JH-7A may possess electronic countermeasures pods, possibly to assist in escort jamming missions. It is also reportedly armed with the Russian Kh-31P/KR-1 anti-radiation missile (ARM), suggesting a role in SEAD operations.[75] The JH-7 is also equipped with MRAAM and a suite of weaponry enhancing its land- and maritime-strike capabilities.[76]

The JH-7 Fighter-Bomber[77]

Bomber Aircraft

Since 1985, the PLAAF has steadily reduced the number of true bombers in its force by the hundreds. However, this downward trend has been accompanied by

the modernization of both the PLAAF's bomber platforms and the weapons that those aircraft can deliver. The only remaining dedicated bomber in the PLAAF's fleet is the H-6, which is also produced by AVIC's XAC, and is based on the mid-1950s era Soviet Tu-16 design.

In the last several years, the PLAAF has upgraded the H-6, enabling the aircraft to launch PGMs such as air-launched cruise missiles, allowing for longer-range standoff offensive air capabilities. The H-6K variant, which China is fielding in greater numbers, integrates standoff weapons and features more efficient turbofan engines in redesigned wing roots. This extended-range aircraft can carry six land-attack cruise missiles (LACMs), providing the PLA a long-range, standoff, precision-strike capability that can reach Guam.[78] The H-6K also has at least five multi-function displays in a glass-enclosed cockpit along with thermal-imaging sensors. The PLAAF has converted some H-6s into aerial tankers (H-6Us).

The PLAAF is also developing new medium- and long-range stealth bombers to strike regional and global targets. Stealth technology continues to play a key role in the development of these new bombers, which probably will reach initial operational capability no sooner than 2025.[79] These new bombers will have additional capabilities, with full-spectrum upgrades compared with current operational bomber fleets, and will employ many fifth-generation fighter technologies in their design.

In 2015, the PLAAF flew H6-Ks over the western Pacific Ocean for the first time, probably to demonstrate their long-range capability. Since then, the PLAAF has flown multiple sorties from all three bomber divisions through the first island chain's Miyako Strait and Bashi Channel over the western Pacific.[80]

The H-6K Medium Bomber[81]

Transport Aircraft

Transport is considered an area of relative weakness for the PLAAF, as it possesses only a limited number of large aircraft capable of long-distance

operations. The PLAAF operates Russian-made IL-76s capable of strategic airlift. The PLAAF was able to deploy four of these aircraft to Libya in 2011 in order to conduct a NEO there. In 2014, the PLAAF also employed IL-76s out of China and later Australia in the search for the missing Malaysian Airlines flight MH370, as well as in support of HA/DR operations following the Nepal earthquake in 2015. These were all relatively small-scale operations, however, and the PLAAF acknowledges the need to expand its strategic lift capacity.

The PLAAF is in better shape when it comes to medium transport aircraft. The PLAAF has built the core of its transport force around the Y-8, which is a domestically-built copy of the Russian-designed An-12 turboprop and is produced at AVIC's Shaanxi Aircraft Industry (Group) Co Ltd (SAIC). It also has several Y-9 medium transports, which is also produced at SAIC and has a maximum payload of 20 tons.

The Il-76 and Y-8 Transport Aircraft[82]

China's aviation industry continues to test its Y-20 large transport aircraft for introduction into the PLA's operational inventory to supplement and eventually replace China's small fleet of strategic airlift assets, which include a limited number of Russian-made Il-76 aircraft.[83] The Y-20, which is produced at XAC, conducted its maiden flight in early 2013 and reportedly uses the same Russian engines as the Il-76. The large transports are intended to support airborne C2, logistics, paradrop, aerial refueling, and strategic reconnaissance operations as well as HA/DR. In the summer of 2016, the Air Force Harbin Flight Academy in Harbin, Heilongjiang Province, was tasked with the transition training for the Y-20[84], a first among all three flight academies. On 6 July 2016 the first serial Y-20 was handed over in a ceremony to the PLAAF's 4th Air Division in Sichuan Province.[85] As a general rule, it takes about two years for a new aircraft to achieve initial operational capability (IOC) once it is assigned to an operational unit. Several Chinese commentators have noted that the successful development of the Y-20 is vital to China's aspirations for building a power projection capability to

complement the J-20 and China's first aircraft carrier, the *Liaoning*.[86] If successful as an airlift platform, the Y-20 could also provide the basis for a range of other functions, including aerial refueling, reconnaissance, and AEW&C. Although various reports have indicated that the PLAAF wants to acquire from 400 to 1,000 Y-20s,[87] that is highly unlikely, because, given that the PLAAF today only has 12 transport regiments,[88]that would mean the PLAAF would have to create at least 16 to 24 Y-20 regiments with 25 aircraft each.

The Y-20 Developmental Transport Aircraft[89]

Reconnaissance Aircraft

The PLAAF has few dedicated manned reconnaissance platforms and their numbers have been dwindling,[90] perhaps due to growing reliance on unmanned platforms for this role. The PLAAF has fielded modified versions of the J-8, such as the J-8FR and JZ-8F, for use in reconnaissance operations. It is also possible that the PLAAF will eventually field a converted JH-7 for reconnaissance purposes.[91]

Regarding reconnaissance UAVs, the PLAAF fields the high-altitude WZ-5 Chang Hong and Chang Kong 1 as well as the long-range BZK-005.[92] Please see the UAV section for more information on the wide variety of UAVs the PLA is procuring.

Two PLA UAVs[93]

The PLAAF also employs several platforms with Advanced Early Warning and Control capability. The most important of these is the KJ-2000, which is produced at XAC as a converted Il-76 airframe that provides enhanced aerial battlespace information in support of both offensive and defensive missions.[94]

Rotary-Wing Aircraft

The PLAAF also employs various rotary-wing helicopters, including the Z-8, Z-9, and Russian Mi-171.[95] Prior to 1986, the majority of the PLA's helicopters belonged to the PLAAF and Naval Aviation. In 1986, the General Staff Department (GSD) created the Army Aviation Bureau and a separate Army Aviation Branch and transferred almost all of the PLAAF's helicopters to the Army.[96] In 2005, however, the PLAAF began creating an independent helicopter flight group subordinate to the 15th Airborne Corps, which was expanded to a regiment in 2012. In 2017, the PLAAF created a transport aircraft brigade under the Airborne Corps and apparently subordinated the helicopter regiment to it in 2018.[97] It also has other helicopters assigned to various units.

Ground Air Defense Branch

Prior to 2013, the PLAAF had a separate SAM branch, which was created in 1958, and a AAA branch, which was created in 1949 as part of the PLA Air Defense Force,[98] which was a separate service until it was merged with the PLAAF in 1957. However, SAM and AAA were merged into a single Ground Air Defense Branch in 2008.[99] Together, the SAM Branch and the AAA Branch were charged with defending military bases and critical civilian infrastructure during a conflict. But, as previously mentioned, AAA seems to be disappearing from the PLAAF.[100] On the indigenous side, the Chinese HQ-9 features mid- to long-range missiles with active radar-homing capability. China also benefits from having the Russian SA-20/S-300 in its inventory, with a range of up to 200 kilometers.[101] These systems are highly mobile and therefore offer improved survivability over earlier model long-range SAM systems.[102] The PLAAF is also introducing the more advanced HQ-12, which will be able to target large- high-value airborne assets, such as airborne warning and control system (AWACS) aircraft and surveillance platforms at long range.[103] In early 2018, Russia began delivering to China the S-400/Triumf SAM system, which Beijing will use to improve its strategic air defense systems as a follow-on to the SA-20.[104] The PLAAF may simultaneously develop its domestically produced CSA-X-19 (HQ-19) to provide the basis for a ballistic missile defense capability.

The HQ-9 Mobile SAM System[105]

Radar Branch

When first integrated into the PLAAF in 1950, radar troops were charged with providing early warning capabilities to air defense. Today, depending on the type of radar systems, radar troops can be either an official branch of the PLAAF or they can be a specialized unit. As such, they provide the technical information for personnel in aviation branch airfield control towers and command posts, as well as in command posts in higher level headquarters and in command vehicles, for SAM and AAA units to be able to vector intercept aircraft or SAMs/AAA toward targets. Radar stations are typically located close to borders, on mountains, or on islands.[106] In addition, radar units conduct air traffic control operations at airfields.[107] As of late 2007, it was reported that China had an "air intelligence radar network" capable of covering the entire country.[108]

Airborne Branch

Unlike in the U.S., the PLAAF is responsible not only for "delivering" troops from its subordinate Airborne Branch to their landing zones, but also for the creation and training of the units.[109] Doctrinally, China has emphasized use of the airborne branch to deploy troops behind enemy lines to seize airfields and conduct sabotage operations alongside PLA Special Operations Forces units.[110] In April 2017, the 15th Airborne Corps was re-named the Airborne Corps, dropping the "15th" appellation.[111] It remains directly subordinate to the PLAAF HQ. As part of the latest reforms, the three former airborne division headquarters were abolished whilst their six subordinate regiments were upgraded to brigades. The revised Airborne Corps has, at a minimum, the following units: six Airborne Brigades, a Transport Air Brigade, a Special Operations Brigade, a Combat Support Brigade, and a Training Base. Prior to the reorganization, the 15th Airborne Corps had a single helicopter regiment that still apparently exists, but it is now directly subordinated to the Transport Air Brigade.[112]

Electronic Countermeasures Branch

ECM units are equipped with a range of modern ground-based electronic warfare systems capable of targeting large portions of the electromagnetic spectrum.[113] For example, Army ECM units use HF/VHF/UHF, radar, and unmanned aerial vehicle (UAV)-borne jamming systems to support maneuver forces.

Specialized Units

In addition to the five combat branches described above, the PLAAF also maintains specialized units of troops for a variety of support missions. These are: communications, chemical defense, and technical reconnaissance (as well as certain types of radar units discussed above). Communications troops (通信兵) perform functions related to communications, navigation, and automated command support to the PLAAF.[114] Chemical defense troops (防化), which actually include nuclear, biological, and chemical defense, are charged with decontaminating PLAAF locations or assets affected by not only chemical but radiological weapons as well.[115] Chemical units are fielded in battalion-, company-, and platoon-sized units.[116] Technical reconnaissance troops (技术侦察) conduct work similar to electronic countermeasures troops in that they are responsible for intercepting, decoding, processing, and analyzing different varieties of signals intelligence including both communications intelligence and ELINT.[117] They also conduct measures and signature intelligence (MASINT).[118] Technical reconnaissance troops support PLAAF units at the regiment level and below and are distributed throughout other types of units including aviation, airborne, and radar units.[119]

Modernization Trends

Several important modernization efforts within the PLAAF will influence its ability to support the ambitious military concepts being espoused by the PLA today. These include the PLAAF's pursuit of low-observable technology, aka stealth, in its next-generation fighters, advances in air-launched missiles, development of heavy lift transports, development of UAVs with high altitude and long endurance (HALE) capability, enhancement AEW&C platforms, and acquisition of increasingly longer-range SAM systems.

Fifth-Generation Stealth Fighters

The PLA's leaders believe that developing advanced, U.S.-termed fifth-generation aircraft will be essential to success in future conflicts and they are pursuing such aircraft energetically. Low observable technology can allow the PLAAF to more effectively engage enemy aircraft in offensive and defensive

counter-air operations and can also enable its aircraft to penetrate enemy defenses and attack both land- and sea-based targets.[120]

In pursuit of these objectives, China is developing two stealth fighters: the J-20 as an official PLA founded project and the FC-31. The FC-31 is, as yet, still a privately AVIC SAC funded program, that however might lead to an operational type called J-31.[121] The J-20, which is under development at Chengdu Aerospace Corporation (CAC), is billed as a heavy aerial dominance fighter similar to the U.S. F-22. The PLAAF seeks to incorporate many characteristics of the F-22 into the J-20 to include "high maneuverability, supercruise, helmet-mounted sights, thrust vectoring, low observability, and sensor fusion characteristics." The J-20 made its maiden flight in 2011 and, within the last eight years, the PLAAF has tested seven prototypes. The first J-20s were handed over to the PLAAF officially in late 2016, where they were assigned to one brigade (176th Brigade) in the PLAAF's Dingxin Flight Test and Training Base (FTTB) and one brigade (172nd Brigade) in the Cangzhou FTTB in order to extend the process of testing the aircraft. In January 2019, the first frontline Brigade (9th Air Brigade) in the Eastern TCAF's Wuhu Base[vii] received the first four J-20As.[122] The J-31, which is under development at SAC, is a competing stealth strike fighter. The second prototype of the J-31 took flight in December 2016. Billed as a medium-strike fighter perhaps geared toward air dominance missions, the J-31 may be able to take off and land on Chinese aircraft carriers in the future.[123] China also may be considering offering the J-31 for sale to foreign customers in order to compete with the U.S.-designed F-35.

The J-20 and J-31 Fifth-Generation Fighters[124]

Air-Launched Missiles

"Progress in advanced aircraft, like the J-20 and the recent acquisition of Russian Su-35s, continues to grab headlines and attention in the Pentagon, and it certainly merits attention. But the PLAAF is also making progress in other areas,

vii In 1992, the former 3rd Air Division at Wuhu, which was known as the (PLAAF Commander) Wang Hai unit, received the first batch of Russian Su-27s and in 2000 received the first batch of Russian Su-30s.

not quite as flashy but equally important for power projection and warfighting capabilities….[one] advance is in the area of Air-launched Cruise Missiles (ALCMs) (likely CJ-20s on H-6Ks) that are dual (conventional and nuclear)-capable….the addition of ALCMs can make for a serious consideration for U.S. war planners, particularly as the U.S. Air Force's Global Strike Command believes China's CJ-20 long-range cruise missiles can deliver nuclear warheads as well as conventional payloads.[125] The combination of a more effective air refuellable bomber with ALCMs means that the U.S. must continue serious work on cruise missile defense (CMD) against ALCMs and develop strategies to eliminate the aircraft before they can launch these missiles."[126] As Andrew Erickson and his colleagues put it, "Cruise missile threats, historically, have not earned the respect they genuinely deserve from the U.S., its allies, and partners, nor have these threats engendered much action on U.S. or its allies and partners' CMD".[127]

Until the mid-1980s, the most common air-to-air missile (AAM) in the PLAAF's inventory was the PL-2, which was a copy of the U.S. AIM-9B Sidewinder.[128] Today the PLAAF's AAM arsenal features radar-guided AAMs, both at medium- and short-ranges, along with "fire and forget" and capability to perform in high off-bore sight engagements.[129] In the near future, the PLAAF plans to integrate AAMs, such as the PL-10, which will possess both imaging infrared-guided as well as thrust-vector control capability.[130]

Another AAM in development, the PL-15, may feature active-radar capability.[131] Once entered into service, these AAMs will be able to engage targets more than 90 degrees off the nose of the firing aircraft, greatly increasing the tactical utility of the aircraft that employ them.[132] During China's biennial Zhuhai Airshow in November 2018, the PLAAF flew a pair of J-20 stealth fighters that opened their weapons bays and showed off full magazines of missiles, including four PL-15 missiles accompanied by two PL-10 missiles on either side.[133] This was the first time such a full load of weapons had been fully exposed and the first time China officially showed off the jet's complete internal weapons configuration. Reports indicate that the PL-15 may have entered service in 2018 and that Pakistan may also acquire the missile in 2019.[134] Although no specific information has been reported about the missile's capabilities, reports indicate that "it may have a maximum range in the order of 200 kilometers and is thought to be fitted with an advanced seeker using an active electronically scanned radar. The maximum range describes how far the missile could reach with an optimized trajectory requiring no maneuvering and with little energy left at the end of the flight. But given that a missile in the class of the PL-15 would often be used to engage a combat aircraft of a similar class, its actual maximum engagement

range against a maneuvering target would be considerably less, though likely still in excess of the present Western generation of solid-rocket medium-range missiles."[135] When the development of the PL-15 entered the public knowledge in 2015, then Commander of the USAF's Air Combat Command, General Herbert "Hawk" Carlisle, voiced serious concerns about the range of the missile and said that "we've got to be able to out-stick that missile" and he called on the U.S. Congress to fund a response.[136]

J-20 and weapons bay with training PL-15 and PL-10 missiles, during a fly-by at the 2018 Airshow China in Zhuhai[137]

The PLAAF is also making advances in air-to-surface missile (ASM) technology. ASMs already in the PLAAF arsenal include the Hellfire-class AR-1, and the HN-1, a long-range cruise missile (LRCM) similar to the U.S. Tomahawk.[138] The H-6K bomber is armed with six Tomahawk-like LACMs. In addition, a new Chinese ASM called the CM-400AKG is billed as a hypersonic anti-ship missile.[139] These capabilities are likely to complicate U.S. and allied efforts to protect land- and sea-based assets in the Western Pacific region.

UAVs

The PLAAF is investing heavily in UAV technologies that will support an assortment of ISR and combat-related missions. Unveiled in 2014, the GJ1, for example, is equipped with PGMs.[140] First presented at China's military parade in September 2016, another platform, the CH-5, appears to resemble the U.S.

MQ-9. It is said to be capable of flying for up to 30 hours and carrying a substantial weapons package.[141] In addition to arming its UAVs and increasing their ranges, the PLAAF will likely seek to develop new models with stealth characteristics in order to help penetrate enemy air defenses. The AVIC 601-S (Lijian, (利剑) or "Sharp Sword"), for example, combines these capabilities and might have capabilities similar to those of the U.S. X-47B and the European nEUROn.[142]

China encounters a more complex engineering problem in developing a HALE capability. To date, the PLAAF lacks HALE-capable drones but is working on systems such as Shendiao ("Divine Eagle") which will, at least in theory, possess such capabilities. The PLAAF's progress on previous UAV projects will serve as important stepping stones toward attaining further advances in this area.

From the 2019 U.S. Defense Intelligence Agency (DIA) China Military Power Report, "During the past 2 years, the PLA has improved its UAV capabilities, unveiled new aircraft that combine strike capability with aerial reconnaissance, and deployed select platforms to new areas, such as the South China Sea. Examples include China's first turbine-powered armed reconnaissance UAV, the Yunying (云影) (Cloud Shadow), and the armed ISR UAV Gongji 1. China also has sold armed UAVs to customers such as Iraq. Marketing material for China's armed UAVs cites speeds of 170 mph, endurance of 20 hours, and payloads of two or more air-to-surface guided munitions."[143]

For a list of select UAVs in the PLA, please see appendix 5.

Enhanced AEW&C Systems

The PLAAF seeks to enhance the sophistication of manned ISR air platforms as well. For example, the KJ-500, a Y-9 four-turboprop transport plane produced at the Shaanxi Aircraft Corporation, has been outfitted for AEW&C missions. The Y-9, which made its formal debut at China's military parade on September 3, 2015, reportedly features a phased-array radar capable of "tracking 60 to 100 targets simultaneously out to 470 kilometers."[144] Further advances in this area are to be expected, given the PLAAF's emphasis on informatized warfare.

PLAAF Over-water Operations

PLAAF aircraft flew over the Miyako Strait for the first time on May 21, 2015 for training in western Pacific, a military spokesperson said.[145] The strait is near Japan's Miyako Islands, which sits astride an international waterway.

"The fact that the PLA air force was able to complete the exercises far

offshore indicated a leveling up of their weaponry, logistic support and combat abilities. All these have showed a rapid improvement in combat capacities of the air force. The open sea drills of the air force came after the PLA Navy's similar operations in the western Pacific, making it possible for our air and navy forces to join hands for future drills in the region and greatly improving our capabilities to protect China's overseas interests."[146]

In September of 2016, the PLAAF flew more than 40 aircraft, including fighters, heavy bombers, in-flight refueling aircraft, and airborne early warning and control aircraft in a 'routine drill' through the Miyako straits into the Pacific.[147]

A PLAAF H06 bomber flying over the Pacific[148]

This activity has only become more common. In May of 2018, the Eastern Theater Command Air Force and Southern Theater Command Air Force deployed aircraft to conduct coordinated actions during training. Su-35 fighter jets flew over the Bashi Channel in formation with the H-6Ks for the first time, which marks a new breakthrough in island patrol patterns, said Shen Jinke, spokesperson for the PLAAF.[149]

Two Su-35 fighter jets and a H-6K bomber fly in formation on May 11, 2018[150]

4. PLA Navy and Marine Corps Aviation

Naval Aviation HQ and Theater Command Navy/Fleet Aviation HQ History

The People's Liberation Army Navy (PLAN) Naval Aviation Department[viii] (海军航空部) was first formed in 1952 for the ostensible purpose of providing the People's Republic of China (PRC) and PLAN with a maritime air capability. *A History of the PLAN Naval Aviation Branch* references the initial mission as one of costal defense and protection of the PRC's littoral waters, as well as the airspace above it. This includes the protection of PLAN surface assets from enemy aviation forces, which at the time was predominantly Republic of China aircraft flying out of Taiwan.[151] The Naval Aviation Department was located at Liangxiang airfield near Beijing. Dun Xingyun became the commander and Li Keru the political commissar. At that time, it was one of six separate administrative departments within PLAN HQ and consisted of 318 personnel. In October of 1955, the PLAN changed the Chinese name for Naval Aviation to Haijun Hangkongbing Bu (海军航空兵部), which remained the same in English, and assigned it the same grade as the three fleets (North Sea/NSF, East Sea/ESF, and South Sea/SSF), which, until 1988, was a bingtuan leader grade (正兵团职) between the corps and military region grades. Over the next five decades, its status changed three times.

As a result of the Cultural Revolution, the department was abolished in November 1969 and its air divisions were directly subordinated to the three fleets. In May 1978, the department was reestablished, and was directly responsible for commanding nine air divisions. In October 2003, it was abolished again and its components were re-subordinated under the PLAN HQ's Headquarters Department as the Naval Aviation Department (海司航空兵部), a second-level department with several subordinate third-level divisions/bureaus that are

viii Note, the PLA does not have a formal term for "headquarters." As such, the fleet Naval Aviation Headquarters are merely identified as Naval Aviation.

responsible for administrative guidance. As such, it no longer serves the function of being the Naval Aviation HQ. To date, no new Naval Aviation HQ has been re-established.

In early 2016, when the PLA reorganized its seven Military Regions into five theater commands, it retained the names of the three fleets for historical purposes. However, in January 2018, the PLAN renamed the three fleets as the Eastern Theater Command Navy (TCN), Southern TCN, and Northern TCN, which are listed in the same protocol order as the five Theater Commands.[152]

Under each theater navy, there is also an aviation headquarters, with subordinate aviation division, brigades, and regiments. With the exception of the J-15's, all other fixed wing combat aircraft are assigned to aviation brigades, which in turn have subordinate flight groups. Separate, independent air regiments operating helicopters, bombers, and unmanned aerial vehicles exist as well and appear to report directly to the theater navy aviation headquarters. At each level, support organizations subordinate to the divisions, brigades, and regiments exist to provide aircraft maintenance and support. Within each theater navy, a number of regiment grade airfield stations provide basic airfield services to home-based and visiting aircraft.

The Eastern Theater Navy (ETN) fields some of the most modern fixed-wing aircraft under the 4th Aviation Brigade. This operates the PLAN's only J-10 fighters and Su-30 fighters. ETN aviation also fields the 6th Aviation Brigade, which consists of JH-7 fighter-bombers.[153] As part of the PLAN's larger structural reforms, ETN aviation stood up a new special mission aircraft division.[154] As of 2019, this division only fields Y-9 ASW variants.[155] An independent aviation regiment consisting of rotary-wing assets, including Ka-31 AEW helicopters, is also subordinate to ESF Naval Aviation.[156]

The Southern Theater Navy (STN) operates two air brigades, a bomber regiment, and a new special mission aircraft division. One brigade consists of J-11 and J-7 fighters and the other is equipped strictly with J-11 fighters.[157] STN aviation also operates one regiment of H-6 bombers, and most likely has other variants of the same platform as well.[158] The new special mission aircraft division operates both Y-9 ASW and KJ-500 AEW aircraft.[159] Rotary-wing assets are subordinate to an independent aviation regiment.

The Northern Theater Navy (NTN) fields the famous 2nd Aviation Division and 5th Aviation Brigade. The 2nd is composed of two regiments of Y-8 and Y-9 specialized aircraft.[160] NTN's 5th Aviation Brigade fields JH-7 attack-bombers and J-8 interceptors.[161] In addition, the PLAN's single J-15 regiment and carrier-qualified helicopter regiment are also subordinate to NTN aviation.[162] Regular

rotary-wing assets under the NTN fall under a separate independent air regiment and consist primarily of Z-9s.[163]

Notably, Northern Theater Navy appears to be unique compared to the other theater navy aviation headquarters. While fleet aviation headquarters and subsequently theater navy aviation headquarters are typically corps grade organizations, NTN aviation appears to be corps deputy grade.[164] The reason for this discrepancy is unknown, but may be related to NTN aviation not having a second aviation brigade.

Each theater navy aviation headquarters also operates a single air defense brigade and a single radar brigade.[165]

Today, each of the three TCN HQ has its own Naval Aviation HQ with the grade of corps leader.[166] In addition, each of the three Naval Aviation commanders serves as a concurrent TCN deputy commander. Naval Aviation currently has about 26,000 personnel.[167]

The Role of Naval Aviation

Modern Naval Aviation has evolved from its primitive beginnings over half a century ago. With the development of PRC, PLA, and PLAN objectives, as well as capabilities, the Naval Aviation branch now fulfills a different set of missions and objectives relative those sixty years ago. Despite the fact that the broad missions of Naval Aviation are stipulated as maritime airspace protection and support of surface ship operations in costal and maritime areas, what this entails is fairly ambiguous and is not discussed directly in PLA writings.[168]

The role of Naval Aviation has further evolved during the past decade. PLAN combatants can now reach farther from shore and are more capable of providing their own air defense. This has allowed the PLAN to concentrate on an expanded array of aerial missions, particularly maritime strike, as well as maritime patrol, ASW, airborne early warning (AEW), and logistics. China's first aircraft carrier signaled a new age for Naval Aviation, which is now evolving from an almost exclusively land-based force to one with a sea-based component.

The Mission

Naval Aviation's areas of responsibility (AORs) include both coastal and blue-water regions. Its mission is composed of several tasks that include protecting both the maritime surface and airspace domains, and supporting surface vessel operations domain, as well as other unidentified missions. Given the different types of aircraft that are subsequently listed, missions, such as maritime reconnaissance and patrol, anti-submarine warfare (ASW), and anti-surface warfare (ASuW),

are slightly more detailed missions than the two broad naval aviation missions initially discussed.[169] PLAN official reporting discusses how blue water (大洋) operations are now part of Naval Aviation's list of responsibilities as well.[ix]

Naval Aviation and the PLAAF have been flying bombers out over the Western Pacific since 2013. During 2013 and 2014, Naval Aviation bomber and reconnaissance aircraft were integrated into PLAN vessel operations in the Philippine Sea west of the Philippines. Specifically, in July and September 2013, a Y-8 surveillance aircraft and an H-6 bomber flew within international airspace over the Miyako Channel; two Y-8s and two H-6s flew the same route over three consecutive days in October 2013; and one Y-8 and two H-6s flew the same route in March 2014. During a mid-December 2014 "Ocean Going Exercise," four iterations of PLAN H-6 maritime strike-capable bombers and both Y-8 and Y-9 reconnaissance aircraft flew south of Okinawa as part of a multifleet exercise in the Western Pacific.

Naval Aviation Fixed-Wing Aircraft

During the past two decades, the PLAN has replaced antiquated fixed-wing aircraft, such as the Q-5 Fantan and the H-5 Beagle, with an array of high-quality aircraft.[170] Beginning in 2012, the PLAN began a wholesale modernization of its fixed wing aircraft fleet. Units phased out older J-7, J-8, Q-5, and H-5 airframes in favor of more modern 3rd generation aircraft. The force is now equipped for a wide range of missions, including offshore air defense, maritime strike, maritime patrol/ASW, and carrier-based operations. Just a decade ago, this air modernization relied very heavily on Russian imports. Following in the PLAAF's footsteps, the PLAN is now benefiting from domestic combat aircraft production. Today, Naval Aviation is taking deliveries of modern, domestically produced fourth-generation fighter aircraft, such as the J-10A and the domestically produced J-11B. Equipped with modern radars and glass cockpits and armed with PL-8 and PL-12 air-to-air missiles, Naval Aviation J-10As and J-11Bs are among the most modern aircraft in China's inventory and are capable of extended fighter patrols beyond China's coastal areas. However, many aircraft still lack organic surface targeting systems and are restricted to using rocket pods, dumb bombs, and occasionally laser-guided munitions.[171]

For maritime strike, Naval Aviation has relied on variants of the H-6 Badger bomber for decades. The H-6 is a licensed copy of the ex-Soviet Tu-16 Badger medium jet bomber, and maritime versions employ advanced ASCMs against

ix Interestingly, this Renmin Haijun article provides uses "大洋". The use of this vernacular as opposed to "远海" seems to indicate that "远海" is a geographic mission area of operations whereas "大洋" simply refers to open ocean. Renmin Haijun 1 APRIL 2009.

surface targets. Despite the age of their design, the H-6s continue to receive electronics and payload upgrades, keeping the aircraft viable as a long-range strike platform. As many as 30 aircraft remain in service. Noted improvements for the upgraded Badger include the ability to carry a maximum of four ASCMs (instead of the two previously seen on earlier H-6D variants). Naval Aviation also has modified a few H-6s to serve as tankers, increasing the range of Naval Aviation fighter aircraft.

