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CHINA AEROSPACE STUDIES INSTITUTE

PLA Aerospace Power:

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

4th Edition

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China Aerospace Studies Institute

The mission of the China Aerospace Studies Institute (CASI) is to advance the understanding of the strategy, doctrine, operating concepts, capabilities, personnel, training, and organization of China's aerospace forces and the civilian and commercial infrastructure that supports them.

CASI supports the Secretary, Chief of Staff of the Air Force, the Chief of Space Operations, and other senior Air and Space leaders. CASI provides expert research and analysis supporting decision and policy makers in the Department of Defense (DoD) and across the U.S. government. CASI can support the full range of units and organizations across the United States Air Force (USAF), U.S. Space Force (USSF), and the DoD. CASI accomplishes its mission through conducting the following activities:

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- CASI conducts conferences, workshops, roundtables, subject matter expert panels, and senior leader discussions to further its mission. CASI personnel attend such events, government, academic, and public, in support of its research and outreach efforts.
- CASI publishes research findings and papers, journal articles, monographs, and edited volumes for both public and government-only distribution as appropriate.
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CASI supports the U.S. 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 Asia-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.

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Acronyms

3PLA	Third Department, General Staff Department
4PLA	Fourth Department, General Staff Department
A2/AD	Anti-access and area denial
AAA	Anti-aircraft artillery
AAM	Air-to-air missile
AMRAAM	Advanced medium-range air-to-air missile
ADIZ	Air defense identification zone
AEW	Airborne early warning
AEW&C	Airborne early warning (and) command [PRC usage; U.S. usage is airborne early warning and control]
AO	Area of operation(s)
AOR	Area of responsibility
AOE	Auxiliary, oil, explosives
ASF	Aerospace Force
ASW	Anti-submarine warfare
AWACS	Airborne warning and control system
AVIC	Aviation Industry Corporation of China
BDA	Battle damage assessment
C2	Command and control
C4ISR	Command, control, communications, computers, intelligence, surveillance, and reconnaissance
CAAC	Civil Aviation Administration of China
CAS	Close air support
CASC	China Aerospace Science and Technology Corporation
CASIC	China Aerospace Science and Industry Corporation
CCP	Chinese Communist Party
CETC	China Electronics Technology Group Corporation
CG	Guided-missile cruiser

CMC	Central Military Commission
CMI	Civil-military integration
CNNC	China National Nuclear Corporation
CSF	Cyberspace Force
CSGC	China South Industries Group Corporation
CSIC	China Shipbuilding Industry Company
CSSC	China State Shipbuilding Corporation
DCA	Defensive counter air
DEAD	Destruction of enemy air defenses
DEP	Dual-enrollment program
DIB	Defense industrial base
DoD	Department of Defense
ECM	Electronic countermeasures
ELINT	Electronic intelligence
EMS	Electromagnetic spectrum
EW	Electronic warfare
FAA	Federal Aviation Administration
GAD	General Armaments Department
GDP	Gross domestic product
GLCM	Ground-launched cruise missile
GSD	General Staff Department
HQ	Headquarters
IADS	Integrated air defense system
ICBM	Intercontinental ballistic missile
IEU	Information Engineering University
IRBM	Intermediate-range ballistic missile
ISF	Information Support Force
ISR	Intelligence, surveillance, and reconnaissance
JLSF	Joint Logistics Support Force

JOCC	Joint Operations Command Center
LHA	Landing helicopter assault
LM	Long March
LPD	Landing platform dock
MAD	Magnetic anomaly detector
MANPADS	Man-portable air defense systems
MCF	Military-Civil Fusion
MDMP	Military decision-making process
MIRV	Multiple independently-targetable reentry vehicle
MOE	Mixed-ownership enterprises
MP	Maritime patrol
MRAF	Military Region Air Force
MRBM	Medium-range ballistic missile
MUMT	Manned-unmanned teaming
NATO	North Atlantic Treaty Organization
NAU	Naval Aviation University
NC3	Nuclear command, control, and communications
NCO	Non-commissioned officer
NDU	National Defense University
NFU	No first use
NORINCO	China North Industries Group Corporation
NSD	Network Systems Department
NTAS	Naval Teenagers Aviation School
NUDT	National University of Defense Technology
OCA	Offensive counter air
OPFOR	Opposing force
PC	Political commissar
PGM	Precision guided munition
PLA	People's Liberation Army