With at least five regiments fielded across the three fleets, the JH-7 and JH-7As augment the H-6 as the workhorse of Naval Aviation's airborne maritime strike force. The JH-7 is a domestically produced tandem-seat fighter-bomber developed as a replacement for obsolete Q-5 Fantan light attack aircraft and H-5 Beagle bombers. Updated versions of the JH-7, know as the JH-7A, feature a more capable radar and additional weapons capacity, enhancing its maritime strike capabilities. They are capable of fielding anti-ship cruise missiles, air-delivered mines, bombs, and electronic warfare pods. The JH-7 can carry up to four ASCMs and two PL-5 or PL-8 short-range air-to-air missiles, providing considerable payload for maritime strike missions, or the JH-7 can sacrifice two ASCMs for underwing fuel tanks, increasing the platform's range. However, the operational radius of these aircraft is limited by the lack of an air refueling capability.

In addition to combat aircraft, Naval Aviation is expanding its inventory of fixed-wing maritime patrol aircraft, AEW, and surveillance aircraft. China has achieved significant new capabilities by modifying several existing airframes. The Y-8, a Chinese license-produced version of the ex-Soviet An-12 Cub, forms the basic airframe for several Naval Aviation special-mission variants. All of these aircraft play a key role in providing a clear picture of surface and air contacts in the maritime environment. As the PLAN pushes farther from the coast, long-range aircraft capable of extended on-station times to act as the fleet's eyes and ears become increasingly important.

Naval aviation has also developed a Y-9 ASW variant. The new aircraft is equipped with a magnetic anomaly detector boom, similar to that of the U.S. Navy's P-3. This Y-9 ASW variant is equipped with surface-search radar mounted under the nose as well as multiple-blade antennas on the fuselage, probably for electronic surveillance. A small EO/ infrared turret is located just behind the nose wheel, and this variant is equipped with an internal weapons bay in front of the main landing gear. Recent pictures of the Y-9 ASW variant suggest at least some aircraft have entered operational service.

In December 2017, the Aviation Industry Corporation of China conducted

the maiden flight of the AG-600 Kunlong, the world's largest seaplane. The aircraft is still under development, but once operational, the AG-600 probably will be used for both civilian and military roles, such as search and rescue operations or defense needs in the South China Sea. Chinese advertising depicts the aircraft as having an endurance of 12 hours and the capacity to rescue 50 people during a single flight.

Aircraft Carrier Program

In September 2012, China commissioned the *Liaoning* joining the small group of countries that have an aircraft carrier.[172] Beijing acquired the Soviet ship, formerly the Varyag, from Ukraine in 2002. Since that time, the PLAN has followed the long and difficult path of learning to operate fixed-wing aircraft from a carrier. The first launches and recoveries of J-15 fighter aircraft occurred in November 2012, with additional testing and training in early July 2013. With the first landing complete, China became only the fifth country in the world to have conventional takeoff and landing fighters aboard an aircraft carrier. In 2017, the *Liaoning* concluded its second deployment to the South China Sea for training, its first with embarked J-15 fighters, and conducted its first port visit to Hong Kong.

The *Liaoning*'s ski-jump configuration restricts aircraft takeoff weight, limiting maximum ordnance loads and overall combat power. The ski-jump design also means it cannot operate large, specialized support aircraft, such as an AEW aircraft.

China's first carrier air regiment is comprised of the Shenyang J-15. The J-15 is externally similar to the Russian Su-33 Flanker D but has many of the domestic avionics and armament capabilities of the Chinese J-11B. The J-15 has folding wings, strengthened landing gear, a tailhook under a shortened tail stinger, two-piece slotted flaps, canards, and a retractable inflight-refueling probe on the left side of the nose.

China's aircraft carrier program also includes efforts to develop domestic carriers. In 2017, China launched its first domestic aircraft carrier, which was a modified version of the *Liaoning* and is expected to enter into service by 2019. Like the *Liaoning*, the ship lacks catapult capabilities and has a smaller flight deck than U.S. carriers. The PLAN began construction in 2018 on its first catapult-capable carrier, which will enable additional fighter aircraft, fixed-wing early warning aircraft, and more rapid flight operations.

Concerning its grade and subordination, the *Liaoning* is a division-leader grade organization.[173] Because it is still a training vessel, it is not subordinate to a TC Navy HQ and is directly subordinate to a newly created Liaoning Aircraft

Carrier Task Force, which is a corps deputy leader-grade organization, which, in turn, is directly subordinate to the PLAN HQ's Staff Department. Once the PLAN begins to incorporate the new aircraft carriers into each TC Navy, they will most likely retain the same grade (division leader) and will each be subordinated to a separate Aircraft Carrier Task Force (corps deputy leader grade), which will, in turn, be directly subordinate to their respective TC Navy HQ (TC deputy leader grade).

A few converted H-6 tankers have been noted as being involved in Naval Aviation exercises; however, only the J-10, Su-30MKK2, J-15, andJ-8 combat aircraft are capable of air-to-air refueling.[174] The PLAN has demonstrated its ability to use its own H-6U tankers as well as PLAAF tankers.[175] This air refueling capability will push out the effective combat radius of only a small percentage of the PLAN's total air fleet.

Helicopters

The PLAN operates three main helicopter variants: the domestically produced Z-9 and Z-8/Z-18 and the Russian-built Helix. The primary helicopter operated by the PLAN is the Z-9C. In the early 1980s, China obtained a license from France's Aerospatiale (now Airbus Helicopter) to produce the AS 365N Dauphin II helicopter and its engine. The AS 365s produced in China were labeled as the Z-9, with the naval variant designated Z-9C. The Z-9C is capable of operating from any helicopter-capable PLAN combatant.

The Z-8 is also a Chinese-produced helicopter based on a French design. In the late 1970s, the PLAN took delivery of the SA 321 Super Frelon. A reverse-engineered version was designated the Z-8, which reached initial operational capability by 1989. Low-rate production continued through the 1990s and into the early 2000s. The Z-8's size provides a greater cargo capacity compared with other PLAN helicopters but limits its ability to deploy from most PLAN combatants.

A new PLAN helicopter labeled the Z-18 has operated with the *Liaoning*. The Z-18 comes in three variants: transport, antisubmarine (Z-18F), and AEW (Z-18J). As with the Z-8, the Z-18's size limits its deployment options.

Variants of the Helix are the only imported helicopters operated by the PLAN. In 1999, the PLAN took delivery of an initial batch of eight Russian-built Helix helicopters. Five were Ka-28 Helix As, and three were Helix Ds. An additional 9 Helix As have been delivered, and all 18 Helix are operational. As with the Russian Ka-27s, the exported Ka-28s can perform several mission sets but are usually used for ASW, and the Ka-27PSs are optimized for SAR and

logistic support missions. The Ka-28 is fitted with search radar and dipping sonar and can employ sonobuoys, torpedoes, depth charges, or mines.

In 2010, China purchased nine Ka-31 AEW helicopters and its E-801 radar system. The Z-18J and Ka-31 provide the PLAN a serviceable sea-based AEW capability to help fill that critical gap until newer catapult-equipped aircraft carriers capable of operating fixed-wing AEW aircraft enter service.

Naval Aviation Air Units

Prior to 2017, Naval Aviation was organized into six air divisions with subordinate air regiments plus air units directly subordinate to PLAN HQ. Unlike the PLAAF, Naval Aviation had some air divisions with a subordinate bomber regiment and a fighter and/or fighter-bomber regiment.[176] Beginning in 2017, Naval Aviation began reorganizing fighter and fighter-bomber/ground attack regiments as brigades, which are directly subordinate to their relevant TCN Naval Aviation HQ, and abolishing their relevant air divisions. However, like the PLAAF, it appears that the former bomber and special mission aircraft divisions and regiments have not changed to a brigade structure. According to the International Institute for Strategic Studies" (IISS) 2019 Military Balance report, Naval Aviation has 350 combat-capable aircraft, as well as helicopters, which include:[177]

- Fighters: 24
- Fighter-bomber/ground attack: 139
- Bombers: 31
- Transports: 38
- Tankers: 5

Naval Aviation Transition to New AEW Airframe

Based on two lengthy articles in February and October 2013 from the PLA Navy's newspaper, Renmin Haijun (人民海军), in 2010, Naval Aviation transitioned to a new airborne early warning aircraft, which was assigned to a North Sea Fleet aviation regiment. Based on the photos in the articles, this is apparently a KJ-200 airframe.

In order to prepare for this, the regiment sent multiple maintenance personnel to the factory to receive material and to observe the aircraft. Although they received written material, it was not very concise. As a result, the unit's personnel started from scratch and wrote a "Textbook for a Certain Early Warning Aircraft's Theory," consisting of eight specialties and more than 1.5 million characters.

In the end, it took 18 months after the first aircraft arrived before it was considered initial operational capable (IOC), meaning that it could perform an operational mission. This involved a three-step process: 1) taking delivery of the aircraft, 2) making the necessary changes, and 3) finally having the aircraft ready for combat training. The switch to the aircraft in fact had already started a few years before 2010, when the regiment dispatched some senior personnel down to the research office to work on the feasibility of the switch. However, since the first day the unit received the aircraft, they had one problem after another that put their progress on hold. Specifically, they had no handbooks, training guidelines or any related systems and rules to follow. Problems came one after another. When the new aircraft first arrived, they only came with the construction, technical specifications and other information on the aircraft. To the aircrew, this looked more like a "user's manual of a product". The unit began by allowing all related personnel to board the aircraft and write up their observations into a collection of articles. These were then turned into more than 10 books of teaching materials as well as rules and regulations such as the "operation manual of a certain model of aircraft", the "training guidelines for a certain model of aircraft", the "flight day organization and implementation rules of a certain model of aircraft", "mission cabin flight preparation implementation methods" and "air mission non-commissioned officers management regulations".

Training Trends

Since 2015, PLAN aviation training has placed a growing emphasis on missions besides maritime strike and ISR in support of surface formations. The amount of training related to defensive counter air missions doubled from 2015 to 2017. However, PLAN aviation has still maintained its proficiency in maritime strike and maritime ISR missions.

This net increase in training is the result of increased training complexity. In 2015, an estimated 70% of PLAN aviation training events were single subject training events. By 2017, roughly 70% of training events consisted of two or more subjects. This allows PLAN aviation units to train to perform a wider array of missions while not sacrificing capabilities in any given mission set.

Despite the increase in PLAN aviation multi-subject training, there has been no noticeable increase in joint or combined arms training. From 2015 to 2017, joint and combined arms training consistently accounted for roughly 25% of identified PLAN aviation training events.[178]

Naval Aviation and PLAAF Joint Training

The PLAAF and Naval Aviation have been conducting joint training since at least 2011, when the PLA Navy and Air Force were reported to have conducted a joint exercise that involved PLAN AEW aircraft directing PLAAF fighters to intercept cruise missiles over water. As of early 2012, however, any type of interaction between the PLAAF and Naval Aviation is apparently still not common.[179, 180]A major breakthrough with regard to the ability to conduct joint training and operations is said to have been the acquisition of an "integrated command platform" (一体化指挥平台) around 2012. In joint training in the years before 2012, numerous barriers to network usage and limitations of information transmission channels were said to have made it difficult for operational units to fuse information. After the advent of the integrated command platform, voice, video, and other signals could reportedly be exchanged freely, effectively shortening the distance between "the commander's tent" (中军帐) (i.e., the AEW&C aircraft) and frontline combat units.[181]

As of 2015, however, joint training between Naval Aviation and the PLAAF was apparently still not routine. A dissimilar combat aircraft training event in September 2015 involving the Nanjing MRAF and the East Sea Fleet (ESF, now Eastern Theater Command Navy), for example, was said to have "*established a basis for* normalization of joint training". In other words, as of September 2015, joint training was not yet "normalized".[182]

In 2016, the overall amount of joint training being conducted apparently increased relative to 2015: an inspection of the annual joint training requirements of the same air division (now part of the Eastern Theater Command Air Force, which replaced the Nanjing MRAF in February 2016) revealed that it was moving toward the normalization of joint training. Whereas the division, which was abolished and the subordinate regiments were upgraded to brigades in 2017, had only conducted two joint exercises in the second half of 2015, it was now planning to conduct "multiple" tri-service joint exercises in 2016.[183] Similarly, a 2016 article in *PLA Daily* stated that the Southern Theater Command Air Force "routinely" initiated joint navy–air force equipment support exercises each year.[184] That the Eastern Theater Command Air Force division was described as "moving toward" the normalization of joint training, as opposed to joint training actually being normalized in 2016, implies that, for this division at least, joint training in 2016 was still not regarded as fully normalized.[185]

The joint training between Naval Aviation and the PLAAF that did occur typically did not involve aviation forces from both services. For example, of 20

joint exercises from 2011 to 2016 that involved both the PLAN and PLAAF, only nine clearly involved aviation forces from both services. Of these, moreover, three were opposing force exercises, meaning that Naval Aviation and PLAAAF fighters were practicing conducting aerial combat against each other. While organizing and conducting those opposing force exercises obviously required aviation units from the two services to work together in planning and conducting the exercise, actual flight operations were presumably coordinated only in the sense that aircraft from the two services were required to arrive at agreed-upon locations at agreed-upon times.

According to an article in *People's Navy*, the entire ESF—which included, among other forces, approximately 16 submarines, eight destroyers, 20 frigates, and six manned aviation regiments—held a total of about 20 joint training events in the first half of 2017. The article describes several of those events, and none of the descriptions mention Naval Aviation and PLAAF forces participating together in the same exercise. This trend seems to have changed by the end of 2017. Based on multiple reports of joint training and combined exercises, integration between PLAAF and Naval Aviation has become a "normalized" occurrence. In addition to the typical opposition force interactions, the PLA has reportedly embraced the concept of joint-operations and is working diligently to incorporate aspects of command and control from the joint level. As an October 2017 article from *China Air Force Magazine* reports, the Southern Theater Command Air Force works closely with Naval Aviation to conduct maritime training by integrating tactics and combat methods.[186] The article further explained how various services took turns leading each other in separate training events.

PLAN Marine Corps Aviation

While previously the PLAN Marine Corps (PLANMC) had to rely on Naval Aviation for the use of helicopter assets, reports from PLA, state-run, and PLAN media indicate that the PLANMC now has its own helicopter component, which is a de facto 'PLANMC Aviation.' In fact, the first members of PLANMC aviation came from the PLAA.[187] It is unclear precisely when the nature of the aerial assets and personnel being utilized by the PLANMC began to change, but there are indications the conversion process may have begun several years ago. Back in 2013, a book, which was part of a series that had "strong support and guidance" from the Ministry of National Defense, referred to the helicopters used by the PLANMC as being part of a "海军陆战队直升机分队."[188] In the English version of the same book, it described a "PLANMC helicopter unit."[189] A 2014

report from the *China Youth Daily* indicated the Z-20 helicopter would eventually be joining the PLANMC.[190] A CCTV special commentator similarly stated in 2016 that the Z-10K helicopter would eventually be joining, among other branches, the PLANMC.[191] More recently, state-run media have been referring to the PLANMC as a "triphibious"/"triphibian" [三栖] force (land-, sea-, and air-capable).[192] Whereas previously the branch's land and amphibious attributes had been lauded, state-run media have more recently referred to the PLANMC as "tigers on the land, dragons on the sea, and eagles in the air".[193] Other reports have similarly indicated an evolving PLANMC, such as one that stated it had gone "from a single branch to being composed of multiple branches." That same report also reiterated that the PLANMC are now "eagles in the air."[194] At least one 2018 CCTV report referred to a helicopter pilot, whom it was interviewing, as "a pilot of a certain brigade of the Marine Corps."[195] At least two 2018 reports from People's Navy have also stated that the PLANMC does indeed have its own aviation assets. One of these reports stated that the PLANMC brigade being covered was strengthening the "operational and technical training for [its] newly selected and transferred pilots." It also spoke of a training exercise being undertaken by "a certain brigade of the Marine Corps Shipborne Aviation" [海军陆战队舰载航空兵某旅].[196] The other stated that the brigade being covered in this report (unclear if it is a different brigade from the report above) had already filled all of its "pilot training posts." All of this evidence indicates there is now a 'PLANMC Aviation,' in substance, if not in name.

5. PLA Rocket Force

As part of major military reforms, CMC Chairman Xi Jinping re-designated the Second Artillery Force, which was an independent branch treated as a service, as the PLA Rocket Force (PLARF) on 31 December 2015 and elevated it to service-level stature. The elevation, accompanied by the remarkable growth in its capabilities and force structure, strongly suggests that the PLARF will continue to play critical roles in Chinese strategic deterrence and conventional precision strike in the coming years. Founded in 1966, China's strategic missile force was originally charged with maintaining and operating China's ground-launched nuclear ballistic missiles.[197] However, since the early 1990s, the PLARF has taken on a conventional mission and significantly expanded its arsenal to include precision strike capabilities at medium ranges using ground-launched conventionally-armed ballistic and cruise missiles.

The transition to the PLARF does not appear to have altered the Second Artillery's basic structure and missions, including its "core" role in strategic deterrence. Nonetheless, the PLARF is transforming through an expanding infrastructure equipped with increasingly survivable, longer-range systems with greater accuracy.[198] Over the last decade, the PLARF adjusted its research, development, and acquisition (RD&A) system, expanded its force structure through additional launch brigades, introduced new missiles into the inventory, and replaced older missile systems with new variants in a number of existing brigades. Organizational reforms began to be implemented in 2016. Following its renaming and upgrade in status, the PLARF has restructured its headquarters staff, re-designated corps-level base commands, reallocated brigades among newly re-designated base commands, reorganized support brigades and regiments, and adjusted the structure of launch brigades.

The PLARF trains, equips, and operates China's land-based nuclear and conventional missiles. The PLARF's transformation continues the CMC's policy of building "dual deterrence and dual operations," meaning a force capable of nuclear and conventional deterrence and strikes. A dual capability not only provides China with nuclear deterrence options, but it also offers conventional "counter-intervention" capabilities to deter, delay, or deny an adversary from deploying to or operating effectively in theaters near China.[199]

Force Structure

The operational command authority of the PLARF is highly centralized. The chain of command runs from the CMC, through the Joint Staff Department-managed Joint Operations Command Center and PLARF Staff Department, down to corps-leader grade base commands, to missile brigades and launch battalions; however, higher echelon units can bypass subordinate units and give orders directly to launch battalions if required. Space-based, airborne, and ground-based sensors managed by the PLASSF provide crucial intelligence, surveillance, and reconnaissance for targeting and battle damage assessment information. PLASSF assets likely are augmented by organic PLARF unmanned aerial systems.

The PLARF is mainly composed of headquarters functions and directly subordinate support units, six corps or corps deputy leader grade missile Bases, a centralized nuclear warhead Base command, an engineering Base command, test and training facilities, and educational institutions. The PLARF's six corps/corps deputy leader grade missile Bases oversee multiple missile brigades and support units. All six Bases consist of at least one conventionally-capable missile brigade, and five of the PLARF's six missile Bases are trained and equipped to carry out nuclear strikes against targets in the continental United States. Missile Bases oversee the peacetime operations of conventional missile brigades, nuclear-capable brigades, and support regiments responsible for training, transportation, operational support, maintenance of launchers, and communications. These Base commands include:

Base 61: (former Base 52), headquartered in Anhui's Huangshan city, was formerly established in August 1965 and oversees support regiments, at least two medium-range ballistic missiles (MRBM), and five short-range ballistic missiles (SRBM) brigades. Beyond the typical five support regiments, Base 61 may also oversee a dedicated unmanned aerial vehicle regiment and unique missile component depot due to its relatively large inventory of missile systems.

Base 62: (former Base 53), headquartered in Yunnan's Kunming city, was formally established in June 1966. Over the last five years, Base 62 has expanded to six brigades equipped with intercontinental range ballistic missiles (ICBMs), MRBMs, LACMs, and possibly intermediate-range ballistic missiles (IRBMs). As such, the command may perhaps be the most diverse among the six missile bases.

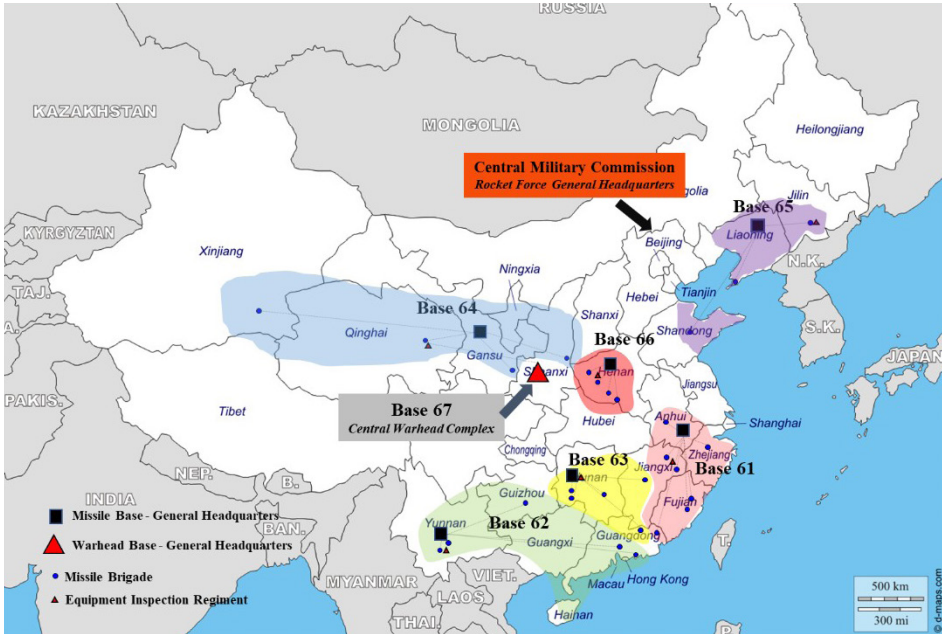
Base 63: (former Base 55), headquartered in Hunan's Huaihua city, was formally established in May 1968. Base 63 has expanded from four to at least five launch brigades equipped with ICBMs, MRBMs, and LACMs.

Base 64: (former Base 56) HQ, previously located in Qinghai's Xining City, relocated to Lanzhou in the 2012 timeframe. Base 64, equipped with ICBMs and IRBMs, has expanded from three to at least five brigades over the last five years.

Base 65: (former Base 51), headquartered in Liaoning's Shenyang city, was formally established in September 1964 and oversees three MRBM brigades. A fourth brigade, equipped with an unknown system, has been recently established.

Base 66: (former Base 54), is headquartered in Henan's Luoyang city. Since 2010, Base 66 has expanded from three brigades to at least, including the first unit to be equipped with the DF-26 IRBM.

PLARF Force Structure



Brigade headquarters and subordinate battalions are garrisoned in locations with convenient access to expressways and railways for rapid mobility. Launch brigades rely on base-level depots and uninterrupted rail and road services for mobility of missile systems, components, and warheads. A typical missile brigade consists of six launch battalions, and operational support, comprehensive support, launch service, position management, technical, and communications battalion.

Due to the centrality of ballistic and land attack cruise missiles for strategic deterrence, the CMC retains control over subordinate Bases and brigades through PLARF HQ in Beijing. Unlike the PLAA, PLAN, and PLAAF, there is no indication of formal peacetime subordination of PLARF Bases to Theater Commands. However, in higher readiness conditions, the CMC may assign selected conventional brigades, battalions, and support units to a Theater Command leadership.[200]

The PLARF relies on a survivable and redundant physical infrastructure to ensure the resilience of command, control, and communications, weapons storage and handling, and other assets and activities. These facilities are typically extensive, concealed, hardened, and linked by modern information technology networks. Because underground facilities are particularly critical for sustained operations, the PLARF employs one of the most advanced tunneling enterprises in world.

An expanded training infrastructure is required to keep up with the growing complexity of PLARF operations. As part of the on-going reorganization, the PLARF appears to have integrated its testing and training units, including the Northwest Training Base (Qinghai/Xinjiang), Southwest Training Base (Guizhou), Combined Training Base (Jilin), as well as a test support regiment in Taiyuan, under a single corps deputy leader grade base command. Associated with the transition is establishment of a possible new unit in Alxa, Inner Mongolia.

Missile Capabilities

The PLARF, cited by CMC Chairman Xi Jinping as the "core of strategic deterrence," has also been modernizing its strategic nuclear forces. In particular, the PLARF is transforming from a rudimentary nuclear force centered on liquid-fueled and silo-based ballistic missiles toward a more modern and diverse nuclear arsenal featuring solid-fueled and road-mobile systems. Solid-fueled missiles can be launched more quickly than liquid-fueled and road-mobility makes missiles more difficult for an enemy to locate, increasing the survivability of nuclear forces in the face of counter-force attacks. The PLARF is also working to enhance the penetrability of its re-entry vehicles and equipping some of its missiles with multiple independent reentry vehicles (MIRVs).

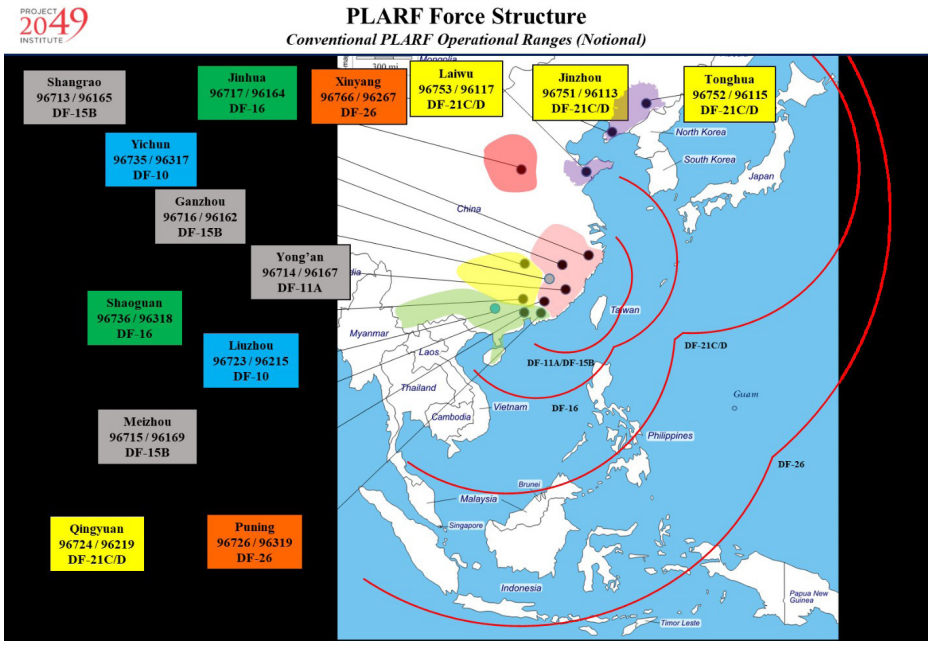
The PLARF fields a diverse array of ballistic and ground launched cruise missiles supporting a range of strategic and operational objectives. These systems include SRBMs, MRBMs, IRBMs, ICBMs, and ground-launched LACMs. The PLARF is the CMC's principal instrument for achieving strategic effects through direct targeting of enemy centers of gravity. During a contingency, the PLARF would be called upon to play key roles in strategic nuclear deterrence and in conventional conflicts in the Indo-Pacific region. Overall, the emphasis of development has been on missiles designed for accurate conventional strikes on targets that would be relevant in a potential Taiwan contingency. Separately, the PLARF continues to modernize its ICBM force to maintain strategic nuclear deterrence.

SRBMs

Existing missile systems, including the DF-11, DF-15, and DF-16, are solid-fueled, single stage systems with ranges of up to 1,000 kilometers. Incrementally advanced variants of each have offered increased range, accuracy and lethality. The PLARF SRBM systems are concentrated in Base 61's area of operations. The DF-15, initially designed by the China Aerospace Science and Technology Corporation's (CASC) China Academy of Launch Technology (CALT/First Academy), was originally intended for the international commercial market. Under the designation of M-9 and with a range of 600 kilometers, CMC granted CASC authorization to begin conceptual design in 1984. Flight testing began in 1987, followed by formal certification of the system for export in 1988. In that year, following a broader study on integrating conventional capability into the Second Artillery, a CMC decision was made to make further improvements on the system. The first unit equipped with the DF-15 was established in 1993 and was a centerpiece in coercive exercises against Taiwan in 1995 and 1996. Upgraded variants of the DF-15 were introduced in 2001 and 2009.

Like the DF-15, the DF-11 SRBM was originally developed by a competing design department for the international market. Flight testing of the initial 300-kilometer range variant was conducted in March 1989 and introduced into the former Nanjing and Guangzhou MRs. Based on a 1993 decision, China Aerospace Science and Industry Corporation (CASIC) began work on an extended range variant – the DF-11A – with the goal being to double the range without a compromise in accuracy. After a series of successful flight tests in 1998, the first brigade was equipped with the DF-11A in Fujian Province in 1999 or 2000. The basic solid-fueled, single staged DF-16 SRBM is believed to have a range of 800-1,000 kilometers. The first

unit equipped with the DF-16 was established in northern Guangdong province in 2010. See the chart below for notional ranges.[201]



MRBMs and IRBMs

The PLARF's core MRBM/IRBM system is the DF-21, which traditionally has been assigned a regional nuclear deterrence mission. Over the last decade, China has significantly improved its conventionally armed MRBM/IRBM force designed to target land and naval assets within the Indo-Pacific region. MRBMs include the conventionally armed, terminally guided DF-21C. A follow-on variant, the DF-21D, is the world's first dedicated medium-range anti-ship ballistic missile (ASBM). The DF-21D ASBM was introduced into the operational inventory as early as 2010 and can deliver a maneuverable warhead to a range over range of 1,500 kilometers.[202] Also, the PLA paraded a new MRBM variant of the DF-16 SRBM in 2017 designated the DF-16G. This system purportedly features high accuracy, reduced preparation time, and an improved maneuverable re-entry vehicle that can better penetrate missile defense systems.[203]

In addition to conventionally-capable variants of the DF-21, the PLARF introduced the DF-26 IRBM into its active inventory in the last five years. First explicitly revealed during China's military parade in September 2015, the DF-

26 IRBM is a solid fueled, two staged mobile system with a maximum range of 4,000 kilometers.[204] The DF-26 is reportedly capable of delivering conventional and nuclear payloads against ground and moving targets at sea.[205]

ICBMs

China invests significant resources to operate and modernize a limited, survivable nuclear force. The PLARF is believed to maintain an inventory of approximately 75-100 ICBMs capable of striking targets in the continental United States. These systems include the silo-based, liquid fueled DF-5A and DF-5B, and solid-fueled, road-mobile DF-31 and DF-31A. The older DF-4 ICBM, a roll-out-to-launch system with a range greater than 5,500 kilometers, is still believed to be in service. China has already introduced the silo-based DF-5B ICBM capable of delivering MIRVd payloads.[206]

LACMs

Over the last 15 years, the PLARF has diversified its means of delivering conventional and nuclear payloads. China's first ground-launched LACM was designed, developed, and manufactured by the CASIC Third Academy. The DH-10 (also known as the CJ-10), was fielded in 2007 and has an estimated range of at least 1,500 kilometers. At least two PLARF brigades are equipped with between 100 and 200 ground-launched LACMs.[207]

Force Modernization

The PLARF is investing into research and development (R&D) on more advanced delivery systems to offset U.S. military advantages. Improvements include greater mobility, range, speed, and penetrability of its missile systems. The PLARF Equipment Department is responsible for force development planning, R&D oversight, and acquisition management. The PLARF relies on two state-owned enterprises (SOEs) – CASC and CASIC – for engineering R&D and manufacturing of missile systems. The China Academy of Engineering Physics (CAEP) is the PLARF's sole supplier of nuclear warheads. The PLARF Equipment Department manages a process for facilitating the effective and efficient introduction of new capabilities into the operational force. The Equipment Department is supported by the PLARF Research Academy, which was established in December 2003 to improve the management of increasingly complex programs. The Research Academy integrates the work of seven research institutes responsible for force planning, program validation, cost and operational

effectiveness analysis, and program management of weapon systems and command automation.

A PLARF operational test and evaluation (OT&E) unit often is established after a CMC/State Council decision to invest in engineering R&D efforts. An OT&E unit familiarizes itself with the civilian design team, industrial supply chain, and final assembly plant. Members of the unit presumably are supported by PLARF Equipment Department representative offices embedded with civilian defense industrial design departments, research institutes, and factories. While maintaining a long-term perspective, PLARF force planners and defense industry rely on conservative, incremental upgrades to existing missile variants. PLARF-sponsored RD&A programs have resulted in an increasingly diverse array of new missile systems and variants of existing missile systems.

Mobility

Mobility is critical to the PLARF's nuclear deterrent and conventional warfighting capability. Recognizing the relationship between mobility and survivability the PLARF has concentrated efforts on transforming its once primarily silo-based nuclear ICBM force into an increasingly road-mobile force. The PLARF is developing a new MIRV-capable and road-mobile ICBM, the DF-41, which could also be silo-based or rail-mobile.[208] A operational test and evaluation unit or brigade, responsible for integrating this new capability into the active inventory, likely was established in the last five years.

In addition, the PLARF's conventional missile force is road-mobile, enhancing its survivability and enabling it to more effectively perform its conventional deterrence and precision-strike missions. Each missile Base oversees a Technical Support Regiment responsible for transporting nuclear and missile components from depot facilities to operational positions, as well as Base-level missile depot facilities, and possibly mating and check out of missiles before roll-out to launch positions.

Range

Although the PLARF already maintains the capability to target virtually any land or naval asset within the first island chain with conventional precision strike, the PLARF continues to seek ways to hold at risk targets beyond this range. Development of the DF-26, for example, extends PLARF conventional strike ranges to targets as far as Guam. Such advancements would enhance the PLARF's ability to conduct counter-intervention operations at extended ranges.

R&D on a new, extended-range variant of the ground launched CJ-10, possibly capable of countering ships at sea, could be underway.

Speed

For traditional ballistic missile systems, extended ranges generally translate into greater re-entry speeds, which in turn can narrow the footprint of terminal missile defense systems, such as PAC-3. Deployment of the DF-16 and an extended range variant opposite Taiwan is a case in point. However, the PLARF is investing in advanced hypersonic glide vehicle (HGV) R&D. These systems leverage conventional ballistic missile propulsion systems to launch and release a flight vehicle that glides in through near space to its target. HGVs typically can cruise at velocities of Mach 5 to Mach 10 for sustained periods. A first-generation HGV, reportedly designated the DF-17, is designed to evade and penetrate missile defenses. When operational, the DF-17 MRBM would reportedly be capable of delivering conventional payloads to ranges between 1,800 and 2,500 kilometers.[209] Preliminary R&D into follow-on HGV capabilities is likely underway.

Penetrability

The PLARF has invested more heavily in enhancing the penetrability of its missile systems to counterbalance improvements to ballistic missile defense technology. The PLARF is attempting to accomplish this by increasingly MIRVing and MaRVing (maneuverable reentry vehicles) some of the missiles in its arsenal. As mentioned earlier, the PLARF, for example, fields the DF-21D, which reportedly uses MaRV technology to target aircraft carriers.

In short, the PLA is continuing to expand and modernize its strategic missile forces for deterrence and to defend against perceived threats to national sovereignty and territorial integrity. The PLA relies on the PLARF for achieving strategic effects through direct targeting of enemy centers of gravity. The Second Artillery's transformation into the PLARF appears to have had little direct tangible effect on the PLA's nuclear force development and operations. Over the last decade, the PLARF has refined its RD&A system, expanded its force structure through introduction of new missile systems, and replaced older missile systems with new variants in a number of existing brigades.

6. PLA Strategic Support Force

The PLASSF, established on 31 December 2015, is "a new-type of combat force to safeguard national security; a key growth point of the military's new-quality combat capability; and a crucial support for PLA's joint-combat systems."[210] The PLASSF reports directly to the CMC, and although it is generally assessed to be an independent force, there have been conflicting reports from Chinese-language sources pertaining to its status within the PLA as a military service.[211] Its functionalities and responsibilities include: Intelligence (情报), Technical Reconnaissance (技术侦察), Electronic Countermeasures or Electronic Warfare, EW (电子对抗)[212], Network Attack and Defense (网络攻防)[213], and Psychological Warfare (心理战).[214] The PLASSF appears to be providing functional support element that will provide information derived from space-based and cyber-based assets to all PLA services and five new Theater Commands to support joint operations.

The PLASSF has at least two Theater Command deputy leader-grade departments: the Space Systems Department (航天系统部) and the Network Systems Department (网络系统部). For the purpose of this Primer, this section will only focus on the military space operations-related components of the PLASSF. In recognition of the importance of outer space, China's 2015 defense white paper specifically referred to space as "a commanding height in international and strategic competition" and stated that "threats from…outer space…will be dealt with."[215] The creation of the PLASSF and the Space Systems Department in particular underscores the importance that China places on the space domain, and enables the PLA to carry out more effective military operations by leveraging space-based assets to disrupt or cripple the ability of adversary forces to use assets in space. Moreover, some preliminary evidence suggests that unlike other PLA services, the PLASSF may have created separate Equipment Departments for

each Systems Department rather than operating an Equipment Department for the force as a whole. The Space Systems Department Equipment Department (航天系统部装备部)[216] may be assessed to serve as a focal point for military space system-related RD&A.

Relationship with PLAAF and PLARF

Xi's creation of the PLASSF suggests that lobbying efforts by the PLAAF to command China's military space forces have failed, at least for now. For years, the PLAAF had argued its case based on three factors. First, starting in 2004, the PLAAF expanded its domain of operations from just "air" to "air and space," implying that it should have a role in the space domain as well. In particular, PLAAF analysts argued that because manned platforms are more responsive than unmanned platforms, the PLAAF could play a leading role in space operations once manned fighter spacecraft or perhaps hypersonic intercontinental bombers became commonplace.[217]

Second, PLAAF analysts contended that it was the most technically-inclined of all the services, and since space is a technical domain, it should naturally command China's space forces.[218] Finally, PLAAF analysts highlighted that out of all other major countries, China is the only one in which the air force does not play the leading role in commanding space forces.[219]

The PLARF, by contrast, did not seem to argue as strenuously that it should be in charge of space, perhaps in part because PLARF control over ballistic missiles makes it nearly impossible to exclude the service from the space domain. Indeed, Chinese military academics wrote in 2013 that the "Second Artillery missile vehicles, with some simple modifications, can be used to launch spacecraft" and that "with more than 40 years of development, [the PLARF] already possesses the basic infrastructure and hardware, as well as personnel, and knowledge to rapidly develop space capabilities."[220] As a result, the PLARF will almost certainly remain involved in the space domain while prospects for the PLAAF's future role appear to be diminished.

It is also worth noting that the inaugural Commander of the PLASSF, General Gao Jin (高津), spent almost his entire military career serving in the former Second Artillery Force (now the PLARF) prior to his appointment to become the President of the Academy of Military Science (AMS) in 2014. The appointment of Gao Jin to command the "space force" of the PLA may further suggest that the PLARF and the PLASSF maintain some degree of connectivity either at the organizational level or at the operational level.

Size and Force Structure

Based on available information, although it is difficult to gauge the exact size of the PLASSF, the basic structure of the PLASSF suggests that it will take on the space-related roles once performed by the General Staff Department (GSD) and the General Armament Department (GAD). The GSD and GAD, along with the PLA's two other general departments, were abolished and their functions distributed among 15 new departments as part of Xi's ongoing structural military reforms. GSD responsibilities had included levying operational tasks against Chinese space-based assets and analyzing space-derived information, while the GAD managed research and development for Chinese military satellites and launch vehicles and operated China's launch and satellite control centers.[221]

From an organizational perspective, the PLASSF now commands China's four space launch centers: Jiuquan Satellite Launch Center, Taiyuan Satellite Launch Center, Xichang Satellite Launch Center, and Wenchang Satellite Launch Center (most likely remains subordinate to Xichang as of January 2019). Jiuquan is the longest-serving launch facility in China and it features the most extensive launch infrastructure of the four sites. Jiuquan has launched China's Long March (LM) rockets, including the LM-2C, LM-2D, LM-2E, LM-2F, and LM-11. Jiuquan is also China's only launch center to specialize in human space flight.[222] Taiyuan launches meteorological, remote sensing, and communications satellites into sun and geosynchronous orbits.[223] Xichang focuses on meteorological, broadcast, and communications satellites into geosynchronous orbit.[224] Wenchang's location on China's Hainan Island helps China to limit the extent to which debris from rocket boosters falls on land. In addition, Wenchang's proximity to the equator allows it to increase satellite payloads by 10 to 15 percent and satellite life by 2-3 years.[225]

The PLASSF also has most likely integrated both land-based and sea-based telescoping, tracking and control (TT&C) centers including the Xi'an Satellite Control Center (XSCC) and China Satellite Maritime Measurement and Control Department based in Jiangyin, Jiangsu. XSCC is tasked with routine telemetry, orbit control and breakdown diagnosis and maintenance of satellites; and it is also able to support simultaneous launch of multiple satellites from multiple aerospace launch sites, and manages multiple stations spreading across a dozen provinces including: Kashgar, Xinjiang; Sanya, Hainan; Jiamusi, Heilongjiang; Changchun, Jilin; Weinan, Shaanxi; Nanning, Guangxi; Qingdao, Shandong; and Xiamen, Fujian.[226] China Satellite Maritime Measurement and Control Department appears to manage China's Yuanwang tracking ships(远望测量船). As of January 2019, there are four operational Yuanwang ships under this department; and two

cargo ship– Yuanwang-21 and Yuanwang-22, which were commissioned in 2012 and 2013 respectively.[227] They have been used for transportation of rockets such as China's Long March-5 (长征五号) and Long March-7 (长征7号).

A new PLASSF base operating out of Wuhan, Hubei may have been created to provide battlefield environment support -including survey and navigation. Over the Chinese New Year of 2019, the PLASSF's official social media account also confirmed that PLASSF personnel had been stationed in Malan, Xinjiang, which is most likely associated with the PLASSF New Hi-Tech Department.[228]

A reorganized PLASSF Space Engineering University also adds to this equation as it may be used as a platform for foundational research in key "strategic" areas, and as a hub to implement more Military-Civil Fusion-related activities to support the PLA's military operations in the space domain. It is a corps leader-grade organization, which is subordinate to the Space Systems Department. It is currently composed of three main campuses in Beijing utilizing more than 3,000 acres in land, and is actively recruiting instructors and researchers alike as of 2018. The State Key Lab for Laser Propulsion and Application is housed at the Space Engineering University, which is most likely inherited from the former Equipment Academy. The focus of this lab is the intersection of laser and aerospace (激光与航空航天交叉领域), and it is equipped with advanced launch validation system (发射验证系统) and China's only state-of-the-art, unified, whole-system, full-process research platform for laser propulsion (国内惟一的全系统全过程激光推进研究平台).[229] Furthermore, "Military Space"- related research and doctrinal development most likely remains to be a key component of the university's missions.

Space-Based Capabilities to Support PLA Operations

Space-Based C4ISR

China's defense white paper in 2015 called for the PLA to become capable of "winning 'informatized' local war."[230] In the past, Chinese military thinkers have commonly used some version of the word "informatized," such as "informatization," to express the need for the PLA to become proficient in real-time collection, processing, and dissemination of battlefield information. The space domain plays a key role in informatization efforts because of the enormous quantity of data to be derived from and passed through C4ISR space-based platforms. These satellites provide capabilities for remote sensing, communications, and navigation and positioning.

Remote Sensing Satellites

Over the past 20 years, China has made significant progress in remote sensing satellite technology.[231] These satellites provide China with an impressive range of capabilities including electro-optical (EO) sensing, synthetic aperture (SAR) sensing, and ELINT collection.[232] China's newest satellites, Yaogan, Gaofen, Jilin, and Zhangheng, provide high-resolution imagery with resolutions within one to two meters, and, in the case of Jilin, below one meter. In January 2018, China put two Gaojing-1, or Super View- 1,observation satellites and two Jilin-1 commercial remote sensing satellites into low-earth orbit. In March 2018, Gaofen-1's 02, 03 and 04 satellites were launched, and by July 2018, Gaofen-5, Gaofen-6, and Gaofen-11 satellites had also been successfully launched into orbit.[233] The Gaofen series of high-resolution earth observation satellites are part of the China High-definition Earth Observation System (CHEOS). In April 2018, five small remote sensing satellites of the Zhuhai-1 constellation were also successfully launched into space.[234]

Communications and Data Relay Satellites

China maintains a combination of commercial, government, and military satellites in a communications system known as Tianlian (Sky Link). These satellites serve as the critical data relay mechanism between remote sensing satellites and the ground station receivers. Without Tianlian, China would be forced to rely on line of sight, which would severely constrain its ability to maintain global remote sensing coverage.[235] In January 2019, a Long March 3B rocket lifted off from the Xichang Satellite Launch Center carrying the Zhongxing 2D, or Chinasat 2D, communications satellite.[236]

In 2016, China launched its first quantum satellite, nicknamed "Micius (墨子)," from its Jiuquan Satellite Launch Center. A few months after this Quantum Experiments at Space Scale (QUESS) mission took place, it was reported that by beaming photons between the satellite and two distant ground stations, scientists had shown that particles could remain in a linked quantum state at a record-breaking distance of more than 1,200 kilometers. That phenomenon, known as quantum entanglement, could be used as the basis of a future secure quantum-communications network.[237]

Navigation and Positioning Satellites

Like the U.S., China relies heavily on navigation and positioning satellites. This capability is particularly relevant when attempting to conduct OTH targeting

of enemy assets. China's Beidou-2 satellite constellation currently allows Beijing to cover all of the Chinese mainland and much of Asia with geo-location signals that provide five-meter accuracy.[238] China is seeking to complete the BeiDou Navigation System (BDS) of 35 active satellites by 2020 to provide Global Navigation Satellite System (GNSS) coverage, with 27 satellites in medium Earth orbits, five in geostationary orbit and three more in inclined geosynchronous orbits. Along with civilian uses such as navigation and positioning, Beidou will also provide weapons targeting, guidance and other services for the PLA, removing previous Chinese military reliance on GPS.[239]

Counter-space Capabilities

The 2018 Worldwide Threat Assessment of the U.S. Intelligence Community warned that China aims to "have nondestructive and destructive counter-space weapons available for use during a potential future conflict."[240] Indeed, China has continued its pursuit of space warfare capabilities while publicly maintaining that space must be a peaceful domain. The creation of the PLASSF and the consolidation of the PLA's space and network-related operations most certainly took into consideration of China's military space strategy. In an outer space context, this capability spans a vast range of both kinetic and non-kinetic capabilities. Kinetic operations typically destroy adversary satellites creating debris, while non-kinetic operations are generally intended to temporarily disable, or "dazzle," space-based assets.

Kinetic Capabilities

Arguably the most visible display of China's kinetic counter-space capabilities occurred in January 2007 when China employed a converted MRBM to conduct a live test of its direct ascent kinetic kill vehicle (KKV), otherwise known as an anti-satellite (ASAT) weapon, against a retired Chinese weather satellite. The Chinese test created the largest man-made space debris field in history, with more than 3,400 pieces of debris.[241] Other key tests took place in 2013 and included a likely ASAT launch into nearly geosynchronous (GEO) orbit, thereby demonstrating the ability to threaten U.S. global position system (GPS) and other types of satellites.[242] On 5 February 2018, as a latest show of capabilities, the Chinese Ministry of Defense confirmed that "China carried out a land-based mid-course missile interception test within its territory."[243] The test was carried out at the Korla Missile Test Complex (likely connected to the PLASSF), which involved a Dong Neng-3 (DN-3/KO09) hit-to-kill midcourse interceptor, a capable

ASAT platform, successfully striking a target DF-21 (CSS-5) medium-range ballistic missile.[244]

A second area of focus for China's kinetic counter-space program is co-orbital technologies. Co-orbital attacks involve positioning spacecraft within close proximity of an adversary's satellites and conducting a range of kinetic operations. For example, a Chinese spacecraft could ram into an enemy satellite or detonate near it.[245] China is also interested in operationalizing robotic arm technology, possibly to "grapple" opposing platforms in order to disable them without creating debris, a capability the PLA apparently tested in August 2013, and was on display at the Zhuhai Airshow in 2018.[246] Yet another form of co-orbital attack might entail employment of lasers or other directed-energy weapons.[247]

Non-Kinetic Capabilities

China is also interested in non-kinetic counter-space capabilities. Such capabilities make it possible to disrupt or disable enemy satellites in a less provocative way and without causing space debris that might pose a threat to other satellites or manned space missions. The damage caused by these non-kinetic capabilities is typically reversible, depending on the power levels used.

One example of a non-kinetic capability involves using directed-energy weapons such as lasers, high-powered microwaves, and particle beams.[248] Specially configured lasers, for example, can be aimed at satellites with EO sensors and "dazzle" those sensors, temporarily blinding them while they are within the line of sight of the laser source. Co-orbital spacecraft can also engage in non-kinetic "blinding" operations. For example, these spacecraft could employ "umbrellas" or "spray paint" to block the view of an adversary's sensors.[249] The PLA can also rely on jamming of enemy space assets. China, for example, can already jam the GPS signal.[250] Another example of non-kinetic capabilities in space involves cyberattacks, which could be directed at targets such as satellite ground control stations.

China's Future Directions in Space

While Chinese military publications and other openly available sources provide only limited insight into China's future plans for space warfare, there are specific technological areas in which China will almost certainly seek to advance its capabilities. First, it is clear that Beijing will continue to develop and launch satellites with increasingly sophisticated sensor payloads to help it acquire global information and intelligence to support decision-makers and planners. China

is unambiguous about constructing an integrated and seamless ground to space infrastructure and seeks to end its reliance on the U.S.-operated GPS system by expanding the coverage of its own Beidou-2 (BDS). Worth noting is that in line with China's 2016 government white paper on BDS[251], China has been expanding its BDS coverage through the "Belt and Rad Initiative" (BRI). For instance, disguised under China's BRI plan, China and Pakistan has deepened their cooperation in space, and Pakistan has become the only foreign country that has been granted access to BDS' military service, allowing more precise guidance for missiles, ships and aircraft.

Finally, China's counter-space capabilities will undoubtedly become increasingly advanced as well, particularly in the area of direct ascent KKV. It also remains an open question whether China will pursue other types of military space capabilities. One possibility raised by some Chinese military publications is manned combat spacecraft, an option other space powers have not favored due to cost and personnel safety concerns. Another is space-based weapons capable of striking targets in the air, at sea, or on the ground.

7. PLA Army (PLAA) Aviation

Prior to the 2017 "below the neck" reforms, the PLA Army operated approximately 981 attack, transport, and light helicopters, and a few light and medium fixed-wing aircraft, organized into seven operational Army Aviation brigades and five regiments (along with several training regiments).[252] At the time, the approximately 1.6 million personnel-strong PLAA controlled 18 corps-level group armies. Five group armies commanded Army Aviation brigades, four group armies commanded Army Aviation regiments, the General Staff Department controlled one Army Aviation brigade, and the Xinjiang Military District (MD) and Tibet MD commanded an Army Aviation brigade and regiment, respectively. Nine group armies had no organic Army Aviation units. (See Table below for information about each Group Army (GA).)

Pre/Post-April 2017 Army Aviation Order of Battle

New/ Old Group Army	Theater/ Military Region	Army Aviation Brigades or Regiments Pre-reform	Army Aviation Brigades Post-reform
71st GA/ 12th GA	Eastern/ Nanjing		Brigade
72nd GA/ 1st GA	Eastern/ Nanjing	Brigade	Brigade
73rd GA/ 31st GA	Eastern/ Nanjing	Regiment	Brigade
Disbanded 14th GA	Southern/ Chengdu		
74th GA/ 41st GA	Southern/ Guangzhou	Regiment	Brigade
75th GA/ 42nd GA	Southern/ Guangzhou	Brigade	Brigade (Air Assault)
76th GA/ 21st GA	Western/ Lanzhou		Brigade
77th GA/ 13th GA	Western/ Chengdu	Brigade	Brigade
Disbanded 47th GA	Western/ Lanzhou		
78th GA/ 16th GA	Northern/ Shenyang		Brigade

79th GA/ 39th GA	Northern/ Shenyang	Brigade	Brigade
80th GA/ 26th GA	Northern/ Jinan	Regiment	Brigade
Disbanded 40th GA	Northern/ Shenyang		
81st GA/ 65th GA	Central/ Beijing		Brigade (Former GSD Brigade)
82nd GA/ 38th GA	Central/ Beijing	Brigade	Brigade
83rd GA/ 54th GA	Central/ Jinan	Regiment	Brigade (Air Assault)
Disbanded 20th GA	Central/ Jinan		
Disbanded 27th GA	Central/ Beijing		
Beijing Garrison	Central/ Beijing	GSD Brigade (to 81st GA)	
Tibet MD	Western/ Chengdu	Regiment	Brigade
Xinjiang MD	Western/ Lanzhou	Brigade	Brigade
Total		**7 Brigades/ 5 Regiments**	**15 Brigades**

During the "below the neck" reforms the size of the personnel strength of the Army was reduced to "less than half" of the 2 million-strong PLA, five of 18 group armies were disbanded, and 13 new group armies were created in the five Theater Commands.[253] Of the five disbanded group armies, none previously had been assigned Army Aviation units, but all of the 13 new group armies have Army Aviation brigades as part of their standardized support structure. The Xinjiang and Tibet MDs also command Army Aviation brigades for a post-reform total of 15 brigades (two of which are designated as Air Assault brigades).

In order to accomplish this reorganization, the five former Army Aviation regiments were expanded into brigades and new Army Aviation brigades were added to four group armies formed around the core of old group armies which did not have any Army Aviation assets. Aircraft and personnel from existing units were transferred from existing units to the newly-formed Army Aviation brigades and approximately 90 new helicopters were added to the overall force, for a total of over 1,071 helicopters of all types.[254] It is likely that not all new brigades currently have their full contingent of aircraft and personnel and it will take a few more years to bring all 15 brigades up to full strength.

Army Aviation brigades now are composed of a combination of attack (WZ-10/Zhi-10), reconnaissance/scout (WZ-19/Zhi-19), and transport helicopters (Russian-made Mi-17 series, Zhi-8 series, Zhi-9 series, some of which are armed, and less than 20 S-70C, purchased from the United States in the 1980s).[255] Brigades are organized with up to six flight battalions along with ground support, such as logistics and maintenance units. At full strength, an Army Aviation likely would command over 70 helicopters with the possibility of future expansion.

Two Army Aviation brigades (in the 75th and 83rd Group Armies) have been designated as Air Assault brigades. In addition to helicopter flight battalions and ground support, Air Assault brigades also have been assigned two or three organic light infantry battalions to conduct air mobile operations.[256] Over the past decade, Army Aviation units have experimented in conducting large-scale air mobile operations in which conventional infantry units were transported and supported by helicopters. Army Aviation units also routinely train with PLAA Special Operations Force (SOF) units. The new Army Aviation brigades indicate these trends will continue.

In addition to the 15 operational brigades, an Army Aviation Training and Test Base in Shaanxi province has been established to evaluate new aircraft and procedures.[257] The PLA Army Aviation Academy, founded in 1999, continues to train officers and NCOs in flight and ground support operations after reform and consolidation of the PLA education system.[258]

Since reorganization, Army Aviation and Air Assault brigades have been training to establish individual and small unit proficiency under their new structure with newly assigned personnel. The Chinese media report the realism and intensity of training has increased with some units doubling their flight hours over previous years.[259] Training in high-altitude regions and along the coast in over-water operations has increased, including reports of training with PLA Navy surface forces.[260] Units also are experimenting in how to conduct operations in the field away from fixed airfields and support. Over the past decade air mobile exercises with infantry units have become larger and more complex. At the same time, Army Aviation units continue routinely to provide support to SOF unit training.

In what appears to be the largest deployment of PLAA Army Aviation assets outside of China, the 79th GA Army Aviation Brigade deployed six Mi-17, six Z-9, and 12 Z-19 helicopters to participate in the massive "Vostok-2018" exercise in Russia in September 2018 in conjunction with elements of a combined arms brigade and engineer and chemical defense brigade from the 78th GA Army and six JH-7 fighter-bombers from the PLAAF.[261]

In May 2017, the PLAA deployed its first detachment of four Mi-17 transport helicopters and 140 personnel from the 81st GA Army Aviation Brigade on a UN peacekeeping operation in Darfur. The unit deployed a second detachment, also composed of an aviation company, a maintenance company and a support company, in August 2018.[262]

The PLAA's helicopter force will continue to expand its capabilities as new aircraft enter the force and personnel and units are trained. A Z-20 medium-lift utility helicopter reportedly is in the late stage of development by the Chinese defense industry.[263] Additionally, China and Russia are expected to sign a contract in the near future to develop a 20-ton Advanced Heavy Lift (AHL) helicopter.[264]

As PLAA operational commanders become more familiar with the capabilities of their modern helicopter fleet, it is likely they will call for the number of units in the force to be augmented to support the increasing demands of systems-of-systems, integrated joint and combined arms operations both on land and in the maritime environment.