PLAA	PLA Army
PLAAF	PLA Air Force
PLAN	PLA Navy
PLANMC	PLA Navy Marine Corps
PLASSF	PLA Strategic Support Force
PLARF	PLA Rocket Force
PRC	People's Republic of China
PME	Professional military education
R&D	Research and development
RD&A	Research, development, and acquisition
SAM	Surface-to-air missile
SAR	Search and rescue
SEAD	Suppression of enemy air defenses
SEU	Space Engineering University
SIGINT	Signals intelligence
SLOC	Sea lines of communication
SMS	*Science of Military Strategy*
SOE	State-owned enterprise
SRBM	Short-range ballistic missile
SSD	Space Systems Department
STEM	Science, technology, engineering, and mathematics
TC	Theater Command
TCAF	Theater Command Air Force
TCN	Theater Command Navy
TT&C	Telemetry, tracking and control
TTP	Tactics, techniques, and procedures
UAS	Unmanned aircraft systems
UAV	Unmanned aerial vehicle
UGF	Underground facility

UK	United Kingdom
USAF	U.S. Air Force
USSR	Union of Soviet Socialist Republics
VTOL	Vertical takeoff and landing
XSCC	Xi’an Satellite Control Center

List of Chinese terms

Aerospace Force	军事航天部队 (*junshi hangtian budui*)
Arm	兵种 (*bingzhong*)
Base	基地 (*jidi)*
Brigade	旅 (*lv*)
Central Military Commission	中央军事委员会 (*zhongyang junshi weiyuanhui*)
Cyberspace Force	网络空间部队 (*wangluo kongjian budui*)
Group Army	集团军 (*jituan jun*)
Information Support Force	信息支援部队 (*xinxi zhiyuan budui)*
Joint Logistics Support Force	联勤保障部队 (*lian qin baozhang budui*)
Joint operations	联合作战 (*lianhe zuozhan*)
Non-commissioned officer	军士 (*junshi*) [士官 (*shiguan*) has also been used]
Officer	军官 (*junguan*)
People's Liberation Army (PLA)	人民解放军 (*renmin jiefangjun*)
PLA Air Force	人民解放军空军 (*renmin jiefangjun kong jun*)
PLA Army	人民解放军陆军 (*renmin jienfangjun lujun*)
PLA Navy	人民解放军海军 (*renmin jiefangjun hai jun*)
PLA Rocket Force	人民解放军火箭军 *(renmin jiefangjun huojian jun*)
PLA Strategic Support Force	战略支援部队 (*zhanlue zhiyuan budui*)
Military Region	军区 (*junqu*)
Regiment	团 (*tuan*)
Service	军种 (*junzhong*)
Theater Command	战区 (*zhanqu*)
Military-Civil Fusion	军民融合 (*jun min ronghe*)

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Preface

The Big Picture

As the People's Liberation Army (PLA) moves ever closer to its centennial anniversary, it shows no signs of slowing the pace of modernization. Under the direct guidance of Xi Jinping, Chairman of the Central Military Commission (CMC) of the Chinese Communist Party (CCP), the PLA has focused heavily on the most advanced and modern aspects of warfighting, with the express goal of catching up to the United States. Chairman Xi has explicitly directed the PLA to have the capability to invade Taiwan by 2027, the 100th anniversary of the PLA's founding. To be clear, this is not a timeline or deadline for such an action. Instead, this is an aspirational readiness goal that Chairman Xi has set for the PLA, and they are working at it diligently. Whether they succeed depends on many factors, some of which lie within the control of the PLA, some with Taiwan, some with the United States (U.S.), and others with the international community as a whole. Whether the PLA hits the centennial mark on time or is slightly delayed is not important. What is important is that they have a goal, they know what they have to do to achieve that goal, and they are moving determinedly to do so.