8. Trends in PLA Aerospace Training and Operational Proficiency

The PLA aerospace forces, the PLAAF, Naval Aviation, and PLARF, have embarked on a set of major institutional reforms aimed at creating a modern, professional fighting force. At the heart of the reform is an effort to train officers and enlisted personnel under what the PLA refers to as "actual-combat conditions." The emphasis on "actual combat conditions" is manifested in training scenarios meant to mimic or simulate real-world battle conditions by adopting within daily training routines elements of nighttime battle training, complex electromagnetic environment (CEME), special geographical environments, and extreme weather conditions, as well as multi-day 24-hour training. Such an emphasis reflects an acknowledgment by senior leaders that the PLA must reorient itself to be able to fight and win wars against highly capable military competitors.

Historical Context

The PLA has been rapidly upgrading its weapons and equipment as well as revising its doctrine and strategy over the past two decades in an effort to develop a modern fighting force. In early 2016, it also implemented its eleventh force reduction (300,000 personnel) and major reorganization since the PRC was formed in 1949 and the former Red Army became the PLA. These changes are geared toward honing a leaner and more capable fighting force.

The PLA has not experienced large-scale combat since 1979, when China's ground forces fought a brief border conflict with Vietnam. The last time the PLAAF fought an air battle was during the second Taiwan Strait crisis in 1958.

The largest air battle the PLAAF has fought was during the Korean War, more than sixty years ago. The PLARF and its predecessor PLASAF has never launched a missile against a foreign target but has been involved in shows of force and

posturing during crises, such as launching a total of 10 missiles north and south of Taiwan during the Third Taiwan Strait Crisis from July 1995 to March 1996.

This lack of recent wartime experience magnifies the importance of constructing a training regime grounded in scenarios that approximate to the greatest extent possible technologically sophisticated battlefield conditions.

Annual Training Cycle

The PLAAF's annual training cycle typically features five partially overlapping segments during the course of a year: 1) new year flight training; 2) training in "subjects" and "topics"; 3) peak drills and exercises; 4) a second round of training in "subjects" and "topics"; and 5) year-end evaluations. Although variations exist in other services within the PLA, most follow this general pattern of training.

Several factors explain the existence of an annual training cycle for PLA aerospace forces. The first is institutional. PLAAF training, for example, must accommodate the annual enlistment cycle of PLAAF conscripts. Conscripts serve for two years and perform many of the lower skill level tasks that are necessary to keep the military functioning. To some degree, the two-year enlisted cycle is an audition, or a probationary period, where conscripts are evaluated to determine their suitability or willingness to become an NCO. In addition, some enlisted personnel are directly recruited as a noncommissioned officer (NCO) at different levels based on their education and specialty. NCOs make up a large proportion of PLAAF aviation branch enlisted personnel in maintenance and other ground-support positions, while junior conscripts constitute a large proportion of enlisted personnel within the ground air defense, airborne, and radar branches. However, in recent years, the PLA has been moving from an enlisted force that is primarily fed by conscription to one that is made up of both volunteers and conscripts.[x]

In order to recruit civilian college/university students and graduates, in 2013 the PLA moved the entire conscription process forward three months, which is now called the summer/fall conscription cycle instead of the winter conscription cycle. In 2015, the PLAAF increased its basic training from about seven weeks to three months. Also, prior to 2015, all new enlisted personnel either went to a training base, where they received basic training and then their specialty training, or directly to their operational base, where they were assigned to a "new soldier company" and, depending on the number of new personnel, into "new soldier battalions", each of which has at least three companies. The personnel in charge of conducting their training included some NCOs and junior officers. In late 2015,

x Technically, the PLA recruits people to volunteer to be conscripted, as conscription is still the only way for enlisted members to join the PLA.

the PLAAF's Headquarters Department (now renamed the Staff Department) created its first new soldier training brigade. This model was then implemented across the PLAAF. Also in 2015, the PLAAF began consolidating the training that was conducted in individual units into numerous "new soldier brigades" each of which has about 1,000 new enlistees. Upon completion of their basic training in mid-December, they are then sent to their operational unit, where they are assigned to their permanent billet and receive on-the-job training. The PLAAF still has various new soldier training bases as well.

Though enlisted members currently account for a small and decreasing percentage of total personnel in the aviation branch (approximately 30 percent today), running large, integrated combined-arms exercises with other branches that have a higher percentage of conscripts may be difficult until their proficiency is raised to a certain standard. In addition to the new enlisted personnel arriving in the summer/fall, all new officers who have just graduated from pilot training or any other PLAAF academic institution around 1 July arrive just a month or two before peak exercise season at the end of summer.

Another driver is the need to accommodate different types of coordinated evaluations and major exercises conducted throughout the year to test the ability of officers and enlisted personnel to perform under standardized criteria. Due to the size and scale of these exercises and evaluations, as well as weather considerations in some areas, they can be carried out only during certain times of the year.

Combined-Arms and Joint Exercises

The PLA has recently emphasized "opposition-force training." All PLAAF pilots, for example, spend most of the summer months of the annual training cycle participating in multi-day exercises. These are major training events that involve a simulated opposition force and combined-arms elements under competitive scenarios among either different branches within the PLAAF itself (aviation, ground air defense, and radar) or joint training that involves one or more of the other services within the PLA (Army, Navy, and Rocket Force). Exercises seek to integrate and apply the routine training subjects and skills practiced by pilots during the year.

Based on open source PLAAF reporting, most combined-arms drills and exercises take the form of either "confrontational air battle assessments" or "system-of-systems (SoS) confrontational drills." For the former, only fighter aircraft and pilots participate in the test, but for the latter, multiple branches are involved, including ground air defense and radar. Both evaluate pilots' ability to

perform "free air combat" and are meant to test pilot combat skills and tactics.

Around 2011, the PLAAF began using the terms "pilot autonomy" and "free air combat," which basically means that pilots create their own flight plan and engage in aerial intercepts (1v1, 2v2, 1v2, etc.) that are not completely scripted. However, they must still follow the training guidance that is set forth in their various regulations. Furthermore, it means that a flight controller in the control tower, command post, or AEW&C aircraft is not telling them what to do step-by-step once the engagement begins; however, the flight controllers, who are normally the unit commander, a deputy commander, or the chief of staff, can provide initial guidance and vectoring in order to get the pilots into the engagement zone. If pilots want to vary from what they have already learned and want to try a new engagement tactic or combat method during free air combat, then the PLAAF must go through a multi-step process to validate it, write regulations, and then have all units implement them accordingly. Though typically a two-year process, the PLAAF has now appears to have reduced the timeline considerably in some cases.

Reflecting this trend, in recent years, flight training for PLAAF combat aircrews has become less scripted and more realistic. For example, mandatory altitude gaps between aircraft, which had been in place as a safety measure and were guided by regulations, have been reduced. Although the PLAAF created a "Blue Force" unit, who theoretically uses foreign tactics, it often merely identifies a unit as a "Blue Force" for purposes of the training event or exercise.[xi] However, information about engagement patterns, airspace, and altitude is prearranged and communicated to pilots ahead of time.

"System of Systems (SoS) confrontational drills," by contrast, involve a higher degree of uncertainty and complexity. They feature two confrontational parties that do not know about each other's conditions, and both parties have to rely on integrated information support, real-time communication, and their own judgment to achieve success. A typical summer combined-arms training "season" for a PLAAF combat aviator may feature between six and twelve drills and exercises involving both "confrontational air battle assessments" and "SoS confrontational drills."

xi The Cangzhou (沧州) Flight Test and Training Base (FTTB/飞行试验训练基地), which is also called a Flight Test and Training Center (飞行试验训练中心), is located in Hebei Province. It was officially established in 1987 replacing the 11th Aviation College. It is the home to the PLAAF's first "Blue Force" unit, which is equipped with J-10 fighters and plays the role of the enemy air force in PLAAF training. Michael S. Chase, Kenneth W. Allen, and Benjamin S. Purser, III, *Overview of PLA Air Force* "Elite Pilots", RAND Project Air Force, October 2015.

Four Key Training Brands Update

"Red Sword" 2018

The "Red Sword" exercise, which began in 2000, is a combination of the "Golden Helmet" opposition-force air competition, "Golden Dart" assault and penetration competition, and "Blue Shield" deployment tactics for air defense and anti-missiles exercises, which took place between May and June 2018 held at the Dingxin Test and Training Base in the Gobi Desert. "Red Sword" is a campaign-grade, all-element System-of-Systems opposition-force activity which focuses on cultivating capable commanding officers and commanding teams. It tests the in-depth integration of combat elements and coordinated operations and is considered the highest form of actual-combat exercise and drills in the PLAAF. The PLAAF deploys multiple branches and aircraft types to participate. The 2018 exercise involved nearly 100 fighter planes, bombers, early warning aircraft, and surveillance aircraft from the aviation branch, as well as surface-to-air missile, radar, electronic countermeasure units.

After over 10 years, the "Red Sword" exercise has completely transformed from tactics-oriented (drills/exercise) to campaign-grade (exercise), from a single service branch to multiple branches and multiple types of aircraft, and from traditional training to "informatized" training. It has become an actual-combat "Training Brand" with the highest Air Force combat content.

"Golden Helmet" 2018

Established in 2011, the "Golden Helmet" opposition-force air combat competition is a 10 to 14 day competition in November and/or December often held at the Dingxin Test and Training Base in the Gobi Desert, and in 2016 it included more than 150 elite pilot participants but was reduced to about 100 in 2017. In 2018, a total of 15 units were involved. The focus was on 3.5-generation aircraft, including the J-16 and J-10C, as well as the J-11B. Apparently, no Su-35s or J-20s have yet to participate. Since 2014, no 2nd-generation aircraft have participated. Individual winners of the annual competition are identified as the PLAAF's "elite pilots" and have the right to wear a gold-colored helmet at their fighter unit. To date, the number of pilots involved in the competition has ranged from 100 to 170 and the number of regiments and brigades participating in the competition has ranged from 10 to 20. Altogether, 66 different pilots have won "Golden Helmets," including three pilots who have won the award twice and one pilot who has won three awards. Although the highest number of pilots to win was 12 in 2015, the PLAAF began limiting the total number of winners to 6 in

2016. There is also a unit award (Skyhawk Cup), which is given to the team with the highest total score.

"Golden Dart" 2018

The "Golden Dart" competition is held in the summer and is considered the highest level of fighter units' tactical air combat training, targeted training for fighter and fighter-bomber, bomber, and ground attack aircrafts' strike capabilities that involves fierce air defense penetration and assault operations. In recent years, the venues of the Golden Dart competitive assessment have expanded from the desert and the Gobi areas to canyons, seas, and grasslands with increasingly difficult battlefield situations for competitors. Red Sword 2017 marked the first time the PLAAF carried out such a campaign-grade opposition-force system-of-systems actual-combat exercise between two bases since the "Base-Brigade" system came into operation. The 2017 exercise reinforced the principle of "focusing on examination rather than competition, focusing on performance rather than format, and focusing on evaluations rather than results". The 2018 exercise, which took place in Jilin Province in April, involved over 200 fighter jet pilots from dozens of PLAAF combat units. According to the assessment regulation, the participating pilots will fly their fighter jet to conduct penetration to first break through enemy air defense systems and then launch an assault to attack enemy land or sea targets. In order to create a real combat environment, the competitions are staged both at daytime and night and live munitions are used in the assault operations. The assessment aims to test the pilots' defense penetrating and assaulting tactics when flying at low altitudes, and the abilities to quickly locate targets in complex environments and conduct continuous attack with different weapons, he added .

"Blue Shield" 2018 Exercise

The Blue Shield exercise is designed to test the capabilities of the PLAAF's ground-based air defense forces, specifically SAMs and supporting radar and information systems. First held in 2002, the exercise has evolved over the years from the training of firepower elements via target shooting, to the training of tactical units via base-focused exercises, to the present training of a combat operations system via live-forces, live-fire confrontations at deployed locations.

According to Senior Colonel Shen Jinke who is the PLAAF's news spokesman, the Blue Shield exercise is "an actual-combat air defense antimissile training mode formulated for the ground-based air defense force to adapt to new threats in the air and space and to changes in the modes of operation, and it has become one

of the four key brands in actual combat training of the Air Force." Based on the requirements for a combined air defense antimissile campaign that focuses on reconnaissance, strikes against incoming threats, protection, and other complex integrated training topics, the Blue Shield exercise is an important platform to test and enhance the PLAAF's air defense and anti-missile operational capabilities.

Blue Shield 2018 was held in North China in June with participation of air defense units from the PLA Army, Navy, Air Force and Rocket Force. The 2018 exercise highlighted realistic combat training with coordination of air defense troops of multiple services, aiming to enhance the inter-service coordinated combat capability and the commanding capability of an air defense base. The joint exercise consisted of drills of 10 subjects, including force projection, combat planning, and air-ground confrontations. Going forward, more efforts will be made to promote the normalization, standardization and institutionalization of the joint air defense training exercise, so as to boost the IT-based joint air defense capabilities of the PLA.

Recent articles in PLA media provide a good overview of how the competitions have advanced over the past decade, to include using different generations of aircraft, dissimilar aircraft, "2v2" as well as "1v1 confrontations using similar and dissimilar aircraft, and a mix of younger and older entrants. The emphasis on younger participants in the competition, many in their late 20s or early 30s, reflects a desire on the part of the PLAAF to develop fighter pilots who are less hidebound and more willing to implement a "free air combat" approach. In order to avoid issues related to "training for the test," the PLAAF HQ began randomly selecting the competitors from each unit in 2014, which resulted in the smallest number of winners to date; however, it is not clear how early they select them. Selection of some participants at random also allows PLAAF leaders a means to assess the quality of average pilots relative to their elite counterparts. Additionally, to more closely approximate realistic combat conditions, the PLAAF is relaxing safety restrictions, such as closing the gap between aircraft in formation to 50 meters and adjusting the altitude for engagement, even though these changes entail higher risk of an accident.

Golden Helmet Winners[265]

Although Naval Aviation pilots had observed earlier Golden Helmet competitions, 2015 was the first time they participated.[266] Two J-10s from an unidentified air regiment in the East Sea Fleet conducted 2v2 dissimilar, free air combat against unidentified PLAAF pilots. Although no Naval Aviation pilots have yet to win a Golden Helmet, in August 2014, two pilots from the ESF's "Blue Force" unit equipped with Su-30MK2s conducted the first-ever joint free air combat opposition-force training over water with the Air Force.[267] The PLAAF pilots were Golden Helmet winners flying J-11s. After training for five months, the Naval Aviation pilots won the competition, which involved 1 vs. 1 and 2 vs. 2 engagements.

International Training with Foreign Militaries

In 2002, the PLA began conducting combined exercises with foreign militaries, which the PLA sometimes refers to as "joint exercises."[268] To date, it has participated in more than 70 such exercises and drills with militaries from over 30 countries. There are no indications that the PLARF or its predecessor has ever participated in training with the forces of any foreign country. It also does not appear that China's space forces, previously under the former GAD and now the PLASSF, have conducted any training events with foreign militaries either.

As part of this effort, the PLAAF has increasingly become involved in exercises with foreign air forces. Units involved have included those with multirole combat aircraft, bombers, and airborne troops. These exercises have allowed the PLAAF to demonstrate its improving capabilities to the international community. They also provide opportunities to observe and learn from foreign militaries in an operational environment, and serve as a vehicle for building trust and cooperation with select countries.

Exercises with foreign countries can be divided into two categories: those with members of the Shanghai Cooperation Organization (SCO) and those with

individual, non-SCO countries. 180 Exercises to date included participation with Russia, Kazakhstan, Turkey, Pakistan, Venezuela, Belarus, Thailand, and Indonesia. PLAAF Il-76 transport aircraft have supported all of the PLAAF deployments abroad, some of which have involved aerial or ground refueling enroute. It should be noted that all of these exercises are highly scripted and the PLAAF trains for the individual components of each exercise for months in advance.

In July 2014, the Russian Air Force hosted "Aviadarts-2014" at Voronezh, Russia, which included the PLAAF and Belarus Air Force. Three PLAAF Su-30s and six pilots competed in six separate events aimed at showing pilot skills in visual reconnaissance, navigation, single-plane or two-plane aerobatics, and air-to-ground attacks. Each crew launched 24 rockets and fired 60 cannon rounds. Based on the total scores, Russia took first place, China took second, and Belarus third. In August 2015, three PLAAF competed in the "Aviadarts-2015" competition, which was held within the framework of the "International Army Games 2015." More than 100 pilots in over 50 flight crews from Russia, Belarus, Kazakhstan, and China flew 12 different types of fixed-wing warplanes and helicopters, including three Chinese-made JH-7 fighter-bombers. Although China took second out of ten teams overall in the International Army Games that year, the PLAAF came in third behind Russia and Kazakhstan but beat Belarus in the Aviadarts competitions. Unlike 2014, when the PLAAF Su-30s used Russian munitions, in 2015 the JH-7s brought their own munitions. A new air combat evaluation system developed in 2016 used at the exercises has shortened the time it takes to evaluate 4-aircraft air combat from three days to three hours.[269] Without this system, it had taken more than 20 days to finalize the evaluation of a competition, whereas in 2016, it only took seven days. By adding close-range air combat to the competition, 2017 involved twice the number of sorties than the previous year, yet the evaluation only took nine days to complete.

Prior to 2016, "Red" and "Blue" were only arbitrary designations for separating the two competing teams. Starting in 2016, the directors set up a target area, clearly designating Red as the attacker and Blue as the defender. August 2017 was the first time the Aviadart competition was held in China (Jilin Province).[270] As of 2018, the PLAAF has participated in the Aviadart competition for four consecutive years as the 2018 competition was again held in Russia.

PLAAF pilot at the 2014 Aviadarts Competition[271]

"Shaheen" is a China-Pakistan Air Force combined training exercise which originally launched in 2011. The 2017 exercise, "Shaheen-VI", occurred in September and involved multiple types of aircraft and multiple branches. China dispatched J-11 fighters, JH-7 fighter-bombers, KJ-200 early warning aircraft and ground forces, including SAM, radar units and airborne special forces. Pakistan sent JF-17 Thunder fighter jets as well as early warning aircraft. PLA Naval Aviation also participated in the training. Shaheen VI took place on a Chinese military base and lasted a little bit longer than 20 days (7-27 September). It used early warning aircraft throughout the entire process,[272] included night-time opposition-force combat. Live munitions were used, and opposition-force combat involved pilots from both countries sitting in the same fighter during the ongoing joint drills.[273] In the past, a campaign-grade joint training such as this would have been organized by a Theater Command level or above headquarters organization, however, with the new Base-Brigade system the Base was responsible for directing and organizing the joint training exercise in 2017. The 2018 version, "Shaheen-VII", took place at an operational air base in Karachi in December.[274]

"Anatolian Eagle" is a China-Turkey joint training activity. Along with the "Aviadart" and "Airborne Platoon", these competitions have all taken place since the conclusion of the 18th Party Congress.[275] Turkey hosts various "Anatolian" type exercises with many countries. As they all take place in Konya, in central Anatolia, south of Ankara, the 2017 exercise most likely took place here as well. The first known instance of a Sino-Turkish relationship took place in 2010 at the first such "Anatolian Eagle" exercise between the two countries. At that time, four Su-27s and at least one Il-76 participated. Turkey flew F-4s.[276]

China and Thailand have held three "Falcon-Strike" exercises in Thailand with the goal of testing tactics, combat methods, and weaponry, and improving actual combat training. "Falcon Strike 2015" took place from 12-30 November 2015 at Korat Airbase,[277] while "Falcon Strike 2017" took place from 17 August

to 3 September and "Falcon Strike 2018" took place from 4-21 September at Udorn Airbase.[278]

The PLAAF's Airborne Corps has also participated in combined bilateral and multilateral exercises abroad since 2007, including exercises in Russia, Belarus, Venezuela, and Indonesia. The International Army Games 2017, which ran from July 29 to August 12, consisted of 28 competitions that were held in Russia, China, Azerbaijan, Belarus, and Kazakhstan. Air forces from China, Russia, Iran, Kazakhstan, Morocco, South Africa and Venezuela participated. In August 2017, the PLAAF's Airborne Corps won first place in 11 out of 12 "Airborne Platoon" events during the International Army Games 2017 component that was held in China's Hubei Province.[279]

Finally, the PLAAF's Bayi Aerobatics Team, which was established in 1962 near Tianjin and upgraded from the J-7 to the J-10 in 2009, has participated in both domestic and international air shows, including the biennial Zhuhai Air Show beginning in 1998. The team has staged more than 600 aerobatic performances for over 700 delegations from 168 countries and regions.[280] It has also participated in six international air shows outside of China in recent years. The first performance was at the 2013 Moscow Air Show. Its second show was in March 2015, at the Langkawi International Maritime and Aerospace Exhibition in Malaysia. In November 2015, the team performed for the first time in Thailand at the invitation of the Royal Thai Air Force at the Korat Royal Thai Air Force Base.[281] In November 2017, the team performed for the first time in the United Arab Emirates at the 15th Dubai Airshow.[282] On the way home from Dubai, the team performed in Quetta, the capital city of Pakistan's Balochistan Province, which was the first time it had performed at high altitude.[283] In August 2018, it performed for the second time in Moscow at the Army 2018 International Military and Technical Forum.

PLA Rocket Force Training

Like other elements of the PLA, the PLARF has emphasized training for actual combat conditions, increasing the force's "informatized" capabilities, and improving "Blue Force" and "opposition-force training." Furthermore, rocket force units focused on improving survivability and the ability to sustain combat operations during war, by conducting training under a variety of conditions, such as training at night, in cold weather and underground, as well as improving their ability to overcome enemy attacks, including air raids, electromagnetic jamming, and reconnaissance activity. It is unclear how often such field training involves

real missiles. Nevertheless, training has been geared toward simulating actual combat conditions in different weather and terrain situations and moving missiles between different launch sites more rapidly during all times of the day.

China's rocket forces apparently continue to encounter problems, such as a lack of qualified personnel, physical and psychological issues associated with training in underground facilities, "training for the test,"[xii] a lack of standardized equipment among units, and equipment breakdowns. Overall, open source reporting tends to highlight success in the five areas below:

- Launching live missiles
- Deploying to a field training or launch site
- Establishing communications along the way and at the final location
- Training all personnel to meet requirements
- Providing support for personnel and equipment during training at distances or in underground facilities.

For example, in 2014, one Chinese report mentioned how an unidentified missile Base satisfactorily completed more than ten major exercises and drills and successfully launched nearly 100 missiles of various types over several years.[284] During another deployment, a large convoy of vehicles crossed through mountains and forests during bad weather while successfully handling simulated "enemy situations," such as bridges having been bombed and harassment by enemy operatives, to arrive on time at a pre-designated launch site.[285] Concerning establishing communications, another article mentioned that within 30 minutes of entering a drill site, one unit made use of field combat operations command support components that it had researched and built on its own, and succeeded in installing and debugging military-civilian telephone, videoconferencing, and a dedicated command network, thereby achieving a peacetime-wartime combined, field combat operations interconnected network.[286]

Realistic Training on the Rise

Elements simulating conditions expected in actual combat have become a centerpiece of training exercises within the PLAAF and PLARF. Based on the types of training tasks being reported in Chinese open source reporting, PLA aerospace forces have clearly increased the degree of difficulty of training subjects to include operating under challenging environmental conditions such as during

xii This refers to the practice of units working only on specific items on which they will be evaluated, and not truly learning or exercising the underlying competency and capability the 'test' is supposed to be evaluating.

the night and under extreme weather conditions, flying at low and very low altitudes under CEME, cultivating "free air combat" skills among aviators with decreased altitude restrictions, and conducting sophisticated multi-branch and service exercises against challenging air defense scenarios to mimic actual battle conditions.

In a significant shift from prior practice, PLAAF pilots in some air units are now given the responsibility to create their own flight plans and have full autonomy over their sorties with little guidance from commanders in the tower or an airborne command post. Such elements are part of a broader effort to improve realism and more effectively evaluate unit performance. These measures are consistent with the PLA's objective of being able to fight and win wars under conditions of informatization against formidable opponents.

9. Industrial Base[285]

In the early 2000s, charged with safeguarding Chinese interests abroad and enforcing territorial claims closer to home, strategic power projection became a driving force for aerospace projects. Further emboldened by a booming economy, a more assertive and confident government embarked on an ambitious program of military modernization that would have been impossible even a few years earlier. The civilian aviation industry has also seen tremendous growth, with China's expanding middle class driving demand for domestic and international travel. The civilian aviation industry, working in tandem with the central government, is attempting to meet domestic demand with indigenously-produced aircraft. However, the Chinese aviation industry today remains reliant on foreign technology but has demonstrated an ability to innovate and improve on foreign designs. This trend suggests truly indigenous, and potentially revolutionary innovation is on the horizon.

At present, large aviation factories are largely consolidated under the banner of the Aviation Industry Corporation of China (AVIC). Due to new government regulations, AVIC and the remaining conglomerates have greater access to funds from capital markets. Chinese Communist Party (CCP) General Secretary Xi Jinping's anti-corruption campaign appears to have largely avoided taking on these industries directly, though the results of official investigations suggest that there have been issues with procurement and they are under greater scrutiny to improve their processes. Repeated restructuring of State Council bodies, including the March 2018 *Plan to Deepen Reform of Party and State Institutions* [深化党和国家机构改革方案], is aimed at improving oversight of China's state-owned industries. Most important, however, are the reforms to the PLA itself, which started in earnest in 2016. These reforms sought to institute a joint structure for

the military, and so far, have resulted in an organization that, in theory at least, should better represent the Research, Development, and Acquisition (RDA) needs of China's services more equally. The reforms are also intended to give greater voice to important guiding bodies such as the Central Military Commission's (CMC) Science and Technology Commission [中央军委科学技术委员会]. To date, however, progress toward functional jointness is slow, with many of the new bodies continuing to be dominated by PLA Army personnel.[xiii]

For both the military and civilian sectors, continuous innovation will be key in building aircraft that are market-competitive or survivable in a conflict. China has made tremendous strides in improving its Research and Development (R&D) systems. While many improvements can be attributed to the aforementioned organizational reforms, additional improvements deserve independent attention. In particular, the acceleration of the use of Computer Integrated Manufacturing Systems (CIMS) [电脑综合制造], which include a full range of processes and tools such as Computer-Aided Design (CAD), Modelling, Quality Control, 3D Printing, and Computer Numerical Control (CNC) milling and lathing, have dramatically sped up the R&D process. As a result, since 2000, projects appear to be completing their conception-to-test-flight phases more rapidly than before. New materials, such as composites, carbon fiber, and titanium, which reduce radar cross-sections, save weight, and allow faster speeds, are frequently cited in the construction of new airframes. However, according to official assessments and statistics put out by Chinese government bodies, China is overwhelmingly reliant on imports of foreign technologies. For example, Xin Guobin [辛国斌], who is a Deputy Director of the Ministry of Industry and Information Technology (MIIT),recently noted that 52 percent of core materials are imported. When certain types of processors and other technology necessary for "intelligentized" [智能化] manufacturing and other industries are taken into account, this number rises to between 70 and 95 percent.[288] While addressing this reliance is a major priority for Xi Jinping and other Party leaders, the aerospace industry has a mixed track record of building capabilities indigenously and developing replacements will take time, particularly in the middle of a trade war.

Despite these vulnerabilities, both civilian and defense aviation firms are benefiting from foreign technology. The government is also emphasizing "spinning on" civilian-developed technologies for military use [民转军], a reversal from the 1980s and 90s when military industrial capacity and know-how was used to build the civilian economy. Xi Jinping has made these types of synergies and increased

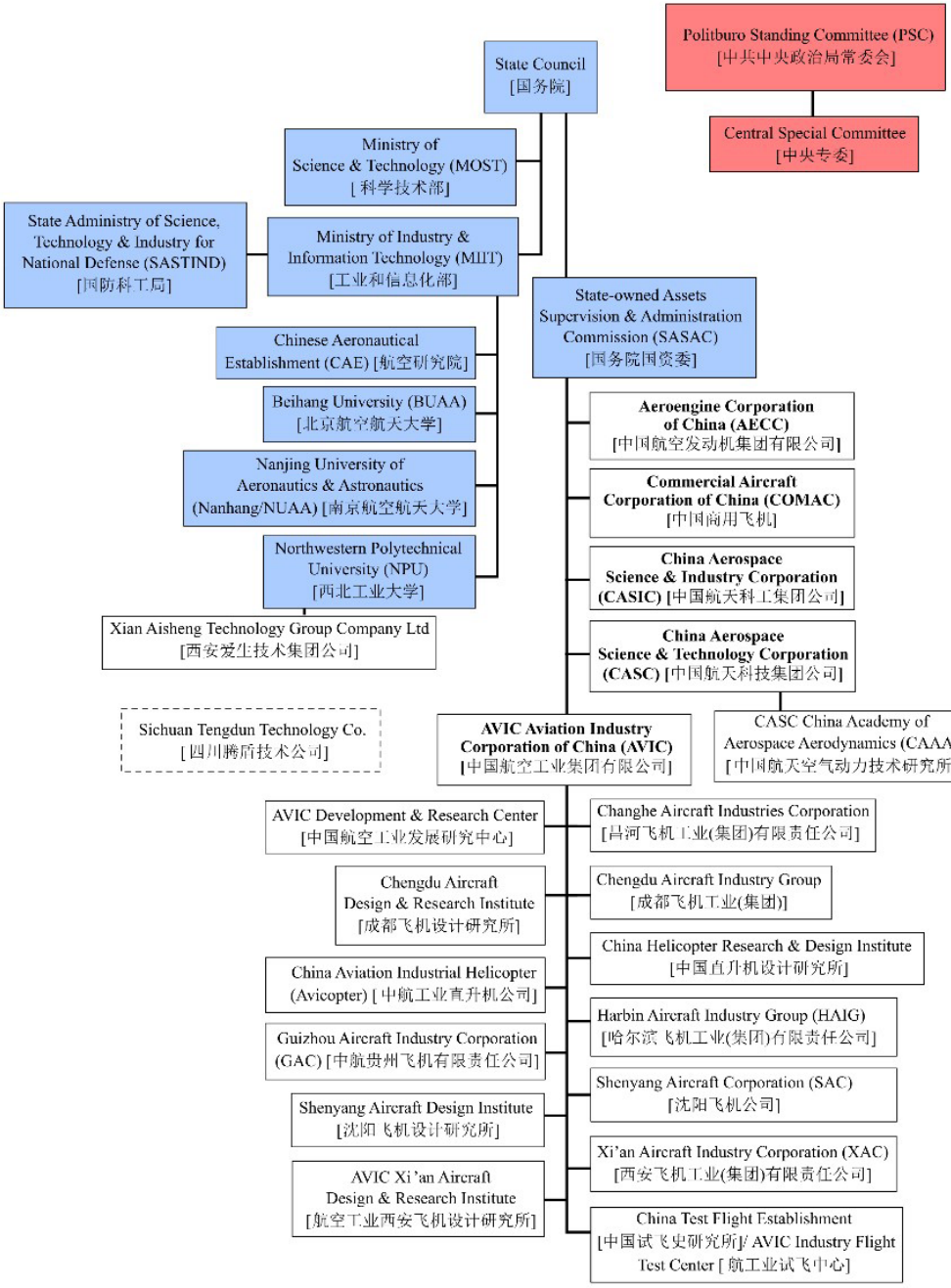
xiii For example, the former GAD was reorganized and renamed as the CMC Equipment Development Department (EDD) in 2016; however, it was downgraded in grade and the director was removed from the CMC during the 19th Party Congress in October 2017.

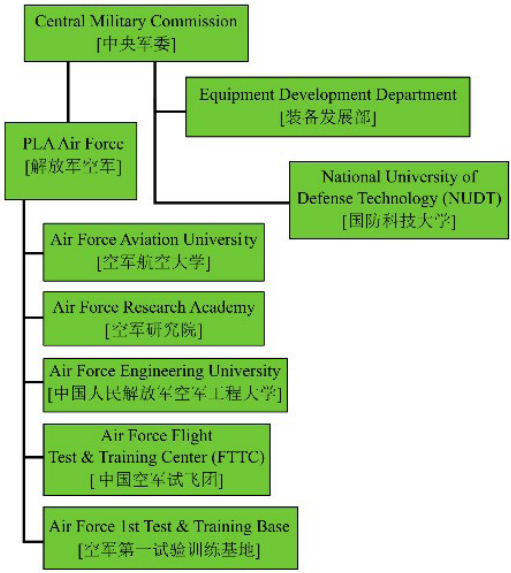
cooperation between the civilian and military sectors (Military-Civil Fusion [军民融合]) a centerpiece of his administration.

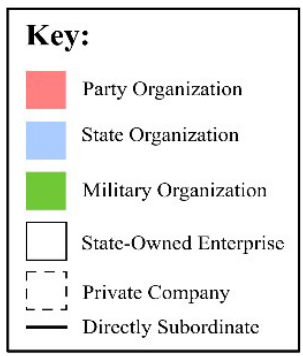
Shifts in civilian market and military requirements and utilization are having a major impact on the Chinese aviation industry. The industry will play a major role in the PLA's modernization more broadly, but specifically with its strategic transformation [战略转型]. Both the PLA Navy's aviation branch and the PLA Air Force (PLAAF) are the recipients of major upgrades over the past decade. The PLAAF has a specific strategy for air operations "Integrated Air and Space Operations, Simultaneous Offensive and Defensive Operations" [空天一体, 攻防兼备], which it adopted in 2004. In 2014, Xi Jinping tasked the PLAAF with becoming a "Strategic Air Force."[289] In 2015, China's Military Strategy [中国的军事战略] said that the PLAAF will "shift its focus from territorial air defense to both defense and offense, and build an air-space defense force structure that can meet the requirements of informationized operations." The PLAAF is also regularly framed as a "Strategic Service" [战略性军种], meant to be capable of precision long-range strike and transport, including airborne, operations.[290] In an interview with People's Daily, Air Force Command College [空军指挥学院] Professor Wang Mingliang [王明亮] described a "Strategic Air Force" as necessarily possessing three capabilities: Strategic Defense Capability [战略防御能力] across all domains; Strategic Attack Capability, including deep strikes against enemy positions regardless of terrain; and Strategic Power Projection [战略投送能力]. This last capability is particularly important and includes logistical support to be able to gather resources needed for operations, as well as the ability to deliver them over long distances in a short time.[291] Additionally, according to the 2018 DOD Report to Congress on China's Military, the "PLAAF has been newly re-assigned a nuclear mission."[292]

These requirements, and similar shifts in operational use of aviation by the Naval Aviation and Army Aviation branches, create a significant shift in the direction of aviation R&D. Purchases of advanced Russian fighter jets (Su-35), indigenous production of the Y-20 heavy-lift transport aircraft, the introduction of advanced variants of the H-6 bomber, and ongoing development of an "H-20" bomber can all be understood as responses to this strategic guidance. Similarly, in the commercial market, government plans such as the Large Aircraft Project [大型飞机项目] are responsive both to commercial market demand and the central government's intention to move China's economy up the value chain through promoting advanced manufacturing.

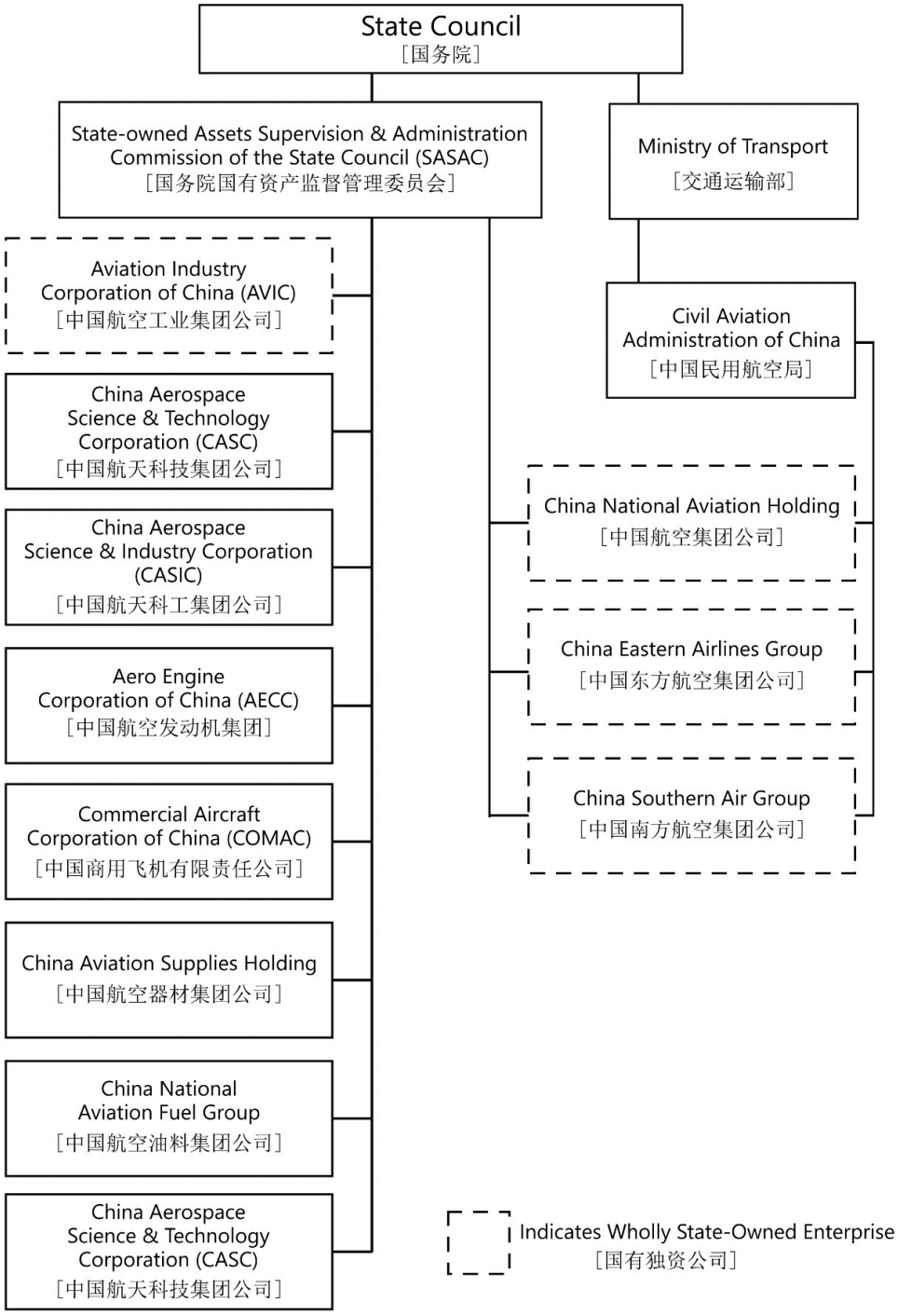
China Aviation Industry




Central Military Commission
[中央军委]
Equipment Development Department
[装备发展部]
PLA Air Force
[解放军空军]
National University of
Defense Technology (NUDT)
[国防科技大学]
Air Force Aviation University
[空军航空大学]
Air Force Research Academy
[空军研究院]
Air Force Engineering University
[中国人民解放军空军工程大学]
Air Force Flight
Test & Training Center (FTTC)
[中国空军试飞团]
Air Force 1st Test & Training Base
[空军第一试验训练基地]


Key:
Party Organization
State Organization
Military Organization
State-Owned Enterprise
Private Company
Directly Subordinate

State Administration of the Aerospace Inudstry in China



10. Outlook

As the U.S. Department of Defense has observed, "The PLAAF is pursuing modernization on a scale unprecedented in its history and is rapidly closing the gap with Western air forces across a broad spectrum of capabilities including aircraft, C2, jammers, EW, and data links."[293] The pace and scope of modernization in China's rocket and space forces has been comparable. Assuming that China's leaders continue to define their nation's interests expansively, they will surely look to the PLA, including the PLAAF, the PLARF, and the PLASSF, to sustain their efforts to field ever more capable forces. Areas of emphasis likely will include strengthening the already formidable air defenses of the Chinese mainland, increasing the reach and lethality of ISR and strike systems out to and beyond the second island chain, improving capabilities to disrupt adversary information systems while better protecting China's, and increasing the scope and complexity of the PLA's security assistance, search and rescue, disaster relief, and other "non-traditional," peacetime activities. All of these areas of policy emphasis will have direct implications for the development of the PLA's air, missile, and space forces.

The ability of the PLAAF, PLARF, and PLASSF to meet the needs of China's increasingly ambitious security strategy will depend, in part, on the future trajectory of military spending in China. Every year between 2000 and 2014, China's military spending grew by more than ten percent, yielding a total increase of more than 480 percent in real terms over that period.[294] China's economy is showing signs of slower growth and this may affect the rate of increase in its military spending in the coming years, potentially reducing the pace of modernization. Additionally, if the PLA is to continue its rapid evolution toward a modern, professional force its leaders will have to sustain efforts to weed out corruption, overcome certain cultural impediments to rigorous training and exercises, and seek new opportunities for forces to gain real-world operational experience beyond China's borders.

The future evolution of China's air, missile, and space power will depend on developments in at least five areas: strategy and doctrine, equipment, recruitment and training, infrastructure, and organization.

Strategy and Doctrine

Statements by the leaders of all elements of the PLA reflect their understanding that the leadership of the CCP expects them to make continued strides in fielding forces capable of contending with those of any adversary. Of all of the PLA's components, the leaders of the PLAAF may have adopted the most ambitious goals, as reflected in their oft-repeated intention of becoming a "strategic air force." By this, they appear to mean a force that has the following characteristics:

- A clearly defined strategy and an accompanying set of missions that enable it to directly achieve important national security objectives and play a decisive role in protecting Chinese national interests; requirements for modern platforms and systems that are commensurate with China's standing as a major power, including advanced offensive and defensive capabilities; and finally, the institutional status befitting its role as a 'strategic service,' an important consideration given that historically the PLAAF has been relegated to a subordinate role in China's traditionally ground force dominated military.[295]
- Building an air force capable of undertaking a broader set of missions over larger areas and executing powerful strikes against adversaries are seen as requirements for supporting China's growing role on the world stage.

Equipment

As we have seen in the preceding chapters, China's air, missile, and space forces have made great strides in developing, acquiring, fielding, and, increasingly, mastering the integrated employment of new generations of aircraft, rocket and space systems, and their associated weapons and support systems. Barring a major reversal in the performance of China's economy, continued progress along these lines should be expected. Certainly, 4th- and even 5th-generation aircraft will continue to fill out PLAAF fighter units as older models are retired, and the PLARF will continue to field modern short-, medium-, and intermediate-range missiles, some with specialized warheads and guidance packages for specific missions. But the most significant future developments may come from programs that bring major boosts in capability to areas generally considered to be support functions:

- If the Y-20 program proves successful, it could provide the basis for the PLAAF to undertake more regularized, long-range airlift operations, greatly increasing opportunities for expanded security cooperation, deployments, humanitarian missions, and support to other PLA and national missions.
- The PLAAF has developed a number of UAVs in recent years but these seem not to have been fully integrated into joint PLA operations. As the PLAAF and other elements of the PLA gain increasing experience with UAVs, these platforms and their associated sensors have the potential to significantly improve the PLA's ability to locate, identify, track, and target high-priority assets. PLAAF theorists are calling for the development of new combat platforms that are "unmanned, stealthy, and informatized."[296] China already possesses one of the largest and most modern forces of SAM systems in the world. The Chinese are also developing their own HQ-19 SAM, which appears to have capabilities similar to those of the Russian S-400.[297] If deployed in significant numbers, these systems will further extend the range of China's integrated air defenses and create new challenges for adversary air forces.
- The PLAAF has lagged, relative to its investment in modern fighter and bomber aircraft, in developing modern airborne warning and control capabilities. Aircraft with powerful on-board radars, controllers, and communication systems can play important roles in orchestrating largescale, complex air operations. China appears to be taking steps to fill this gap in its capabilities by introducing a new platform, the KJ-500.[298]

Recruitment and Training

As they have fielded more sophisticated and modern equipment and sought to adopt more complex tactics, the PLAAF, PLARF, and PLASSF have found that human capital is also an essential element of operational proficiency. Accordingly, all three arms of the PLA have taken steps to recruit more highly educated personnel and to retain top performers. The degree to which they succeed at this will go a long way toward determining the extent to which each service will be able to accomplish the ambitious range of missions they have defined for themselves.

This volume has reviewed efforts within China's aerospace forces to make training more valuable and realistic. By all accounts, these efforts have begun to bear fruit, though PLA open sources document continued shortfalls in numerous areas. We should expect to see continued investments by the PLAAF and PLARF in such assets as opposition forces and systems that can replicate the electromagnetic

conditions of actual combat. Additionally, the scale, complexity, and "jointness" of PLA exercises likely will continue to increase, reflecting the intent of PLA leaders to prepare their forces to confront any adversary.

Military Infrastructure

As with its combat forces, the past twenty years have seen significant and sustained investments in key infrastructure to support PLA operations. The proliferation of redundant, hardened command and control facilities has perhaps been the most dramatic development in this area, though air bases, missile garrisons, and other facilities have been upgraded as well. We should expect to see future investments in training infrastructure, such as instrumented bombing ranges and airspace, as the PLAAF continues its emphasis on more realistic and rigorous training.

Organization

As noted earlier in this volume, the PLA is in the midst of implementing its 11th major reorganization since 1949. By elevating the Second Artillery Force to the status of a military service, now called the PLA Rocket Force, and by establishing the PLA Strategic Support Force to consolidate China's military space activities into an independent branch, China's leaders have made clear the importance they place on missile forces and space capabilities. While it will take several years for the reorganization to be fully implemented, and thus for its implications to become totally clear to outside observers, but what has been announced so far suggests that as the PLA implements the reorganization, air and space power will play increasingly prominent roles in Chinese military strategy.

Appendix 1: PLA 15 Grades and 10 Ranks

In the PLA, all officers are assigned one of 15 grades that determine their billet.[299] In addition, every organization, including naval vessels, is assigned one of the 15 grades. The only numbers that are assigned to grades are for special technical officers. Officers are also assigned one of 10 ranks, such that each grade, except for CMC vice chairman, has two ranks. As such, grades, which are linked to billets, are more important than ranks when determining where an officer fits into the overall structure. The 15 grades are shown below from highest to lowest. Every grade also has a mandatory retirement age assigned to it. Unless an officer meets his mandatory retirement age, he can be demobilized, and not "retired", such that they may receive a one-time payment, but not ongoing retirement benefits.[xiv] For example, 150,000 officers, many of who had over 20 years of service, were demobilized during the current reorganization.[300]

- CMC vice chairman (军委副主席)
- CMC member (军委委员)
  - CMC's Joint Staff Department (JSD), Political Work Department (PWD), and Discipline Inspection Commission (DIC)
- Theater Command leader (正战区职)[xv] and deputy leader (副战区职) (former Military Region leader and deputy leader)
  - Leader: 4 Services, PLA Strategic Support Force, 5 Theater Commands
  - Deputy Leader: 5 Theater Command Army HQ, 3 TC Navies (former fleets), and 5 TC Air Force HQ

xiv During the current force reduction, 150,00 NCOs were also demobilized. In order for an NCO to retire, they must have served a full 30 years or reach the age of 50.

xv The PLA uses both zhi (职) and ji (级) to identify its grades. In addition, unless the character zheng (正), which refers to leader, or fu (副), which refers to deputy leader, is used, the term usually refers to both leader and deputy leader. For example, jun zhi (军职) and jun ji (军级) refer to both corps leader and corps deputy leader.

  - CMC Training and Administration Department, and National Defense Mobilization Department
- Corps leader (正军职) and deputy leader (副军职)
- Division leader (正师职) and deputy leader (副师职) (brigade leader)
  - Divisions have subordinate regiments and battalions
  - The PLA is shifting toward a brigade structure for several organizations
  - Brigades are not subordinate to divisions and have subordinate battalions
  - Brigades can have subordinate regiments of a different type (e.g., operational brigade with a subordinate support regiment)
- Regiment leader (正团职) (brigade deputy leader) and deputy leader (副团职)
- Battalion leader (正营职) and deputy leader (副营职)
  - Some independent battalions are treated like and organized like a regiment
- Company leader (正连职) and deputy leader (副连职)
- Platoon grade (排职)

Each grade, except CMC vice chairman, has 2 ranks (primary and secondary)

- Sometime in the future, the PLA may very well implement a 4-star general rank and abolish the senior colonel rank—the driving force is dealing with foreign militaries, most of which have 4-star flag officers
- Each rank can be assigned to officers in up to 4 grades (e.g., major general)
- Grade promotions up to regiment leader are every 3 years, but there are growing exceptions for earlier promotions at 2 years. Promotions above regiment leader are not automatic and are based on multiple components.
  - Grade promotions are more important than rank promotions because they are linked to billets
  - Grade and rank promotions rarely ever occur at the same time
- Rank promotions up to colonel are every 4 years. Rank promotions above colonel leader are not automatic and are based on multiple components.
- Officers serve in one of five career paths: military (Commanders, Deputy Commanders, and personnel assigned to the Headquarters/Staff Department), political, logistics, equipment, or special technical.
- Since 2004, NCOs have been filling former officer technical billets up to the battalion deputy leader grade level; however, they are considered "acting leaders" because they cannot be assigned an officer grade.

The figure below shows the grades, mandatory retirement ages for combat and non-combat officers, the grades for non-technical and technical officers, and the ranks assigned to each grade.PLAAF Headquarters

Retirement Age Combat Troop	Non-combat	Grade (Non-Special Technical Officers)	Grade (Special Technical Officers)	Primary Rank	Secondary Rank
N/A		CMC Chairman (军委主席) Vice Chairmen (军委副主席)	N/A	N/A GEN/ADM	N/A
See Note Below		CMC Member (军委委员)	Grade 1 (1级)	GEN/ADM	
65	65	TC Leader (正战区职)	Grade 2 (2级)	GEN/ADM	LTG/VADM
63		TC Deputy Leader (副战区职)	Grade 3 (3级)	LTG/VADM	MG/RADM
55	60	Corps Leader (正军职)	Grade 4 (4级)	MG/RADM	LTG/VADM
	58	Corps Deputy Leader (副军职)	Grade 5 (5级)	MG/RADM	SCOL/SCPT
50	55	Division Leader (正师职)	Grade 6 (6级)	SCOL/SCPT	MG/RADM
		Division Deputy Leader (副师职) (Brigade Leader)	Grade 7 (7级)	COL/CPT	SCOL/SCPT
45	50	Regiment Leader (正团职) (Brigade Deputy Leader)	Grade 8 (8级)	COL/CPT	LTC/CDR
	45	Regiment Deputy Leader (副团职)	Grade 9 (9级)	LTC/CDR	MAJ/LCDR
40	40	Battalion Leader (正营职)	Grade 10 (10级)	MAJ/LCDR	LTC/CDR
		Battalion Deputy Leader (副营职)	Grade 11 (11级)	CPT/LT	MAJ/LCDR
35	35	Company Leader (正连职)	Grade 12 (12级)	CPT/LT	1LT/LTJG
		Company Deputy Leader (副连职)	Grade 13 (13级)	1LT/LTJG	CPT/LT
30	30	Platoon Leader (排职)	Grade 14 (14级)	2LT/ENS	1LT/LTJG

Since 2002, CMC members who are 67 or younger at the time of the Party Congress can remain until the next congress (age 72). Members who are 68 at the time of the Party Congress must retire.

Appendix 2: PLA Air Force Leadership

This Appendix provides profiles of PLAAF personnel who serve as the Commander, Political Commissar (PC), and Deputy Commanders or Deputy PCs in PLAAF HQ, each Theater Command HQ, and each Theater Command Air Force (TCAF) HQ. The Appendix is organized first by key leaders in the Central Military Commission, followed by the 10 key leaders in PLAAF HQ who compose the PLAAF's Party Committee's Standing Committee, and then by the PLAAF personnel who serve as key leaders in each of the 5 TCs and subordinate TCAFs in protocol order – Eastern, Southern, Western, Northern, and Central. Of note, it is not uncommon for a political officer to move from one service to another at the top of their career.

Central Military Commission Departments

LGEN Chang Dingqiu (常丁求) (b. 1967, Hunan Province) became a Deputy Chief of Staff in the CMC Joint Staff Department in July 2018 with the grade of TC leader.[301] He joined the PLAAF in 1984 as a pilot cadet. He moved his way up the career ladder as a pilot, flight group Commander, air regiment Commander, and Deputy Commander and Commander of the 3rd Fighter Division (Nanjing MRAF). In 2003, he studied abroad at a Russian Military Academic Institution. He then served as an Assistant to the PLAAF Chief of Staff and then became the Chief of Staff in the Shenyang MRAF and as a Deputy Commander of the Southern TC starting in February 2016. He received a rank promotion in July 2012 (MGEN) and in August 2018 (LGEN).

LGEN An Zhaoqing (安兆庆) (b. May 1957, Shenyang, Liaoning Province; Xibo/Sibe (锡伯) ethnic minority), who is a career Air Force political officer, became the PC of the CMC Equipment Development Department (EDD) in January 2017 with the grade of TC leader.[302] Is the first non-Army officer to ever serve in any leadership billet, and probably any billet, in the EDD and its predecessor GAD since it was created in 1998. During his career, he served in three different MRAFs, Shenyang, Nanjing, and Guangzhou. He began his career as an enlisted member during the Cultural Revolution before receiving a direct promotion as an officer and then transitioned into the political career path as a political officer in a flight group, air division, 1st Flight College, and deputy director and director of MRAF HQ Political Departments, as well as the PC for the Dalian Air Force Base, Guangzhou MRAF, Shenyang MRAF, and Southern TCAF, where he was a concurrent MR/TC Deputy PC. He received rank promotions in July 2009 (MGEN) and July 2016 (LGEN).

PLAAF Headquarters

LT GEN Ding Laihang (丁来杭) (b. 1957, Zhejiang Province) became the 12th Commander of the PLAAF in August 2017 with the grade of TC leader.[303] He previously served in the Beijing MRAF as a Deputy Commander and Commander of the 24th Air Division's 71st Air Regiment and Deputy Commander of the 24th Air Division, and Commander of the Beijing MRAF Transition Training Base. He then transferred to the Nanjing MRAF where he served as Chief of Staff of the 8th Air Corps and Commander of the Air Force Fuzhou Command Post, which was the 8th Air Corps' successor, and then became the Commandant of the Air Force Command College in Beijing. In 2009, he became the Chief of Staff of the Chengdu MRAF. In 2012, he became the Commander of the Shenyang MRAF and concurrent Deputy Commander of the Shenyang MR. In February 2016, when the Shenyang MR and MRAF became the Northern TC and TCAF, respectively, he continued as the TCAF Commander and concurrent TC Deputy Commander. Concerning his education, he received his flight training in the 1970s at the PLAAF's 9th Flight School in Hubei Province and a Bachelor's Degree in Political Work from the Air Force Command College. Unlike his predecessors, Ma Xiaotian and Xu Qiliang, there is

no information about him receiving any joint education at NDU. He received rank promotions in July 2003 (MGEN) and July 2013 (LGEN). He should receive his third star (General) sometime in 2019.

GEN Yu Zhongfu (于忠福) (b. 1956, Shandong Province) became the 13th PLAAF PC and Secretary of the PLAAF Party Committee's Standing Committee in July 2015 with the grade of TC leader.[304] He joined the PLAAF in 1974 as an enlisted member before becoming an officer and worked his way up the career ladder as a political officer with various leadership positions in subordinate administrative and functional organizations within the Political Department starting at the regiment level. He then became a PC in various units, including the 19th Fighter Division (Jinan MRAF) and 24th Fighter Division (Beijing MRAF), before becoming a Deputy Director of the Nanjing MRAF's Political Department. He then became the PC of the Air Force Shanghai Command Post (Nanjing MRAF), PC of the Jinan MRAF, and PC of the Nanjing MRAF. He received rank promotions in March 1994 (Senior Colonel), July 2007 (MGEN), July 2014 (LGEN), and July 2017 (General).

LT GEN Ma Zhenjun (麻振军) (b. 1962, Henan Province) became a PLAAF Deputy Commander in November 2017.[305] Prior to that, he was 13th PLAAF Chief of Staff (i.e. Director of the Headquarters Department / Staff Department) in August 2013 with the grade of TC deputy leader. He worked his way up the career ladder as a pilot and unit Deputy Commander and Commander to the air division level in the Guangzhou MRAF, including serving as one of the first Su-27 Fighter Regiment Commanders. After serving as Commander of the 2nd Fighter Division (Guangzhou MRAF), he became a Deputy Chief of Staff in the Guangzhou MRAF HQ, a Deputy Commander in the Jinan MRAF, Chief of Staff for the Beijing MRAF, and a Deputy Chief of Staff in the PLAAF HQ. Prior to becoming the PLAAF Chief of Staff, he served as the Commander of the Beijing MRAF for one year. He received a rank promotion in 2008 (MGEN) and 2013 (LGEN).