The PLA is making progress more rapidly in some areas than others, and in some cases, it is advancing even faster than the U.S. military. In hypersonics, for example, the PLA is demonstrably ahead of the U.S., having fielded four brigades of hypersonic weapons, while the U.S. has yet to get similar weapons out of the test phase. While U.S. hypersonics may be better, faster, and more accurate, we will not know until they are employed on a battlefield. Until that time, China remains in the lead.

In other areas, like "jointness," for example, the PLA is far behind the U.S. and our allies and partners. However, the driving reason behind the massive reforms that Chairman Xi initiated in 2015 was to make the PLA more joint in its organization, training, and warfighting ability. The PLA has watched the U.S., its allies, and partners fight for two decades, closely observing the amazing warfighting advantages that jointness has delivered. The PLA wants to be able to do the same.

In some areas, PLA modernization efforts have barely begun. Close air support (CAS) is a perfect example. The PLA can barely spell CAS, whereas CAS is exercised and employed by all services of the U.S. joint force day in and day out. The caveat remains: the Chinese know their CAS inexperience, have a plan to fix their shortcomings, and are diligently working on it.

At the end of the day, the CCP maintains the initiative on the timing of any military action against Taiwan. As a result, the CCP will likely wait until they have high confidence in the success of all of their military, as well as geostrategic capabilities before they resort to military force against the free and democratic people of Taiwan, unforeseen external events notwithstanding.

People's Liberation Army Services and Forces

As the PLA pursues wholesale modernization, there are several notable areas of focus attracting greater resources and leadership attention, almost all of which involve aerospace.

The newly created Information Support Force (ISF) is now a leading organization for warfighting in the information domain,[i] which the PLA conceives of as a domain in and of itself, equal to air, land, sea, and space. The new ISF will apparently work alongside the former Strategic Support Force's (PLASSF) two departments for space and cyber because the PLA sees those as two sides of the same coin, particularly when viewed through the lens of countering intervention by the U.S. and allies and partners in a Taiwan or regional contingency. China is "all in" when it comes to space, seeking to reap all the potential peacetime economic benefits available to space-capable nations. If kinetic violence occurs, the CCP wants to be ready and capable of fighting from, to, and in, space. We have seen rendezvous and proximity operations, satellite grappling and disposal maneuvers, fractional orbital tests, on-orbit refueling and service programs, and a reusable uncrewed space plane. The Chinese have been thinking about, and planning for, war in space for a long time. It is the U.S. military, and our allies and partners' turn to play catch up in this regard. On that score, the U.S. Space Command and Space Force, in coordination with our British, Australian, Japanese, and other allies, is now moving out quickly to make up for lost time.

The PLA Rocket Force (PLARF) continues to have the largest and broadest missile program of any military on the planet. Unencumbered by arms control treaties, the PLARF has developed an entire array of rockets and missiles, from short-range to intercontinental, tactical to strategic, and conventional to nuclear. The PLARF continues to intermingle nuclear and conventional units, equipment, and command and control as a feature (not a bug) of its system. As China continues to build out its nuclear triad, we will have to wait and see how their Nuclear Command, Control, and Communications (NC3) adapts, but until then, you can read about it in CASI's publication "Chinese Nuclear Command, Control, and Communications," available on our website at www.AirUniversity.AF.EDU/CASI.

The PLA Air Force (PLAAF) continues to grow in size and improve in quality. We saw the massive transfer of all land-based fighter aircraft from the PLA Navy (PLAN) to the PLAAF in 2023, along with the transfer of responsibility for mainland air defense (which had previously been divided between the PLAN and the PLAAF). We see continued developments in the WS series of high-performance jet engines. Gone are the days when aero-engines were the bane of PLAAF development; Chinese military aerospace enterprises are now producing engines nearing the caliber of those from North Atlantic Treaty Organization (NATO) nations. The PLAAF has fielded long-range air-to-air missiles that have a greater range than American missiles and continues to develop even more advanced capabilities in this area. Finally, as of this writing, we expect to see the new 'stealth' H-20 bomber in the near future with attendant implications for

[i] On April 19, 2024, Chairman Xi Jinping announced the creation of the ISF, the dissolution of the PLASSF, and other (yet to be specified) changes to PLA information domain forces. As of this writing, it appears that the two departments of the former PLASSF, the Space Systems Department (SSD) (the military space forces) and the Network Systems Department (NSD) (the military cyber forces) will remain and will have a new organizational relationship with the ISF, Theater Commands, and the CMC itself.

People's Republic of China (PRC) force projection intentions and further development of a robust air component for its nuclear triad.

The Industrial Base of the PRC

China is competing on a "whole of society" level and has been for quite some time. Because the Chinese system is different from democracies and free market economies, it can be a challenge for people to understand just how broad and deep that competition goes. CASI has an entire project line dedicated to studying the aerospace industrial base in China. A major difference between China and free market economies is that the PRC has state-owned enterprises (SOEs). These are "companies" that are essentially part of the PRC government and are run and directed by the CCP. A rough analogy would be if Boeing, Lockheed-Martin, and indeed JPMorgan Chase Bank were all entities of the U.S. government directed from the top of the executive branch. This gives the PRC the ability to leverage resources across industry, academia, finance, and research organizations with the end goal of strengthening the PLA and increasing China's "comprehensive national power." Some of these plans may not be clandestine, but often it is not obvious to uninitiated foreign observers just how directed the activities of PRC entities truly are. One example of this is highlighted by CASI's series on the state of hypersonics research in China. We followed up the main report with three others that detailed the cooperation of organizations and academics in Sweden with the PRC, and then with United Kingdom (UK) and PRC cooperation, and finally organizations and individuals in the U.S. that were collaborating with the PRC on hypersonics research. The goal was not to "name and shame" but rather to expose some of the methods and tactics the CCP employs to access the science and technology that they seek for PLA modernization.

In that vein, CASI has begun to outline and describe the Chinese system so that others can make informed decisions when deciding whether or not to accept Chinese money or to cooperate with Chinese organizations on national security-related research. CASI continues to improve its "CASI Database of China's National Defense Industrial Base" so that academics and leaders of institutions can understand the nature of the relationship between those who fund projects and the PLA. CASI has started producing company profiles for some of the major players in the aerospace industry like, for example, the Aviation Industry Corporation of China (AVIC), and some of the less well-known, but just as important players, like the Chang Guang Satellite Technology Company.[ii] We have also started to explain the PRC state & defense laboratory system, first with an overview and then with a deeper report into individual parts of the apparatus.

As NATO member states wrestle with how to rebuild their defense industrial bases and shift from the efficient but fragile systems that exist now, including in the U.S., to the stronger, more resilient, distributed, and robust military-industrial ecosystems that are required to face powerful peer competitors, China continues to drive its formidable military industrial base to new heights. PRC maritime industrial capacity is the undisputed world leader. China has nearly 47% of the global shipbuilding market and is the largest shipbuilding state by far. A single shipyard,

[ii] For more information on the Chang Guang Satellite Technology Company, see Matthew Bruzzese, "Chang Guang Satellite Technology, China Aerospace Studies Institute, March 2024, https://www.airuniversity.af.edu/CASI/Display/Article/3727764/chang-guang-satellite-technology-company-overview/.