LGEN Xu Anxiang (徐安祥) (b. 1956, Jiangsu Province) became a PLAAF Deputy Commander in December 2017 with the grade of TC deputy leader.[306] He previously served as the Commander of the 14th Air Division (Nanjing MRAF) and as one of the Deputy Chiefs of Staff before becoming the Chief of Staff in the Nanjing MRAF HQ. In July 2011, he moved to PLAAF HQ to become one of the Deputy Chiefs of Staff. In December 2012, he became the Commander of the Guangzhou MRAF, which became the Southern TCAF in 2016. He also served as a concurrent Deputy Commander of the Guangzhou MR and Southern TC. He received a rank promotion in 2007 (MGEN) and 2014 (LGEN).

MGEN Zheng Yuanlin (郑元林) (b. 1962, Shandong Province) became a PLAAF Deputy Commander in December 2018.[307] He currently holds the TC deputy leader grade. He joined the PLAAF in 1978 and became a transport pilot. He served as a transport regiment Commander, transport division Chief of Staff, 13th Transport Division (Guangzhou MRAF) Commander, a Guangzhou MRAF Deputy Chief of Staff, an Assistant to the PLAAF HQ Chief of Staff, Chengdu MRAF Chief of Staff, and Guangzhou MRAF/Southern TCAF Chief of Staff. He studied at the PLAAF Command College's Campaign Course. He received a rank promotion in July 2010 (MGEN). He should receive his second star (LGEN) in 2019.

LGEN Chen Xuebin (陈学斌) (b. 1959, location unknown) became the PLAAF's only Deputy PC in May 2018.[308] He is a TC deputy leader grade officer. Until he assumed his current billet, he was a career PLA Navy political officer. He previously served as the Director of a PLAN air division's Political Department and then as a Deputy PC in the same unit. He then became a Deputy Director of the North Sea Fleet's (NSF) Political Department before becoming an NSF Deputy PC and concurrent PC for the NSF's Naval Aviation HQ. He then became the Secretary of the PLAN's Discipline Inspection Commission and a PLAN Party Standing Committee Member before becoming a PLAN HQ Deputy PC and concurrent Director of the PWD. He received a rank promotion in July 2010 (Rear Admiral) and July 2017 (Vice Admiral).

MGEN Yu Qingjiang (俞庆江), (b. 1963, Jiangsu Province) became the PLAAF's Headquarter's Chief of Staff in December 2017.[309] He is currently a TC deputy leader grade officer. He is also a special-grade pilot. From 1981-1984, he was a Flight Cadet at the Air Force 3rd Aviation School in Jinzhou, Liaoning Province. Upon graduation, he served in the Shenyang MRAF as a Deputy Commander and Commander of a flight squadron, flight group, and air regiment in the 1st Air Division before becoming a Deputy Commander and then Commander of the same air division. He remained in the Shenyang MRAF as the Commander of the Dalian Command Post and then as one of the MRAF Headquarters' Deputy Chiefs of Staff. He then moved laterally to the Jinan MRAF as a Deputy Chief of Staff before becoming the MRAF's Chief of Staff. He then became the Commandant of the PLAAF's Command College in Beijing. He received a Master's Degree in Management and Engineering (apparently by correspondence) from the Air Force Engineering University. He has traveled abroad to the Czech Republic, Hungary, Romania, Bulgaria, South Korea, the United Arab Emirates, Russia, and the U.S.. He was promoted in rank to MGEN in 2010. He should receive his second star (LGEN) in 2019.

MGEN Du Yuanfang (堵远放) (b. unknown) became the Director of the PLAAF's PWD in January 2017 with the grade of TC deputy leader.[310] Since the mid-2000s, he has served as a Deputy Director and then Director of the PLAAF HQ Political Department's Cadre Department, PC of the Air Force Fuzhou Command Post, Director of the Guangzhou MRAF HQ Political Department, and a Deputy Director of the PLAAF HQ Political Department in 2015, which became the PWD in 2016. He received a rank promotion in July 2012 (MGEN).

MGEN Zheng Xuexiang (郑学祥) (b. unknown, Shandong Province) became the Director of the PLAAF's Logistics Department in December 2014 with the grade of corps leader.[311] He previously served as a Deputy Director of the Beijing MRAF Logistics Department, Director of the PLAAF Logistics Directly Subordinate Supply Department, and Director of the Chengdu MRAF Logistics Department. He received a rank promotion in July 2010 (MGEN).

MGEN Zhu Cheng (朱程) (b. 1964, Jiangsu Province) became the Director of the PLAAF's Equipment Department in September 2018.[312] He is a corps leader grade officer. He previously served in the General Armament Department's Service and Branch Equipment Department as Director of the Aviation Bureau, then as a Deputy Chief Engineer. He then became the Director of the CMC Equipment Development Department's Scientific Research and Acquisition Bureau. He received a rank promotion in March 2018 (MGEN).

Eastern Theater Command Headquarters

LGEN Sun Herong (孙和荣) (b. 1957, Shandong Province) became a Deputy Commander of the Eastern TC in February 2016 with the grade of TC deputy leader. He previously served as the Commander of the Jinan MRAF.[313] He graduated from the Air Force Engineering University in Xi'an, Shaanxi Province, with a specialty in management science and engineering. He also received a Master's in Engineering. He previously served in several units, as well as serving as one of the Deputy Chiefs of Staff in the Shenyang MRAF Headquarters Department, one of the Deputy Chiefs of Staff in the Nanjing MRAF, and Chief of Staff in the Jinan MRAF. In 2011, he became one of the Deputy Commanders of the Jinan MRAF, and, in 2012, he became the Commander of the Jinan MRAF.

Eastern Theater Command Air Force Headquarters

LGEN Huang Guoxian (黄国显) (b. 1962, location unknown) became the Commander of the Eastern TC Air Force and a concurrent Deputy Commander of the Eastern TC in February 2016.[314] He is currently a TC deputy leader grade officer. He previously served in the Chengdu MRAF as a flight group Commander in a flight training base, as an air regiment Commander, and as an air division Chief of Staff and Commander. He then served as the Commander of the Air Force Fuzhou Command Post (Nanjing MRAF). While serving as one of the PLAAF HQ Deputy Chiefs of Staff in 2011, he was selected to become the Nanjing MRAF Chief of Staff. In 2013, he became the Nanjing MRAF Commander. He received a rank promotion in July 2014 (LGEN).

MGEN Yuan Huazhi (袁华智)) (b. 1961, Hubei Province) became the PC of the Eastern TCAF in December 2018.[315] He is also most likely a concurrent Eastern TC Deputy PC. He is a TC deputy leader grade officer. He previously served as a PLA Navy political officer, including being the first PLA Navy Marine Corps PC, when a Marine Corps HQ was created for the first time in March 2017. Prior to that, he served as the PC for a South Sea Fleet (SSF) Marine Corps brigade, the Head of the PLAN's official newspaper People's Navy (人民海军), the Secretary General of the PLAN HQ Political Department, a Deputy Director of the South Sea Fleet's Political Department, PC of the PLAN HQ Equipment Research Academy, and PC of the PLAN HQ Logistics Department. He received a rank promotion in July 2015 (Rear Admiral).

Southern Theater Command Headquarters

LGEN Jia Zhigang (贾志刚) (b. unknown, Jiangsu Province) became a Deputy Commander of the Southern TC in January 2019 with the grade of TC deputy leader.[316] He previously served as the Commander of a Lanzhou MRAF air division, a Deputy Commander of a PLAAF Test and Training Base, and a Deputy Commander in the Eastern TCAF. He received rank promotions in December 2013 (MGEN) and most likely in 2018 (LGEN).

Southern Theater Command Air Force Headquarters

MGEN Zhou Li (周利) (b. unknown) became the Commander of the Southern TCAF in December 2018 with the grade of TC deputy leader.[317] He previously served as the Director of the Training Department in the PLAAF HQ Headquarters' Department, a Deputy Chief of Staff in the Nanjing MRAF HQ, the Chief of Staff of the Jinan MRAF, a Deputy Commander of the Jinan MRAF, and Director of the Jinan MRAF's Post-Reform Settlement Office that was created to deal with the MRAF HQ that was downgraded as a base in early 2016. In April 2017, he became the Commander of the Henan Military District, which was subordinated to the CMC's National Defense Mobilization

Department, and apparently served as the first Air Force officer to ever serve as a Military District Commander. He received a rank promotion in 2009 (MGEN).

MGEN Xu Xisheng (徐西盛) (b. 1964, Shandong Province) became the PC of the Southern TCAF and a concurrent Deputy PC of the Southern TC in June 2017 with the grade of TC deputy leader.[318] He previously served as the PC in the Nanjing MRAF's Fuzhou Command Post, Director of the Beijing MRAF HQ Political Department and the successor Central TCAF HQ PWD. He received rank promotions in July 2013 (MGEN) and July 2018 (LGEN).

Western Theater Command Headquarters

MGEN Wang Qiang (王强) (b. unknown) became a Deputy Commander of the Western TC in January 2019 with the grade of TC deputy leader.[319] He previously served as the Commander of the Jinan MRAF's 12th Air Division, a Deputy Chief of Staff of the Jinan MRAF, and then the Chief of Staff of the Western TCAF and a concurrent Deputy Chief of Staff of the Western TC. He received a rank promotion in July 2014 (MGEN).

Western Theater Command Air Force Headquarters

LGEN Zhan Houshun (战厚顺) (b. 1957, Heilongjiang Province) joined the PLAAF in 1973 and became the Commander of the Western TCAF and as a concurrent Deputy Commander of the Western TC in February 2016, when the former Chengdu MRAF and Lanzhou MRAF were merged.[320] He is currently a TC deputy leader grade officer. He previously served as the Commander of Air Force 1st Air Corps (Changchun, Shenyang MRAF), Chief of Staff and then a Deputy Commander of the Chengdu MRAF, and became the Commander of the Chengdu MRAF and concurrent Deputy Commander of the Chengdu MR in 2013. He received a rank promotion in 2002 (MGEN) and 2014 (LGEN).

MGEN Jiang Ping (姜平) (b. unknown) became the PC of the Western TCAF in January 2019 with the grade of TC deputy leader.[321] He previously served as the PC of the Aviation University of the Air Force and as a Deputy Director of the PLAAF HQ PWD. He received a rank promotion in July 2014 (MGEN).

Northern Theater Command Air Force

LGEN Fan Xiaojun (范骁骏) (b. 1956, Shandong Province) became the PC of the Northern TC in January 2017 with the grade of TC leader.[322] He previously served as the Director of the PLAAF HQ Political Department starting in July 2015., which was renamed the Political Work Department in March 2016. Prior to that, he served as a Deputy Director of the Beijing MRAF's Political Department, Director of the Guangzhou MRAF's Political Department, PC of the 15th Airborne Corps, and PC of the Jinan MRAF and concurrent Deputy PC of the Jinan MR. He received rank promotions in 2006 (MGEN) and July 2015 (LGEN).

LGEN Wang Wei (王伟) (b. 1957, Shandong Province) became one of the Deputy Commanders of the Northern TC in February 2016.[323] He is currently a TC deputy leader. He previously served as the Commander of the Air Force Fuzhou Command Post (Nanjing MRAF), Chief of Staff of the Shenyang MRAF, and a Deputy Commander of the Shenyang MRAF. He received a rank promotion in March 2018 (LGEN).

Northern Theater Command Air Force

MGEN Xu Xueqiang (许学强) (b. unknown) became the Commander of the Northern TCAF and most likely a concurrent Deputy Commander of the Northern TC in November 2017 with the grade of TC deputy leader.[324] He previously served as the Commander of the Nanjing MRAF's 29th Air Division, the Commander of the Nanjing MRAF's Shanghai Command Post

and the successor Shanghai Base, and Chief of Staff of the Nanjing MRAF. He received a rank promotion in 2013 (MGEN).

LGEN Bai Wenqi (白文奇) (b. 1955, Liaoning Province) became the PC of the Northern TCAF and a concurrent Deputy PC of the Northern TC in February 2016.[325] He is currently a TC deputy leader grade officer. He spent most of his career in the PLA Navy. He began his career as a political officer at various times in Naval Aviation units in the NSF, as well as the ESF and SSF. Until July 2012, he served as the PC for the NSF Naval Aviation HQ. In July 2012, he became the PC for the NSF. In 2015, he transferred to the PLAAF to become the PC of the Jinan MRAF. In August 2013, he received a promotion in rank from Rear Admiral to Vice Admiral. Upon assuming his PLAAF billet, he traded his Navy uniform for an Air Force uniform and assumed the rank of Air Force LGEN.

Central Theater Command Headquarters

LGEN Yi Xiaoguang (乙晓光) (b. 1958, Jiangsu Province) became the Commander of the Central TC in August 2017 with the grade of TC Leader.[326] He is the first PLAAF officer to ever serve in this type of billet but it follows the appointment of Vice Admiral Yuan Yubai as the commander of the Southern TC in January 2017. Previously, all former MR commanders were Army officers. He joined the PLAAF in 1974 as a flight cadet and worked his way up the career ladder as a pilot, flight squadron Commander, flight group Commander, Gunnery Director in the Chengdu MRAF Headquarters Department's Training Division, air regiment Commander, air division Chief of Staff, Director of the Political Department of the Chengdu MRAF Flight Transition Training Base, air division Commander, Director of the PLAAF HQ Headquarters Department's Military Training Department, Deputy Chief of Staff of the Chengdu MRAF, Commander of the Wuhan Base (Guangzhou MRAF), a Deputy Chief of Staff of the Guangzhou MRAF, Commandant of the Air Force Command College (Beijing), a Deputy Chief of Staff in PLAAF HQ, a Deputy Commander in the Nanjing MR and concurrently Commander of the Nanjing MRAF, and an Assistant to the Chief of the General Staff. From August 2014

to January 2017, he was a Deputy Chief of the General Staff Department, which became the Joint Staff Department in 2016. He has a Master's Degree in Military Science from the National Defense University. Over the years, he has flown the MiG-15, J-5, J-6, J-7, Su-27, and Su-30. In 1997, he flew in an F-15 while part of a delegation visiting Hawaii. In 2000, he flew in a Mirage 2000 and F1 simulator while visiting Greece. While visiting Turkey, he flew an F-16 simulator. Between 1992 and 1995, he wrote a 100,000-word Pilot's English Dictionary. When he was promoted to corps leader grade in 2004, he was the second youngest officer in that grade in PLAAF HQ. He received a rank promotion in July 2001 (MGEN) and July 2012 (LGEN), at which time he was the youngest PLAAF 2-star general. He should receive his third star (General) sometime in 2019.

LGEN Zhang Yihu (张义瑚) (b. 1962, Jiangsu Province) became one of the Deputy Commanders of the Central TC in February 2016.[327] He is currently a TC deputy leader grade officer. He joined the PLAAF in the 1980s and served as a flight squadron Commander and flight group Commander. He was also a regiment Commander for a regiment under 3rd Air Division (Nanjing MRAF), when the regiment received the first Russian Su-27s. In 1999, he was the overall Commander of the flight demonstration over Tiananmen for the PRC's 50th anniversary. In 2002, he became the Commander of the 33rd Air Division (Chengdu MRAF). He then served as one of the Deputy Chiefs of Staff in the Chengdu MRAF, an assistant to the Chief of Staff in PLAAF HQ, the Chief of Staff for the Lanzhou MRAF, the Chief of Staff of the Beijing MRAF, and finally a concurrent Commander of the Lanzhou MRAF and Deputy Commander of the Lanzhou MR. He received a rank promotion in July 2009 (MGEN) and July 2014 (LGEN).

Central Theater Command Air Force Headquarters

MGEN Han Shengyan (韩胜延) (b. 1963, Hebei Province) became the Commander of the Central TCAF in December 2018.[328] He is currently a TC deputy leader grade officer. In the early 1990s, he studied abroad. Starting around 2000, he served as a Deputy Commander of the 3rd Air Division (Nanjing MRAF), Commander of the 1st Air Division (Shenyang MRAF), Commander of the 3rd Air Division, a Deputy Chief of Staff in the Chengdu MRAF, Chief of Staff of the Lanzhou MRAF, a Deputy Commander of the Chengdu MRAF, and Commander of the Dingxin Test and Training Base (Jiuquan, Gansu Province), where he oversaw the annual Golden Helmet competition in 2014 and 2015. In February 2016, he became one of the Western TC Deputy Commanders. He received a rank promotion in July 2009 (MGEN) and August 2017 (LGEN).

LGEN Guo Puxiao (郭普校) (b. 1964, Shaanxi Province) became the PC of the Central TCAF and a concurrent Deputy PC of the Central TC in September 2017 with the grade of TC deputy leader.[329] He previously served as the PC for a SAM brigade (Lanzhou MRAF), the PC for the Urumqi (Xinjiang) Command Post, the PC for the 37th Air Division (Lanzhou MRAF), the Director of the 15th Airborne Corps' PWD, then PC of the 15th Airborne Corps. He received rank promotions in 2012 (MGEN) and July 2018 (LGEN).

Appendix 3: PLA Rocket Force Leadership

LT GEN Zhou Yaning (周亚宁) (b. 1957, Hebei Province) became the PLARF commander in September 2017 at age 60 with the grade of TC leader.[330] He joined the PLA in 1975 or 1976, most likely as an enlisted member and then received a direct promotion as an officer. He has spent his entire career in the PLA Second Artillery Force (now Rocket Force),. No information is available about his early career, but he apparently moved his way up the career ladder in launch units, including serving as a missile launch brigade commander. He then served as the Director of the Logistics Department then as the Chief of Staff (Director of the Headquarters Department) in Base 52 (Huangshan, Anhui Province). He then served three years as the commander of Base 53 (Kunming, Yunnan Province) before returning to Base 52 for another three years as the commander. In December 2014, he became a PLASAF deputy commander and remained in that position when the PLARF was created. He received rank promotions in July 2009 (MGEN) and August 2016 (LGEN). No information was found concerning his education background.

LT GEN Wang Jiasheng (王家胜) (b. 1955, Liaoning Province) became the PC of Second Artillery in December 2014 and continued in the position when the PLARF was created on 31 December 2015.[331] He is currently a TC leader grade officer. In 1984, he received an Associate's Degree in Electronic Specialties from the PLA's National University of Defense Technology. He served

as a Deputy Director of the GAD's Political Department, PC of the GAD's 27th Test and Training Base (Xichang Satellite Launch Center, Sichuan Province), the Director of GAD's Political Department, and a Deputy PC of Second Artillery and concurrent Secretary of the Discipline Inspection Committee. He received rank promotions in July 2004 (MGEN) and July 2013 (LGEN).

Appendix 4: PLA Strategic Support Force Military Space Force Leadership

MAJ GEN Shang Hong (尚宏) (b. 1960, Shandong Province) became the Commander of the PLASSF's Military Space Force and a concurrent Deputy Commander of the PLASSF in August 2016 with the grade of TC deputy leader.[332] He joined the PLA in 1982 and, at some point, graduated from Taiyuan Institute of Mechanical Engineering (now North University of China), Shanxi Province, with a specialty in Automatic Control Systems. He previously served in the Taiyuan Satellite Launch Base for several years before transferring to GAD HQ as the Director of the subordinate Logistics Department's Test Equipment Materials Bureau and then as a Deputy Chief of Staff and Chief of Staff in GAD before becoming the Commander of the 20th Test and Training Base (Jiuquan Satellite Launch Center, Gansu Province). It is not clear when he received his rank promotion to MGEN (probably around 2006-2007) but received a rank promotion to LGEN in October 2017.

LGEN Kang Chunyuan (康春元) (b. 1958, Hebei Province) became the PC of the PLASSF's Military Space Force in August 2016 with the grade of TC deputy leader.[333] He served most of his career in the Beijing MR HQ, including the Director of the Political Department's Propaganda Department before becoming the Director of the 65th GA's Political Department in Hebei Province. He then returned as a Deputy Director of the Beijing MR's Political Department before becoming a Deputy PC in the Lanzhou

MR HQ. He received a rank promotion in July 2006 (MGEN) and August 2016 (LGEN).

Appendix 5: Select UAVs in the PLA

PLAAF:

ASN-301 mobile anti-radiation is a reverse engineered Israeli Harpy fielded by a PLAAF ECM regiment

BZK-005 (Changying/Giant Eagle) high-altitude, long-range reconnaissance

BZK-007 (Sunshine) Tactical Reconnaissance

BZK-008 reconnaissance and surveillance missions

CH-802 small drone flown by PLAAF airborne brigades

Divine Eagle/ Shendiao, high-altitude, long-range reconnaissance in prototype stage.

EA-03 (Soaring Dragon II) High-Altitude Long Endurance ISR

GJ-1 Gongji-1 Wing Loong (aka WD-1K), is a Medium-Altitude Long-Endurance variant of the Pterodactyl (Yilong)

GJ-2 Wing Loong II/ Pterosaur, next-generation medium-altitude long-endurance and strike-capable

WZ-9 Xianglong / Soar Dragon air to ground attack

PLA Navy

ASN-209 Silver Eagle Medium Altitude Medium Endurance

BZK-005 (Changying/Giant Eagle) high-altitude, long-range reconnaissance

BZK-007 (Sunshine) Tactical Reconnaissance

BZK-008 reconnaissance and surveillance missions

WZ-9 Xianglong / Soar Dragon air to ground attack

PLA Rocket Force

ASN-207 advanced reconnaissance

PLA Army

BZK-006A/ WZ-6A light-weight medium-range reconnaissance

BZK-008 reconnaissance and surveillance missions

Appendix 6: Acronyms and Abbreviations

Acronym	Term
AAA	Antiaircraft artillery
AAM	Air-to-air missile
AESA	Active electronically scanned array
AEW	Airborne early warning
AEW&C	Airborne early warning and control
AI	Artificial intelligence
ALCM	Air-launched cruise missile
AMS	Academy of Military Science
ARM	Anti-radiation missile
ASAT	Anti-satellite
ASBM	Anti-ship ballistic missile
ASCM	Anti-ship cruise missile
ASM	Air-to-surface missile
AVIC	Aviation Industry Corporation of China
AWACS	Airborne warning and control system
BDS	BeiDou Navigation System
BRI	Belt and Road Initiative
BVR	Beyond-visual-range
C2	Command and control
C4ISR	Command, control, communications, computers, intelligence, surveillance, and reconnaissance
CAEP	China Academy of Engineering Physics
CALT	China Academy of Launch Vehicle Technology
CASC	China Aerospace Science and Technology Corporation

CASI	China Aerospace Studies Institute
CASIC	China Aerospace Science and Industry Corporation
CASI	China Aerospace Studies Institute
CCP	Chinese Communist Party
CEME	Complex electromagnetic environment
CAC	Chengdu Aircraft Industry Corporation
CHEOS	China high-definition earth observation system
CMC	Central Military Commission
CMD	Cruise missile defense
COSTIND	Commission for Science, Technology, and Industry for National Defense
DIA	Defense Intelligence Agency
ECM	Electronic countermeasures
EDD	Equipment Development Department
ELINT	Electronic intelligence
EO	Electro-optical
EOTS	Electro-optical targeting system
ESF	East Sea Fleet
EW	Electronic warfare
FTTB	Flight Test and Training Base
GA	Group army
GAD	General Armament Department
GEO	Geosynchronous
CGAC	Central People's Government Administration Council
GNSS	Global Navigation Satellite System
GPS	Global position system
GSD	General Staff Department
HA/DR	Humanitarian assistance and disaster relief
HALE	High Altitude and Long Endurance
HGV	Hypersonic glide vehicle
HQ	Headquarters
IADS	Integrated air defense system
ICBM	Intercontinental ballistic missile
IOC	Initial operational capability
IRBM	Intermediate-range ballistic missiles
KKV	Kinetic kill vehicle
LACM	Land-attack cruise missile

LM	Long March
LRCM	Long-range cruise missile
MAI	Ministry of Aviation Industry
MaRV	Maneuverable reentry vehicles
MAS	Ministry of Aero-space Industry
MASINT	Measures and signature intelligence
MD	Military district
MIIT	Ministry of Industry and Information Technology
MIRV	Multiple independent reentry vehicle
MMI	Ministry of Machine Building
MND	Ministry of National Defense
MOOTW	Military operations other than war
MR	Military region
MRAAM	Medium-range air-to-air missile
MRAF	Military region air force
MRBM	Medium-range ballistic missile
MSGT	Master sergeant
NCO	Noncommissioned officer
NEO	Non-combatant evacuation operation
NPC	National People's Congress
NSF	North Sea Fleet
OT&E	Operational test and evaluation
OTH	Over-the-horizon
PAP	People's Armed Police
PC	Political commissar
PGM	Precision-guided munitions
PLA	People's Liberation Army
PLAA	PLA Army
PLAAF	PLA Air Force
PLAN	PLA Navy
PLARF	PLA Rocket Force
PLASAF	PLA Second Artillery Force
PLASSF	PLA Strategic Support Force
PRC	People's Republic of China
PWD	Political Work Department
R&D	Research and development
QUESS	Quantum Experiments at Space Scale

RD&A	Research, development, and acquisition
SAC	Shenyang Aircraft Corporation
SAIC	Shanghai Aircraft Industry (Group) Co Ltd
SAM	Surface-to-air missile
SAR	Synthetic aperture
SASTIND	State Administration for Science, Technology, and Industry for National Defense
SCO	Shanghai Cooperation Organization (SCO
SCOSTIND	State Commission for Science, Technology, and Industry for National Defense
SEAD	Suppression of enemy air defenses
SLOCs	Sea lines of communication
SOE	State-owned enterprise
SoS	System-of-systems
SRBM	Short-range ballistic missile
SSF	South Sea Fleet
TC	Theater Command
TCA	TC Army
TCAF	TC Air Force
TCN	TC Navy
TSGT	TSGT
TT&C	Telescoping, tracking and control
U.S.	United States
UAV	Unmanned aerial vehicles
XAC	Xi'an Aircraft Industry Corporation
XSCC	Xi'an Satellite Control Center

ENDNOTES

1 Zhang Tao, "Foreign Media: PLA Rocket Force the Core Force of China's Strategic Deterrence," *China Military Online*, January 4th, 2016, http://english.chinamil.com.cn/news-channels/pla-daily-commentary/ 2016-01/04/content_6843095.htm.

2 *China Military Power: Modernizing a Force to Fight and Win*, U.S. Defense Intelligence Agency (DIA), January 2019.

3 Note that the PLA often uses defence instead of defense for multiple terms; however, for purposes of this report, only defense is used.

4 http://military.people.com.cn/n1/2016/0105/c1011-28011251.html

5 "Chinese President Urges Stronger Air Force," *Xinhua*, April 14th, 2014, accessed online on 1 February at: http://news.xinhuanet.com/english/ china/2014-04/14/c_133261588.htm.

6 http://news.12371.cn/2016/02/01/ARTI1454322611613248.shtml

7 "The Chinese Air Force accelerates its strategic transformation in flying to the open sea and self-confidence" (中国空军在飞向远海开放自信中加快战略转型), Chinanews.com in Chinese, 22 September 2016, www.chinanews.com/m/mil/2016/09-22/8011754.shtml.

8 In Ronald O'Rourke (Congressional Research Service), Maritime Territorial and Exclusive Economic Zone (EEZ) Disputes Involving China: Issues for Congress. 6 June 2014. p. 17.

9 Hu Jintao, "Report to the Eighteenth National Congress of the Communist Party of China," November 8, 2012.

10 Paul H.B. Godwin, "Change and Continuity in Chinese Military Doctrine, 1949-1999," in eds. Ryan, Mark A., Finkelstein, David M., and McDevitt, Michael A., *Chinese Warfighting: The PLA Experience Since 1949*, Armonk, NY: M.E. Sharpe, 2003, p. 23.

11 The State Council Information Office of the People's Republic of China, "China's Military Strategy," May 2015, accessed on 21 March 2016 at: http://www.chinadaily.com.cn/china/2015-05/26/content_20820628.htm. In today's paradigm, "Active Defense" may be interpreted as the guiding approach toward China's development of an "Anti-Access and Area Denial" (A2/ AD) strategy. Although the PRC does not use the term A2/AD, China nevertheless emphasizes taking offensive measures to defend the homeland. These operations are tantamount to counter-intervention operations though the PRC does not refer to them as such either.

12 Jiang Zemin, *Jiang Zemin's Selected Works*, Vol. 1, Beijing: Renmin chubanshe, 2006, p. 285.

13 Jiang Zemin, *Jiang Zemin's Selected Works*, Vol. 3, Beijing: Renmin chubanshe, 2006, p. 608.

14 M. Taylor Fravel, "China's New Military Strategy: 'Winning Informatized Local Wars,'" *China Brief*, Vol. 15, No. 13, 23 June, 2015.

15 These descriptions are drawn from several sources of Chinese military writings to include *Science of Campaigns 2006, PLA Military Terms, 2011*, and *Science of Military Strategy (SMS) 2013* as produced by the PLA's Academy of Military Science (AMS).

16 AMS Military Strategy Research Department, *The Science of Military Strategy* (战略学), Beijing: Academy of Military Science, December 2013.

17 *PLA Military Terms*, 2011, pp. 109-110.

18 PLA AMS, *SMS*, 2013, p. 236.

19 *SMS*, 2013, p. 229 cited in draft Michael S. Chase, "PLA Rocket Forces: Executors of China's Nuclear Strategy and Policy," p. 13.

20 Mark A. Stokes, "China's Quest for Joint Aerospace Power: Concepts and Future Aspirations," in eds. Hallion, Richard P., Cliff, Roger, Saunders, Phillip C., *The Chinese Air Force: Evolving Concepts, Roles, and Capabilities*, Washington, DC: National Defense University Press, 2012, p. 39.

21 *Science of Campaigns 2006*, ed. Zhang Yuliang, Beijing: National Defense University, 2006. Accessed on 27 May 2016 at: https://michalthim.files.wordpress.com/2015/12/the-science-of- campaigns-e68898e5bd-b9e5ada6-2006.pdf.

22 Cristina L. Garafola, "The Evolution of the PLAAF Mission, Roles and Requirements," p. 12.

23 Cliff, Roger, et al, *Shaking the Heavens and Splitting the Earth: Chinese Air Force Employment Concepts in the 21st Century*, Santa Monica, CA: The RAND Corporation, MG-915-AF, 2011, p. 117.

24 *SMS*, 2013, p. 221, cited by Garafola, p. 8.

25 Cliff et al, p. 117[23] Ibid., pp. 85-6.

26 Ibid.

27 Ibid.

28 Cited in Ibid., p. 145.

29 *PLA Military Terms*, 2011, p. 969.

30 Ibid., p. 964.

31 Cliff et al., p. 166.

32 Chinese authors of the PLA's *The Science of Second Artillery Campaigns*, for example, suggest that China could drop or place conditions on its longstanding No First Use policy in response to particularly threatening conventional attacks by a powerful enemy. Specifically, they state that this method could be used when a powerful nuclear-armed enemy that enjoys conventional military superiority conducts continuous medium- or high-intensity air raids against major strategic targets in China. See *Science of Second Artillery Campaigns*, cited in Michael S. Chase and Arthur Chan, *China's Evolving Approach to "Integrated Strategic Deterrence,"* Santa Monica: The RAND Corporation, 2016, p. 43.

33 Office of the Secretary of Defense (OSD), *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2016*, Washington, DC: U.S. Department of Defense, 2016, p. 30.

34 *The 2019 Military Balance Chart: China's Armed Forces*, The International Institute for Strategic Studies.

35 "China vows military reform by 2020, with plans for new anti-corruption watchdog in PLA," *South China Morning Post*, 26 November, 2015, https://www.scmp.com/news/china/diplomacy-defence/article/1883606/china-vows-breakthrough-long-awaited-military-reform

36 "Xi urges breakthroughs in military structural reform," *Xinhua*, 26 November 2015, http://news.xinhuanet.com/english/2015-11/26/c_134859089.htm.

37 Hu Guangzheng, ed. *Contemporary Military Organizational Reform Research* (当代军事体制变革研究), Beijing: Military Science Publishing House, October 2007, p. 95-97.

38 For greater details, see Michael S. Chase and Cristina L. Garafola, "China's Search for a 'Strategic Air Force'," *Journal of Strategic Studies*, Routledge Taylor & Francis Group, 2015. Zhu Hui, ed., *Strategic Air Force* [战略空军], Beijing: Lantian Press, July 2009.

39 *China's Military Strategy*, PRC State Council Information Office, May 2015.

40 See Jana Allen and Kenneth Allen, *The PLA Air Force's Four Key Training Brands*, China Aerospace Studies Institute, June 2018.

41 See the China Aerospace Studies Institute's *"Brigadization" of the PLA Air Force*, May 2018 for more information.

42 Lawrence "Sid" Trevethan, *"Brigadization" of the PLA Air Force*, China Aerospace Studies Institute, 2018.

43 U.S. Department of Defense, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2018*, 16 May 2018.

44 *The Military Balance 2018*, London. *Directory of PRC Military Personalities 2018*.

45 "Witness Air Force Aircraft Circumnavigate Around Islands from the Air Force's Fujian Base's Combat Command Center" (在空军驻福建某基地作战指挥中心见证空军绕岛巡航), *Xinhuanet*, 27 April 2018, www.xinhuanet.com/politics/2018-04/27/c_1122754629.htm. "The Newly Formed Air Force Air Defense Base Debuted and Will Become the Air Force's Main Combat Body in the Future" (空军新组建的空防基地亮相演兵场, 未来将成为空军作战主体), *Sohu.com*, 13 December 2017, www.sohu.com/a/210153340_260616. "'Skills win' - Air Force 'Red Sword-2018' Exercise Boosts Operational Command Capacity" (精兵制胜——空军"红剑-2018演习助力作战指挥能力建设提升), *Xinhuanet*, 25 May 2018, www.xinhuanet.com/politics/2018-05/25/c_1122889824.htm. Hao Maojin and Huang Shubo, "Air Force 'Red Sword-2017' Explores the Integration of All-Factor Actual Combat System" (空军"红剑-2017"探索全要素实战化体系作战融合之道), Ministry of National Defense, 28 November 2017, www.mod.gov.cn/power/2017-11/28/content_4798486.htm.

46 "Air Force Ace Brigade Commander Hao Jingwen Received a [Grade] Promotion as a Deputy Commander of a new Air Defense Base" (空军王牌旅长郝井文获晋升履新空防基地副司令), 1 February 2019, https://news.163.com/19/0201/18/E6UVENF70001875N.html.

47 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019.

48 *The 2019 Military Balance Chart: China's Armed Forces*, The International Institute for Strategic Studies.

49 OSD, *Annual Report to Congress*, 2015, p. 11.

50 Anthony H. Cordesman and Steven Colley, "Chinese Strategy and Military Modernization in 2015: A Comparative Analysis," Center for Strategic and International Studies (CSIS), 30 December 2015, p. 268.

51 Ibid.

52 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019.

53 Academy of Military Science (AMS), *World Military Yearbook 1991* (世界军事年鉴), PLA Press (解放军出版安设), p. 65. AMS has published this book annually since the early 1980s, which includes occasional publications that cover two years, such as 1993-1994 and 1995-1996. China's National Defense (中国的国防) 2002 did not include a radar branch. This report has been published biennially from 1998 through 2010 by the PRC State Council's Information Office. This publication is usually referred to as the Defense White Paper (白皮书).

54 *World Military Yearbook 2013*, p. 48. The protocol order is aviation, ground air defense, radar, airborne, and ECM.

55 This information is based on analysis of research on this topic based on PLAAF sources over the past few years.

56 Cliff et al., p. 20.

57 OSD, *Annual Report to Congress*, 2016, p. 32.

58 Kenneth W. Allen, "Reforms in the PLA Air Force," *China Brief*, Vol. 5, No. 15, July 5, 2005a.

59 Andreas Rupprecht, *Modern Chinese Warplanes | Chinese Air Force - Aircraft and Units*, Harpia Publishing L.L.C., 29 October 2018.

60 "China: Air Force," *Jane's World Air Forces*, February 23, 2007. And, Kenneth W. Allen, "PLA Air Force Organizational Reforms: 2000-2012," in Kevin Pollpeter and Kenneth W. Allen, eds., *The PLA as Organization Reference Volume v2.0*, Vienna, VA: Defense Group Inc., 2015, p. 317

61 David Shlapak, "Equipping the PLAAF: The Long March to Modernity," in eds. Hallion, Richard P., Cliff, Roger, Saunders, Phillip C., *The Chinese Air Force: Evolving Concepts, Roles, and Capabilities*, Washington, DC: National Defense University Press, 2012, p. 39. p. 191.

62 Ibid., p. 192

63 Ibid., p. 195.

64 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019, p. 85.

65 This file is licensed under the Creative Commons Attribution-Share Alike 2.0 Generic (https://creativecommons.org/licenses/by-sa/2.0/deed.en) license. Photograph by Rob Schleiffert (http://www.flickr.com/people/109661044@N07). Downloaded from https://commons.wikimedia.org/wiki/File:Two_F7s_ (Chinese_version_of_the_MiG-21F-13_%27Fishbed%27)_at_Tirana_Airport_(11278465865).jpg.

66 Shlapak, p. 195.

67 Defense Dept. photograph by U.S. Air Force Staff Sgt. D. Myles Cullen, Downloaded from https://commons.wikimedia.org/wiki/File:Chinese_Su-27.JPG. This file is licensed under the Creative Commons Attribution 2.0 Generic (https://creativecommons.org/licenses/by/2.0/deed.en) license. Photograph by Flickr user mxiong (http://www.flickr.com/people/73385013@N00) was uploaded to Wikimedia Commons using Flickr upload bot on 17:53, 19 January 2011 (UTC) by Dura-Ace (talk). Downloaded from https://commons.wikimedia.org/wiki/File:Chengdu_10.jpg.

68 Shlapak, p. 196.

69 https://en.wikipedia.org/wiki/Shenyang_J-16. John Pike. "J-16 (Jianjiji-16 Fighter aircraft 16) / F-16". Globalsecurity.org. *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019, p. 88.

70 Ibid., p. 196.

71 Dmitriy Pichugin collection http://www.airliners.net/search/photo.search?photographersearch=Dmitriy%20Pichugin%20&distinct_entry=true Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2.

72 Shlapak, p. 193.

73 Ibid., pp. 193-4.

74 Cordesman and Colley, p. 274.

75 IHS Jane's "China Air Force Summary," pp. 35-6.

76 Shlapak, p. 195.

77 Dmitriy Pichugin collection http://www.airliners.net/search/photo.search?photographersearch=Dmitriy%20Pichugin%20&distinct_entry=true Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.2.

78 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019, p. 85.

79 Ibid.

80 Nathan Beauchamp-Mustafaga, Derek Grossman and Logan Ma, "Chinese Bomber Flights Around Taiwan: For What Purpose?", September 13, 2017, https://warontherocks.com/2017/09/chinese-bomber-flights-around-taiwan-for-what-purpose/. Nathan Beauchamp-Mustafaga, "Bomber Strike Packages with Chinese Characteristics: From Theory to Practice," Draft report prepared for the CAPS-RAND-NDU PLA Conference, Arlington, VA November 30-December 1, 2018. *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019.

81 Photograph by 日本防衛省統合幕僚監部. This file is licensed under the Government of Japan Standard Terms of Use (Ver.2.0)

82 Photograph by Flickr user Dongyi Liu. Licensed under the Creative Commons Attribution-Non-Commercial and Photograph by Flickr user Luke McConville. Licensed under the Creative Commons Attribution-NonCommercial-

83 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019, p. 87.

84 *Kongjun Bao*, 21 Jun 2017, page 3.

85 "Yun-20 Delivery Ceremony, Xu Qiliang Attended and Spoke," (运-20飞机授装接装仪式举行许其亮出席并讲话), *Xinhua*. 6 July 2016.

86 Michael S. Chase and Cristina L. Garafola, "China's Search for a 'Strategic Air Force,' *Journal of Strategic Studies*, Routledge Taylor & Francis Group, 2015, p. 14.

87 Fisher, Richard D Jr; Hardy, James (28 July 2014). "China's NDU recommends 400-strong Y-20 fleet". "China military fleet to get 1,000 large strategic aircraft, Posted on June 8, 2016 by chainsoff, https://chainsoff.me/2016/06/08/china-military-fleet-to-get-1000-large-strategic-aircraft/.

88 Andreas Rupprecht, *Modern Chinese Warplanes | Chinese Air Force - Aircraft and Units*, Harpia Publishing L.L.C., 29 October 2018.

89 This file is licensed under the Creative Commons Attribution-Share Alike 4.0 International (https://creativecommons.org/licenses/by-sa/4.0/deed.en) license.
Downloaded from https://commons.wikimedia.org/w/index.php?title=File:Xian_Y20_at_the_2014_Zhuhai_Air_Show.jpg&oldid=143117479".

90 IHS Jane's "China Air Force Summary," p. 39.

91 Ibid., p. 39.

92 Michael S. Chase, Jeffrey Engstrom, Tai Ming Cheung, Kristen A. Gunness, Scott Warren Harold, Susan Puska, and Samuel K. Berkowitz, *China's Incomplete Military Transformation*, Santa Monica: The RAND Corporation, RR893-USCC, 2015, p. 105.

93 Screenshot of VOA video at http://www.voanews.com/media/video/china-announces-troop-cuts-at-world-war-twoparade/2943575.html. This file is licensed under the Creative Commons Attribution-Share Alike 2.0 Generic

94 IHS Jane's "China Air Force Summary," p. 39. And Shlapak, p. 198.

95 Andreas Rupprecht and Tom Cooper, *Modern Chinese Warplanes: Combat Aircraft and Units of the Chinese Air Force and Naval Aviation*, Houston, TX: Harpia Publishing, 2012.

96 Mark A. Stokes and Ian Easton, "The Chinese People's Liberation Army General Staff Department: Evolving Organization and Missions," Dennis J. Blasko, "The PLA Army/Ground Forces," and Kenneth W. Allen, "PLA Air Force Organizational Reforms: 2000-2012," in Pollpeter and Allen, eds., *The PLA as Organization Reference Volume v2.0*, 2015, p. 132-133, 235, and 317.

97 *Kongjun Bao*, 24 October 2017, p. 1. *Kongjun Bao*, 8 March 2018, p. 1.

98 National Air & Space Intelligence Center (NASIC), *People's Liberation Army Air Force 2010*, 1 August 2010, Chapter 9 and 10. The PLAAF's SAM branch was created when China received its first SA-2 missiles (5 launchers and 62 missiles) from the Soviet Union, in October 1958. The PLAAF's AAA branch was originally established in 1946 as part of the ground forces. In August 1955, the CMC formally established the PLA Air Defense Force (解放军防空军) as one of the PLA's four services. The new force was created by merging the ground forces' AAA, searchlight, observation, and radar units. In May 1957, the CMC merged the Air Defense Force (ADF) into the Air Force, into a single service with aviation and air defense units.

99 Academy of Military Science (AMS), *World Military Yearbook 1991* (世界军事年鉴), PLA Press (解放军出版安设), p. 65. AMS has published this book annually since the early 1980s, which includes occasional publications that cover two years, such as 1993-1994 and 1995-1996. China's National Defense (中国的国防) 2002 did not include a radar branch. This report has been published biennially from 1998 through 2010 by the PRC State Council's Information Office. This publication is usually referred to as the Defense White Paper (白皮书).

100 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019, p. 87.

101 Shlapak, p. 202.

102 IHS Jane's "China Air Force Summary," p. 42.

103 Shlapak, p. 201.

104 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019, p. 87.

105 *Voice of America*, http://www.voachinese.com/content/us-experts-pla-taiwan-scenairos-20150526/2791401.html. Retrieved from https://commons. wikimedia.org/w/index.php?title=-File:HQ-9_at_the_China%27s_60th_anniversary_parade.jpg&oldid=171425228.

106 NASIC, p. 101.

107 Ibid., p. 99.

108 Cliff et al, p. 22.

109 Cliff et al, pp. 22-3.

110 Ibid., p. 165.

111 *The Military Balance 2018*, London; and *Directory of PRC Military Personalities 2018*.

112 He Zhiqin, "Heroes Live Forever in the Fire," *Kongjun Bao*, 8 March 2018, p. 1. Note that this is an anomaly, because regiments are normally not subordinate to brigades.

113 *China Military Power: Modernizing a Force to Fight and Win*, DIA, p. 58.

114 NASIC, p. 99.

115 Ibid., p. 102.

116 Ibid., p. 103.

117 Ibid.

118 Ibid.

119 Ibid.

120 Cordesman and Colley, p. 286.

121 Andreas Rupprecht, *Modern Chinese Warplanes | Chinese Air Force - Aircraft and Units*, Harpia Publishing L.L.C., 29 October 2018.

122 Correspondence with Andreas Rupprecht.

123 Cordesman and Colley, p. 285 and IHS Jane's "China Air Force Summary," p. 37.

124 This file comes from the Danny Yu collection and is licensed under the Creative Commons Attribution-Share Alike 4.0 International (https://creativecommons.org/licenses/by-sa/4.0/deed. en) license. N05/8726577075/

125 "Strategic Weapon Systems," IHS Jane's Sentinel Security Assessment - China and Northeast Asia, April 7, 2017, available at https://janes.ihs.com/Janes/Display/cnaa015-cna.

126 Testimony of Dr. Brendan S. Mulvaney before the U.S.-China Economic and Security Review Commission, Hearing on "China's Military Reforms and Modernization: Implications for the United States", Topic: (PLA) "Air Force Modernization", 15 Feb 2018.

127 Dennis M. Gormley Andrew S. Erickson, and Jingdong Yuan, *A Low Visibility Force Multiplier: Assessing China's Cruise Missile Ambitions* (Washington DC: NDU Press, 2014).

128 Shlapak, p. 200.

129 Ibid., p. 200.

130 IISS, *Military Balance*, 2016, p. 223.

131 Ibid., p. 223.

132 Ibid., p. 223.

133 Tyler Rogoway, "China's J-20 Stealth Fighter Stuns by Brandishing Full Load of Missiles at Zhuhai Airshow," *The Warzone*, 11 November 2018, www.thedrive.com/the-war-zone/24841/chinas-j-20-stealth-fighter-stuns-by-brandishing-full-load-of-missiles-at-zhuhai-air-show.

134 Douglas Barrie (IISS), "It's Not Your Father's PLAAF: China's Push To Develop Domestic Air-To-Air Missiles," 21 February 2018, https://warontherocks.com/2018/02/not-fathers-plaaf-chinas-push-develop-domestic-air-air-missiles/. https://militarywatchmagazine.com/article/reports-pakistan-s-jf-17-fighters-to-deploy-chinese-pl-15-missiles-could-even-the-odds-against-the-elite-of-india-s-air-force.

135 Douglas Barrie (IISS), "It's Not Your Father's PLAAF: China's Push To Develop Domestic Air-To-Air Missiles," 21 February 2018, https://warontherocks.com/2018/02/not-fathers-plaaf-chinas-push-develop-domestic-air-air-missiles/.

136 "Carlisle reiterates on need to counter the range of Chinese PL-15 BVRAAM," http://alert5.com/2015/09/20/carlisle-reiterates-on-need-to-counter-the-range-chinese-pl-15-bvraam/. Chen Zhuo, "China's most powerful air-to-air missile equipped on warplanes," *Global Times*, 26 March 2019, http://eng.chinamil.com.cn/view/2019-03/26/content_9459759.htm.

137 Tyler Rogoway, "China's J-20 Stealth Fighter Stuns by Brandishing Full Load of Missiles at Zhuhai Airshow," *The Warzone*, 11 November 2018, www.thedrive.com/the-war-zone/24841/chinas-j-20-stealth-fighter-stuns-by-brandishing-full-load-of-missiles-at-zhuhai-air-show.

138 Shlapak, p. 201.

139 IHS Jane's "China Air Force Summary," pp. 44-45.

140 IHS Jane's "China Air Force Summary," p. 40.

141 Franz-Stefan Gady, "China Unveils Its Largest Killer Drone to Date," *The Diplomat*, September 2nd, 2015, accessed on June 6th 2016 at: http://thediplomat.com/2015/09/china-unveils-its-largest-killer-drone-to-date/. Also see Adam Rawnsley, "Meet China's Killer Drones," *Foreign Policy,* January 14th, 2016, accessed on June 6th 2016 at: http://foreignpolicy.com/2016/01/14/ meet-chinas-killer-drones/.

142 Cordesman and Colley, p. 287.

143 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019.

144 IHS Jane's "China Air Force Summary," p. 40.

145 China's Air Force Conducted Four Drills over the Western Pacific in 2015, http://english.cri.cn/12394/2016/01/03/4182s911236.htm

146 Colonel Han Xudong, China's Air Force Conducted Four Drills over the Western Pacific in 2015 http://english.cri.cn/12394/2016/01/03/4182s911236.htm

147 PLAAF deploys 40 aircraft to western Pacific in show of strength, Andrew Tate, London - IHS Jane's Defence Weekly, 27 September 2016

148 Taken October 27, 2013 by Japan Air Self-Defense Force and released by the Joint Staff Office of the Defense Ministry of Japan

149 China sends Su-35 fighter jets for island patrol training, *Xinhua*| 2018-05-11 20:45:10|Editor: Yamei

150 Ibid.

151 Shipborne Weapons. "中国海军航空兵发展纪实." Shipborne Weapons, 2003.

152 Ma Shiye, "North Sea Fleet Submarine Zhidui Conducts Actual-Combat Training," R*enmin Haijun*, 16 January 2018, p. 1. Cao Zhenhui, "Eastern Theater Command Navy Frigate Zhidui Strengthens Political Cadre Unit Development," *Renmin Haijun*, 17 January 2018, p. 1. Of note, unlike the PLAAF shift to the five Theater Command Air Force HQ in 2016, no ceremony was held to change the names.

153 http://bsq.sh.gov.cn/bswz_website/HTML/bsmh/bsmh_zwxx_zxbd/2017-07-31/Detail_104250.htm And http://navy.81.cn/content/2019-03/05/content_9441291.htm

154 http://www.shbsq.gov.cn/bswz_website/HTML/bsmh/bsmh_tpbd/2017-07-31/Detail_104250.htm

155 https://mp.weixin.qq.com/s/_pXMhEmvL0_4uCjSLauNnw

156 The National Bureau of Asian Research. China Military Forces. Washington, D.C., 2013.

157 http://www.bjrbj.gov.cn/ztfw/zt_wsdx/rs_dyzj/rs_djjj/201901/t20190118_80252.html and http://navy.81.cn/content/2018-09/22/content_9298018.htm

158 —. "海军某轰炸机团: 巡航在祖国的最南端." navy.81.cn. MARCH 6, 2013. http://navy.81.cn/content/2013-03/06/content_5246592.htm (accessed APRIL 21, 2013).

159 http://www.mdfzhn.com/news/1572.html And https://www.defensenews.com/digital-show-dailies/singapore-airshow/2018/02/05/china-ramps-up-production-of-new-airborne-early-warning-aircraft/

160 —. "组图: 海军水上飞机翱翔海天间." navy.81.cn. OCTOBER 12, 2012. http://navy.81.cn/content/2012-10/22/content_5061304.htm (accessed APRIL 21, 2013).

161 http://tv.81.cn/sytj-tupian/2018-12/02/content_9362738.htm

162 http://www.chinanews.com/mil/2018/12-03/8690943.shtml

163 —. "北海舰队联合机动编队远洋训练之: 战鹰巡航." Navy.81.cn. NOVEMBER 3, 2012. http://navy.81.cn/content/2012-11/03/content_5079122.htm (accessed APRIL 21, 2013).

164 http://www.cqedu.cn/Item/31698.aspx

165 https://chinese-military-aviation.blogspot.com/p/helicopters-i.html and http://www.xinhuanet.com/mil/2015-10/27/c_128361446.htm

166 *Directory of PRC Military Personalities 2018*, DIA.

167 *The 2019 Military Balance Chart: China's Armed Forces*, The International Institute for Strategic Studies.

168 —. 中国海军"航空兵"部队. 2012. http://navy.81.cn/hkb.htm (accessed April 25, 2013).

169 Navy.81.cn. 中国海军. 2013. http://navy.81.cn (accessed April 20, 2013).

170 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019.

171 Office of Naval Intelligence. China's Navy 2007. United States Navy, 2007. And - Asian Military Review. "Asian Military Review Regional Airforce Directory 2013." Asian Military Review. February 01, 2013. http://www.asianmilitaryreview.com/the-amr-regional-airforce-directory-2013/ (accessed April 21, 2013).

172 *China Military Power: Modernizing a Force to Fight and Win*, DIA, January 2019.

173 *Directory of PRC Military Personalities 2018*, DIA.

174 目击东海舰队航空兵某师新型歼击机空中加油训练. 中国海军. October 22, 2013. http://navy.81.cn/content/2013-10/22/content_5600882.htm (accessed on November 1, 2013).

175 —. "大航时，远航程, 战鹰空中蓄力攻击!." . MARCH 30, 2013. http://navy.81.cn/content/2013-03/30/content_5283321_2.htm (accessed APRIL 20, 2013).

176 *The 2019 Military Balance Chart: China's Armed Forces*, The International Institute for Strategic Studies. Andreas Rupprecht, *Modern Chinese Warplanes: Chinese Naval Aviation – Aircraft and Units*, Harpia Publishing, 2018.

177 *The 2019 Military Balance Chart: China's Armed Forces*, The International Institute for Strategic Studies.

178 2018 CASI conference slide deck from ONI

179 Roger Cliff, "Converging Trajectories: Integration of the Aviation Forces of the PLA Navy and PLA Air Force," CNA China Studies, published by CASI, 2019.

180 Zhang Tiannan (张天南), Zhang Gang (张刚), and Zhang Nenghua (张能华), "Seamen Guide Air Force Warbirds in "Hunting", (水兵引导空军战鹰"捕猎"), *PLA Daily*, (解放军报), November 20, 2011; Liu Jun (刘俊) and Yan Guoyou (闫国有), "An Air Force Base Realizes Innovative Development in Joint Training, Great Fusion Eliminates Barriers to Joint Training and Coordination," (空军某基地联合训练实现创新发展大融合破除连训协作壁垒), *PLA Daily*, (解放军报), February 27, 2012.

181 Liu Jun (刘俊) and Yan Guoyou (闫国有), "Air Force Base Realizes Innovative Development."

182 Zhang Heng (张恒), ""Back-to-Back" Contest Held." See also Cai Cen (蔡岑) and Zhang Qingbao (张庆宝), "The Great Ocean Sharpens the Sword, Realistic Training Raises Raging Waves," (大洋砺剑, 实战化练兵起狂澜), *People's Navy*, (人民海军), September 27, 2016.

183 Xu Sheng (徐生) and Chi Yuguang (迟玉光), "Joint Training of an Aviation Division."; Mou Xingguang (牟星光) and Chi Yuguang (迟玉光), "'Training Requirements List'."

184 Fan Yishu (范以书), Zeng Ke (曾科), and Li Jianwen (李建文), "Southern Theater Command Air Force."

185 Xu Sheng (徐生) and Chi Yuguang (迟玉光), "Joint Training of an Aviation Division."; Mou Xingguang (牟星光) and Chi Yuguang (迟玉光), "'Training Requirements List'."

186 Ai Zhengwei (艾政伟), *China Air Force Magazine*, October 2017, pg 41-43

187 Li Faxin, *The PLA Marines*, (Beijing, PRC:China Intercontinental Press, 2013), 10.

188 Li Faxin [李发新], *The PLA Marines* [中国人民解放军海军陆成队] (Beijing: China Intercontinental Press [五洲传播出版社], 2013), 107

189 *The PLA Marines*, (Beijing, PRC: China Intercontinental Press, 2013), 122

190 Li Youcheng and Li Wei [李友成, 李伟], "Z-20, Another Piece of Star-Status Equipment of the Chinese Troops" [直-20, 中国军队的又一款明星装备], *China Youth Daily* [中国青年报], February 7, 2014.

191 "Focus Today [今日关注], CCTV-4, November 2, 2016

192 Ni Guanghui [倪光辉], "Marine Corps: Triphibious Crack Force Rides the Waves (New Era Strong Military Fight Song)" [海军陆战队: 三栖劲旅踏浪来(新时代强军战歌)], *People's Daily* [人民日报], February 11, 2018, 6; "Live News," CCTV-Xinwen, April 13, 2018

193 Ni Guanghui [倪光辉], "Marine Corps: Triphibious Crack Force Rides the Waves (New Era Strong Military Fight Song)" [海军陆战队: 三栖劲旅踏浪来(新时代强军战歌)], People's Daily [人民日报], February 11, 2018, 6.

194 "Unmasking the Chinese Navy's Five Major Branches! Liaoning Warship Enters the Ranks to Produce a New Type of Main Combat Power" [揭秘中国海军五大兵种! 辽宁舰入列催生新型主战力量], *CCTV Online* [央视网], April 13, 2018, available at <http://news.cctv.com/2018/04/13/ARTIVrCLD4fzObEHaemhpch3180413.shtml>

195 "Our Military Frogmen Rapidly Transported Covert Infiltration to Successfully Carry Out a 'Decapitation' Operation" [我军蛙人快速输送隐蔽渗透成功实施 "斩首" 行动], *People's Daily Online* [人民网], November 2, 2018, available at <http://military.people.com.cn/n1/2018/1102/c1011-30378714.html>.

196 Fan Xudong and Fu Yuanye [范旭东, 傅原野], "Standardize Training Method and Accumulate Power to Spread One's Wings and Soar – Marines of a Certain Brigade Sticks Close to Actual Combat and Launches Day-to-Night Flight Training" [规范施训方法蓄力展翅高飞– 陆战队某旅紧扣实战开展跨昼夜飞行训练], *People's Navy* [人民海军], March 12, 2018, 2

197 Some observers have speculated that the PLARF will be responsible not only for ground-launched nuclear missile systems, but also sea- and air-launched nuclear missiles. However, at this point this scenario appears unlikely, and we have yet to observe any expansion in PLARF nuclear command and control to these domains. In addition, the PLA does not yet possess a fully functioning nuclear triad. For example, PLAAF bombers can drop nuclear bombs but do not currently have nuclear tipped air-launched cruise missiles (ALCMs). Reports suggest, however, that the PLARF is developing this capability. The PLA Navy (PLAN) has yet to conduct its first nuclear patrol using one of its new Jin-class submarines, but this may occur soon.

198 For a comprehensive overview of the PLARF and the reorganization, see David C. Logan, "PLA Reforms and China's Nuclear Forces, *Joint Force Quarterly* (4th Quarter 2016), at http://ndupress.ndu.edu/JFQ/Joint-Force-Quarterly-83/Article/969665/pla-reforms-and-chinas-nuclear-forces/; and David C. Logan, "Making Sense of China's Missile Forces," in Phillip C. Saunders, Arthur S. Ding, Andrew Scobell, Andrew N.D. Yang, and Joel Wuthnow (eds), Chairman Xi Remakes the PLA: Assessing Chinese Military Reforms (NDU: Wash DC, 2019), pp. 393-436. Also see Michael S. Chase, "PLA Rocket Force Modernization and China's Military Reforms," Testimony presented before the U.S.-China Economic and Security Review Commission, February 15, 2018.

199 "Counter-intervention" is commonly known in the West as A2/AD capabilities. Beijing, however, does not use the term A2/AD or counter-intervention. Instead, it typically refers to deploying capabilities consistent with countering a powerful adversary's military intervention in a conflict involving China.

200 For reporting on joint command and control reform, see Wang Shibin (王士彬), An Puzhong (安普忠), and Liang Pengfei (梁蓬飞), "Xi Jinping Inspects CMC Joint Operations Command Center" (习近平视察军委联合作战指挥中心), April 20, 2016, at http://www.mod.gov.cn/leaders/2016-04/20/content_4650183.htm; and "Why is Xi Jinping Emphasizing the Joint Operational Command System?" (习主席为何如此重视联合作战指挥体系), *Xinhua*, April 21, 2016, at http://news.xinhuanet.com/politics/2016-04/21/c_1118687310.htm.

201 Mark Stokes, "PLA Rocket Force Leadership and Unit Reference," Project 2049 Institute, Arlington, VA, April 9, 2018, based on open-source analysis; and Mark Stokes, "The PLA Rocket Force: Transformation and Mid- to Long-Term Challenges," briefing presented at Rajaratnam School of International Studies (RSIS) conference, *The People's Liberation Army in Its Tenth Decade: Assessing the Prospects of China's Military Transformation under Xi Jinping*, August 13, 2018, Singapore.

202 *China Military Power: Modernizing a Force to Fight and Win*, DI, January 2019, p. 91

203 DoD Annual Report To Congress: Military and Security Developments Involving the People's Republic of China (2018), p. 91.

204 DIA Report, p. 93.

205 DoD Annual Report To Congress: Military and Security Developments Involving the People's Republic of China (2018).

206 DIA, pp. 36-37.

207 DoD Military Power Report (2009),p. 22. It should also be noted that other PLA services are responsible for other types of cruise missiles. For example, the PLAN operates surface-, air, and submarine-launched anti-ship cruise missiles (ASCMs).

208 DoD Annual Report To Congress: Military and Security Developments Involving the People's Republic of China (2018), , p. 37.

209 See Ankit Panda, "Introducing the DF-17: China's Newly Tested Ballistic Missile Armed With a Hypersonic Glide Vehicle," *The Diplomat*, December 28, 2017, at https://thediplomat.com/2017/12/introducing-the-df-17-chinas-newly-tested-ballistic-missile-armed-with-a-hypersonic-glide-vehicle/.

210 Lu Xiaolin, Zong Zhaodun, and Zou Weirong (卢晓琳, 宗兆盾, 邹维荣), "Forging New-type Combat and Elite force (打造新型作战力量尖刀铁拳)," 4 June 2017, *People's Daily*, p 6.

211 For a detailed discussion of this matter, see Kevin L. Pollpeter, Michael S. Chase, and Eric Heginbotham, *The Creation of the PLA Strategic Support Force and Its Implications for Chinese Military Space Operations*. Santa Monica, CA: RAND Corporation, 2017. https://www.rand.org/pubs/research_reports/RR2058.html.

212 One official PLA source suggested that the PLA views "electronic countermeasures" and "electronic warfare" interchangeably. *The PLA Air Force Officer Handbook* (中国人民解放军空军军官手册), Lantian Publishing Press (蓝天出版社), 2006, 1st edition. p.235.

213 It may also be translated as "cyberattack and cyber defense."

214 "What kind of force is the PLASSF that Xi Jinping recently inspected (习近平视察的战略支援部队是一支怎样的力量)?" http://news.cctv.com/2016/08/30/ARTI2Xi1zgynCfj6TYsecOcb160830.shtml CCTV net (央视网), August 30, 2016.

215 The State Council Information Office of the People's Republic of China, "China's Military Strategy," May 2015, accessed at: http://www. chinadaily.com.cn/china/2015-05/26/content_20820628.htm.

216 512所成功举办"航天系统部2016年度国军标主编人员第一期培训班," accessed at: http://www.cast512.com/cn/news_detail.asp?ID=399

217 Kevin Pollpeter, Eric Anderson, Jordan Wilson, Fan Yang, "China Dream, Space Dream: China's Progress in Space Technologies and Implications for the United States," *U.S.-China Economic and Security Review Commission*, no date, p. 96, accessed on 21 March 2016 at: http://origin.www.uscc.gov/sites/default/ files/Research/China%20Dream%20Space%20Dream_Report.pdf., p. 95.

218 Ibid., p. 95.

219 Ibid., p. 95.

220 Kevin Pollpeter and Jonathan Ray, "The Conceptual Evolution of Space Operations as Seen in the Science of Military Strategy," no date, provided by Kevin Pollpeter, p. 16.

221 Kevin Pollpeter, Eric Anderson, Jordan Wilson, Fan Yang, "China Dream, Space Dream: China's Progress in Space Technologies and Implications for the United States," *U.S.-China Economic and Security Review Commission*, no date, p. 96, accessed on 21 March 2016 at: http://origin.www.uscc.gov/sites/default/ files/Research/China%20Dream%20Space%20Dream_Report.pdf.

222 Pollpeter et al, p. 97.

223 Ibid., p. 97.

224 Ibid., p. 98.

225 Ibid., p. 98.

226 Yue Huairang (岳怀让), "Yu Peijun becomes director of Xi'an Satellite Control Center, Qi Yahu becomes its Party Secretary (余培军任西安卫星测控中心主任, 祁亚虎任党委书记)

227 Wei Long (魏龙), "China's Yuanwang fleet conducted safe voyage more than 120,000 NMs in 2016 (中国'远望号'船队2016年安全航行12万余海里)," *China News* (中国新闻网), 2017-01-18, accessed at: http://www.xinhuanet.com/politics/2017-01/18/c_129452095.htm

228 Mi Xiangyang (弥向阳), Liu Guohui (刘国辉), "Malan celebrates the Chinese New Year's Eve (除夕夜, 这是属于马兰的浓浓年味) " accessed at: https://mp.weixin.qq.com/s/GF8wl_apa6h8jkL4eIYRcA ; Also Li Zhiyong (李志勇), Liu Guohui (刘国辉), "Experiencing Malan during the Chinese New Year celebrations (新春走军营| 海量图片带你走进马兰广场游艺活动现场), https://mp.weixin.qq.com/s/scCAJg8WlHyO-zZbPI1vAA

229 Gao Yuan (高原), "Our country's first State Key Lab of laser propulsion and applications is founded (我国首个激光推进及其应用国家重点实验室成立)," http://jz.chinamil.com.cn/newscenter/zongbuzhishu/content/2012-05/08/content_4855631.htm, May 8, 2012.

230 "China's Military Strategy," in Pollpeter, "Space, the New Domain," p. 6.

231 Pollpeter, "Space, the New Domain," p. 6.

232 Ibid., p. 6.

233 Andrew Jones, "China launches five commercial remote sensing satellites via Long March 11," https://spacenews.com/china-launches-five-commercial-remote-sensing-satellites-via-long-march-11/

234 Xu Hong (徐红), "2018年我国对地观测遥感卫星迎来密集发射期," 2018年08月30日, 中国经济网-(经济日报), accessed at: http://www.ce.cn/xwzx/gnsz/gdxw/201808/30/t20180830_30158740.shtml

235 Ibid., p 7.

236 Stephen Clark, "China begins 2019 launch campaign with a success," January 10, 2019," https://spaceflightnow.com/2019/01/10/china-begins-2019-launch-campaign-with-a-success/

237 "China's quantum satellite clears major hurdle on way to ultrasecure communications," https://www.nature.com/news/china-s-quantum-satellite-clears-major-hurdle-on-way-to-ultrasecure-communications-1.22142#/b1, Davide Castelvecchi, 15 June 2017

238 Ibid., p 7.

239 "China just set new national launch record while putting up two more Beidou navigation satellites, by Andrew Jones — August 25, 2018 https://spacenews.com/china-just-set-new-national-launch-record-while-putting-up-two-more-beidou-navigation-satellites/

240 "Statement For The Record Worldwide Threat Assessment Of The Us Intelligence Community, February 13, 2018," Https://Www.Dni.Gov/Files/Documents/Newsroom/Testimonies/2018-Ata---Unclassified-Ssci.Pdf

241 Pollpeter, "Space, the New Domain," p. 8. Historical point from Pollpeter's CASI presentation in February 2016.

242 Pollpeter, "Space, the New Domain," p. 8.

243 "China successfully carried out a land-based mid-course missile interception test (中国成功进行陆基中段反导拦截技术试验)," *Xinhua News Agency*, 2018-02-06, Accessed at: http://www.xinhuanet.com/2018-02/06/c_1122375009.htm

244 Ankit Panda, "Revealed: The Details of China's Latest Hit-To-Kill Interceptor Test," February 21, 2018, https://thediplomat.com/2018/02/revealed-the-details-of-chinas-latest-hit-to-kill-interceptor-test/

245 Pollpeter et al, p. 18.

246 Pollpeter, "Space, the New Domain," p. 9.

247 Pollpeter et al, p. 18.

248 Pollpeter, "Space, the New Domain," p. 9.

249 Pollpeter et al, p. 18.

250 Pollpeter, "Space, the New Domain," p. 10.

251 "V: International Cooperation and Exchanges," http://www.china.org.cn/government/whitepaper/2016-06/16/content_38681035.htm

252 *Military Balance 2016*, pp. 241- 42.

253 "Marking 91st birthday, PLA marches into new era of reform, capacity building," *PLA Daily*, August 1, 2018, http://eng.chinamil.com.cn/view/2018-08/01/content_9238948.htm.

254 *Military Balance 2019*, pp. 258.

255 Ibid. The Army Aviation corps also has assigned a few Y-7 and Y-8 transport aircraft and two new Y-9 medium transports assigned to the 81st Group Army Army Aviation Brigade. See "Transport planes boost PLA abilities," PLA Daily, December 20, 2017, http://english.chinamil.com.cn/view/2017-12/20/content_7874499.htm.

256 "Assault, The Direction the Army Takes Off" (新春走军营·记者在战位), *PLA Daily*, January 21, 2019, http://www.81.cn/jmtt/2019-01/21/content_9409406.htm.

257 "Military Report," CCTV-7, December 25, 2018, [timing 08:30], http://tv.cctv.com/2018/12/25/VIDEbq8WmYwfFKemQrlu3Xdm181225.shtml. The *Military Balance 2019* also holds four helicopter training regiments. It is possible that the Training and Test Base has incorporated some or all of those training units into its structure.

258 "2015 Army Aviation Academy Admissions Guide" (2015年陆军航空兵学院招生简章), *PLA Daily*, May 12, 2015, http://www.81.cn/rdzt/2014/0421bkjx/2015-05/12/content_6487495.htm.

259 "Reorganized and Rebuilt, Flight Training Time 'Doubled'" (重组再建, 飞行训练时间"翻一番"") *PLA Daily*, October 31, 2018, http://www.81.cn/jmywyl/2018-10/31/content_9327210.htm.

260 "A Helicopter Battalion Commander's 'Circle of Friends'" (一名直升机营长的"朋友圈"), *PLA Daily,* January 7, 2018, http://www.81.cn/jfjbmap/content/2018-01/07/content_196348.htm.

261 "Battle of Tsugol, 'East 2018' Strategic Exercise Enters Climax" (鏖战楚戈尔, "东方-2018"战略演习进入高潮), Ministry of National Defense, September 14, 2018, http://www.mod.gov.cn/action/2018-09/14/content_4824917_2.htm.

262 "China sets up its 2nd peacekeeping helicopter detachment to Sudan," *PLA Daily*, August 8, 2018, http://english.chinamil.com.cn/view/2018-08/08/content_9245933.htm.

263 "How about the performance of China's Z-20 medium-lift utility helicopter?" *PLA Daily*, February 24, 2018, http://english.chinamil.com.cn/view/2018-02/24/content_7950952.htm.

264 "China and Russia to jointly develop heavy lift helicopters," *PLA Daily*, March 18, 2019, http://eng.chinamil.com.cn/view/2019-03/18/content_9452246.htm.

265 http://kj.81.cn/content/2015-12/30/content_6837163.htm.

266 Sun Yu and Wang Zhenyang, "'Fierce Dragons' Fight against 'Golden Helmets'," *Renmin Haijun*, 6 January 2016, p. 1.

267 Kenneth Allen and Lyle J. Morris, *PLA Naval Aviation Training and Operations: Missions, Organizational Structure, and Training* (2013-15), CASI, December 2017.

268 Kenneth Allen, Phillip C. Saunders, and John Chen, *Chinese Military Diplomacy, 2003-2016*, Washington, D.C.: National Defense University, July 2017.

269 Xu Yi (许毅), ""Golden Helmet" and implications for actual-combat training ", *Kongjun Bao*, 24 Nov 2017

270 Xu Tongxuan (徐同宣) , "A Northern TCAF air brigade participated in "Aviadart" Competition ", *Kongjun Bao*, 2 Aug 2017

271 http://china-defense.blogspot.com/2017/07/professional-research-report-of-day.html.

272 Yang Zhen (杨振), Yang Jin (杨进) , "PLAAF and Pakistan "Shaheen VI" ", *Kongjun Bao*, 11 Sept 2017

273 Ed. Yang Yi, *Xinhua News* online, http://www.xinhuanet.com//english/2017-09/23/c_136630864.htm 23 Sept 2017

274 Yao Jianing, "Army chief witnesses Pak-China international air exercise," Chinanmil.com, 13 December 2018, http://english.chinamil.com.cn/view/2018-12/13/content_9377328.htm.

275 Su Xiao (苏啸), Meng Pu (孟璞) , "PLAAF's "Four Training Brands" , *PLA Air Force Magazine*, October 2017

276 Garafola, Heath; "China's First Steps toward becoming an Expeditionary Air Force", RAND, 2017

277 Li Kaiqiang (李开强), Zhang Lei (张雷) , "Chinese, Thai air forces conduct combined training ", *PLA Air Force Magazine*, September 2017. Li Jiayao, "China, Thailand host joint air force exercise 'Falcon Strike 2018'," *China Military Online*, 7 September 2018, http://english.chinamil.com.cn/view/2018-09/07/content_9275202.htm.

278 Li Jiayao, "China, Thailand host joint air force exercise 'Falcon Strike 2018'," *China Military Online*, 7 September 2018, http://english.chinamil.com.cn/view/2018-09/07/content_9275202.htm.

279 Zhang Tao, "China's airborne troops win 11 events in Int'l Army Games," *Xinhuanet*, 10 August 2017, http://english.chinamil.com.cn/view/2017-08/10/content_7714078.htm.

280 Li Jiayao, "Chinese Air Force aerobatics team departs for performance in Russia," *Xinhuanet*, 16 August 2018, http://english.chinamil.com.cn/view/2018-08/16/content_9255259.htm.

281 Yao Jianing, "Chinese Bayi Aerobatic Team makes debut in Thailand," *China Military Online*, 27 November 2015, http://english.chinamil.com.cn/news-channels/china-military-news/2015-11/27/content_6789790.htm.

282 Li Jiayao, "Four spotlights in Dubai Airshow," *China Military Online*, 14 November 2017, http://english.chinamil.com.cn/view/2017-11/14/content_7825193.htm.

283 Li Jiayao, "Bayi Aerobatics Team performs at high altitude for first time," *China Military Online*, 21 November 2017, http://english.chinamil.com.cn/view/2017-11/21/content_7835530.htm.

284 Liu Gang and Zhou Xianren, "Strive for Realistic Environment, Strive for Difficult Contents, Strive for Strict Evaluations, and Strive for Practical Drills; Unidentified Base Acts Upon Order and Makes Clarion Call for Real Combat Oriented Training in New Calendar Year," *Huojianbing Bao*, 1 1 January 2014, p. 1.

285 Zhou Yubo, "There is No Choice in the 'Timing' of War; 'Blind Spots' Are Refused in Training Soldiers; A Brigade Analyzes Typical Cases and Strives to Improve the Quality of Night Training" *Huojianbing Bao*, 1 January 2014, p. 2.

286 Hu Yikai and Feng Jinyuan, "Regiment Tempers Communication Command Capabilities in Complex Environment" *Huojianbing Bao*, 22 January 2014, p. 2.

287 This section was taken directly from "China's Aviation Industry: Lumbering Forward", CASI May 2019

288 "工信部副部长: 中国制造业核心技术短缺局面尚未根本改变," *Xinhua* [新华], 13 July 2018, http://www.chinanews.com/cj/2018/07-13/8565912.shtml

289 Chen Jie [陈杰], "习近平在空军机关调研," *Xinhuanet* [新华网], 14 April 2014, http://www.xinhuanet.com/photo/2014-04/14/c_126389555.htm.

290 "战略空军的新航迹—空军向'空天一体, 攻防兼备' 战略目标振翅奋飞," *PLA Daily* [解放军报], 9 May, 2018, http://www.81.cn/jfjbmap/content/2018-05/09/content_205686.htm.

291 "'鲲鹏'列装,空军加速向'战略性军种'转型," *People's Daily Overseas Edition* [人民日报海外版], 9 July, 2016, http://news.ifeng.com/a/20160709/493226420.shtml.

292 "Military and Security Developments Involving the People's Republic of China 2018," Office of the Secretary of Defense, 16 May 2018.

293 OSD, *Annual Report to Congress: Military and Security Developments Involving the People's Republic of China 2014*, Washington, DC: U.S. Department of Defense, 2014, p. 9.

294 SIPRI Military Expenditure Database, SIPRI Milex data 1988-2014 Nov15.xlsx, http://www.sipri.org/research/armaments/milex/milex_database.

295 Chase and Garafola, 2015, p. 2.

296 Huang Sujian and Zhang Zhengping, 'The Development of the Essential Properties of the US Strategic Air Force and Its Inspiration for China's Air Force Building,' in Zhu Hui, *Strategic Air Force*, 282.

297 OSD, *Annual Report to Congress, 2014*, p. 10.

298 "China's KJ-500 AEW&C Platform 'Enters Service,'" *Jane's Defence Weekly*, 24 Mar. 2015.

299 For background see Kevin Pollpeter and Kenneth W. Allen, eds., *The PLA as Organization v2.0* at https://www.airuniversity.af.edu/Portals/10/CASI/Books/PLA_as_Organization_v2.pdf, and Kenneth Allen, "China Announces Reform of Military Ranks," *China Brief,* Volume 17, Issue 2. 30 January 2017, https://jamestown.org/program/china-announces-reform-military-ranks/.

300 See Marcus Clay, Understanding the "People" of the People's Liberation Army: A Study of Marriage, Family, Housing, and Benefits, CASI, 2018, https://www.airuniversity.af.edu/Portals/10/CASI/Books/Understanding_the_People_of_the_PLA.pdf.

301 "51-year old Chang Dingqiu Appointed as Deputy Chief of the General Staff (51岁常丁求履新中央军委联合参谋部副参谋长), *The Paper*, 11 July 2018, www.thepaper.cn/newsDetail_forward_2255404. https://baike.baidu.com/item/常丁求.

302 www.pasdxw.com/show.asp?id=48232, www.gywb.com.cn/content/2015-07/22/content_3537417.htm. http://baike.baidu.com/item/安兆庆.

303 https://baike.baidu.com/item/丁来杭. https://zh.wikipedia.org/wiki/丁来杭. "China to appoint new air force commander," http://www.scmp.com/news/china/diplomacy-defence/article/2108010/china-appoint-new-air-force-commander-sources-say. http://www.360doc.com/content/17/0130/19/8527076_625485478.shtml.

304 https://baike.baidu.com/item/于忠福/73984. http://baike.baidu.com/view/361579.htm. http://mil.sohu.com/20140815/n403487437.shtml.

305 https://baike.baidu.com/item/麻振军. https://zh.wikipedia.org/wiki/麻振军. http://china.caixin.com/2017-12-27/101189931.html.

306 https://zh.wikipedia.org/wiki/徐安祥. http://www.epochtimes.com/gb/18/2/22/n10164015.htm. https://baike.baidu.com/item/徐安祥/18709463.

307 www.baike.com/wiki/郑元林%5B空军党委常委%5D. https://zh.wikipedia.org/wiki/郑元林. www.thepaper.cn/newsDetail_forward_2865679 (解放军空军总部迎来一名副司令员: 南空参谋长郑元林升任). www.thepaper.cn/newsDetail_forward_1428083 (郑元林任南部战区空军参谋长, 张铁良任副参谋长)

308 https://baike.baidu.com/item/陈学斌/17204556. https://zh.wikipedia.org/wiki/陈学斌. https://zh.m.wikipedia.org/zh-hans/陈学斌. www.thepaper.cn/newsDetail_forward_2149963 (海军副政委兼政工部主任陈学斌跨军种调任空军副政委).

309 http://baike.baidu.com/item/俞庆江?fr=aladdin. www.wholife.com.cn/junxianjinsheng/20150469466.html. www.tianya999.com/yaowen/2015/1023/139803_2.html. https://baike.baidu.com/item/俞庆江. www.thepaper.cn/newsDetail_forward_1930567 (徐安祥任空军副司令员, 俞庆江任空军参谋长).

310 https://baike.baidu.com/item/堵远放.

311 https://baike.baidu.com/item/郑学祥.

312 https://baike.baidu.com/item/朱程/19317539. www.thepaper.cn/newsDetail_forward_2427444 (空军装备部部长换将: 朱程接棒李凡). https://baike.baidu.com/item/朱程/19317539. www.bjd.com.cn/sd/mrq/201803/06/t20180306_11081579.html (出席两会的这11位将军升级了). www.powerapple.com/news/shi-zheng-jiao-dian/2018/3/6/3059790.html (江胡支持修宪习军中心腹悄然晋升).

313 http://sd.ifeng.com/a/20160324/4398961_0.shtml

314 http://sd.ifeng.com/a/20160324/4398961_0.shtml, www.mnw.cn/news/china/1101849.html, http://news.ifeng.com/a/20160206/47382568_0.shtml, http://china.caixin.com/2016-02-23/100911521.html, and http://baike.baidu.com/黄国显.

315 http://china.caixin.com/2019-01-15/101370268.html (人事观察|湖北仙桃籍少将袁华智升任东部战区空军政委). www.thepaper.cn/newsDetail_forward_2856033 (海军陆战队首任政委袁华智已任东部战区空军政委). https://zh.wikipedia.org/wiki/袁华智.

316 http://www.givebette.com/ ?s=空军贾志刚副司令. http://china.caixin.com/2019-01-30/101376014.html (人事观察|东部战区空军副司令员贾志刚少将任南部战区副司令员). https://baike.baidu.com/item/贾志刚/23275159. http://china.caixin.com/2019-01-31/101376743.html (人事观察|空军少将王强升任西部战区副司令员). http://pyoooo.com/junshi/234732.html (人事观察|东部战区空军副司令员贾志刚少将任南部战区副司令员).

317 https://www.thepaper.cn/newsDetail_forward_2812716 (河南省军区原司令员周利空军少将已升任南部战区空军司令员). https://baike.baidu.com/item/周利/18879282. http://cqfb.people.com.cn/news/2017412/60109.htm (空军少将周利调任河南省军区司令员, 接替卢长健少将). https://www.thepaper.cn/newsDetail_forward_2812716 (河南省军区原司令员周利空军少将已升任南部战区空军司令员).

318 http://news.sina.com.cn/c/2018-07-29/doc-ihfxsxzh4371321.shtml (四军种7人晋升中将最年轻54岁). www.baike.com/wiki/徐西盛&prd=so_1_pic. http://pyoooo.com/junshi/57500.html. https://zh.wikipedia.org/wiki/徐西盛. https://baike.baidu.com/item/徐西盛.

319 http://blog.sina.com.cn/s/blog_8c0e29aa0102wga6.html. http://china.caixin.com/2019-01-31/101376743.html (人事观察|空军少将王强升任西部战区副司令员). https://zh.wikipedia.org/wiki/王强. http://www.niubb.com/riji/2015/10-29/174051.html (邱型柏2002-2015历次授衔上将, 中将, 少将名单及简历). https://baike.baidu.com/item/王强/17194165.

320 http://news.ifeng.com/a/20160206/47382568_0.shtml and http://baike.baidu.com/战厚顺.

321 http://www.fei123.com/1300000/1297540_13.shtml. www.thepaper.cn/newsDetail_forward_2849306 (空军政治工作部副主任姜平少将升任西部战区空军政委). www.weibo.com/2369379394/HcoI2DES1?type=comment#_rnd1549817586182. www.360doc.com/content/15/0113/15/21515339_440430053.shtml.

322 https://zh.wikipedia.org/wiki/范骁骏. https://baike.baidu.com/item/范骁骏.

323 http://blog.sina.com.cn/s/blog_8c916de60102wikh.html. http://blog.sina.com.cn/s/blog_de1ebd570102w6rc.html. http://www.twoeggz.com/news/7499545.html.

324 https://baike.baidu.com/item/许学强/17194138. www.thepaper.cn/newsDetail_forward_1898359. www.thepaper.cn/newsDetail_forward_1898359 (许学强履新北部战区空军党委副书记). http://www.baike.com/wiki/许学强. www.niubb.com/riji/2015/10-29/174051.html (邱型柏2002-2015历次授衔上将, 中将, 少将名单及简历).

325 *Jiefangjun Bao*, 10 March 2016 and http://news.ifeng.com/a/20160206/47382568_0.shtml

326 https://zh.wikipedia.org/wiki/乙晓光, http://baike.baidu.com/乙晓光, http://news.163.com/11/0201/05/6RPJ6SI10001124J.html, http://www.sqssyw.com/default.php?mod=article&do=detail&tid=241898, http://www.oumil.com/article/zhenggong/7102.html, http://renwuku.news.ifeng.com/index/detail/349/yixiaoguang, www.shm.com.cn/newscenter/2011-02/01/content_3365763.htm, http://baike.baidu.com/view/1115423.htm, Kongjun Bao (23 April 2003, 4).

327 http://baike.baidu.com/张义瑚.

328 https://zh.wikipedia.org/wiki/韩胜延. https://baike.baidu.com/item/韩胜延.

329 https://baike.baidu.com/item/郭普校. https://zh.wikipedia.org/wiki/郭普校. www.niubb.com/riji/2015/10-29/174051.html. www.niubb.com/riji/2015/10-29/174051.html.

330 https://zh.wikipedia.org/wiki/周亚宁. https://baike.baidu.com/item/周亚宁.

331 https://zh.wikipedia.org/wiki/王家胜. https://baike.baidu.com/item/王家胜/82408. https://wapbaike.baidu.com/item/王家胜/82408.

332 https://zh.wikipedia.org/wiki/尚宏_(中将). https://baike.baidu.com/item/尚宏/27778. http://china.caixin.com/2017-10-19/101158389.html.

333 https://zh.wikipedia.org/wiki/康春元. https://baike.baidu.com/item/康春元. www.thepaper.cn/newsDetail_forward_1521187.