Jiangnan Changxing Shipyard in Shanghai, currently exceeds the capacity of all U.S. shipyards combined.[1] The aerospace industry in China is not as robust as the maritime one, but it has aspirations to get there. Unfortunately for China, the commercial aviation industry is ruthless when it comes to efficiency of aircraft and engines, and China's C-919 is still well below par on that mark. But they are making progress, and with steady government subsidies and support over time, they will make up the difference.

All of this is possible because, despite the COVID slowdown and its lasting economic impacts, the PLA still enjoys enviable year-on-year growth in its budgets, with a 7.2% increase in national defense spending in 2024 alone.[2] It is also important to keep in mind that in the PRC system, it is not the PLA that pays for research and development but rather the SOEs that foot the bill. Therefore, the actual size of the national defense budget in China is far larger than the "official" numbers and gets much closer to that of the U.S. when one compares "apples to apples."

The End Goals

As declared by PRC senior leaders, the goals are:

1. By 2027 to have the capability to invade Taiwan, if necessary
2. By 2035 to have basically completed the modernization of the PLA
3. By 2049 to return China to the "Center of the World Stage" which includes building the PLA into a "World Class Military"

What that means in practice is that Beijing wants to be able to do militarily what the United States can do now. Commensurate with these military capabilities, the CCP wants nations, especially those on its periphery, to defer to China's interests. The PRC also wants to be able to defend its interests anywhere in the world. If armed conflict becomes "necessary," the PLA wants to fight under a United Nations flag, if they can arrange it; with a coalition of the willing, if they can build one; or be able to fight on their own, if necessary, and do so where they are likely to prevail. Right now, none of those options exist in a meaningful way for the PRC, but they are rapidly building toward that. Of course, there are plenty of 'lesser included tasks,' and many avenues that the CCP might choose to get to their destination, but make no mistake, they want to be "one of" if not "*the*" predominant powers of the world—economically, diplomatically, technologically, in trade and finance, and in space and cyberspace, all of which require a "world-class" military.

We should expect to see continued advances in aerospace engines. We should look for PRC SOEs to utilize all methods at their disposal to obtain or develop technologies that are critical to the high-end fight in areas like stealth, counter-stealth, counterspace, hypersonics, protected communications (probably quantum-encrypted), computer-aided (or perhaps directed) information processing and decision making, autonomous vehicles in air, on land, on and under seas, and more. Generally speaking, anything that the United States and our allies and partners are doing, we should expect the PRC to be closely watching so that they can either learn to do the same things or learn to defeat those things in new ways.

China will continue to come up with Chinese solutions to Chinese problems. Counter-intervention means the PLA would push back American and Allied forces with ballistic missiles,

cruise missiles, and long-range air-to-air missiles by attacking not just the fighters and bombers but also the tankers, transport aircraft, aircraft carriers, ballistic missile defense ships, and the entire logistics tail that supports all of those capabilities. The PLA has a plan to keep the U.S. and its allies out of the fight, and they won't be using the same Military Decision-Making Process (MDMP) as the U.S. does; it will instead be MDMP "with Chinese characteristics."

When and if the PRC goes to war, it would be a whole-of-government, whole-of-nation, whole-of-society effort. The CCP would leverage its system of control within the PRC to direct and drive talent, use its system of patriotic education to enlist citizens, and attempt to enlist those with historic and cultural ties to China to tell its story, spread its narrative, and collect information and technology. The CCP would leverage its Military-Civil Fusion (MCF) laws and policies to access and direct the PRC's research and development entities, along with PRC academia and commercial companies, to achieve its goal of increasing the PRC's "comprehensive national power."

Strategic competition with the People's Republic of China under the Chinese Communist Party requires a response in at least equal measure by the free and democratic nations of the world. The CCP and the PLA are already running hard to win this competition. Secretary of the Air Force Frank Kendall said it best, "We are in a race for military technological superiority with a capable pacing challenge [in China]. Our cushion is gone. We are out of time."[3]

PLA Air Force[iii]

Overview

Over the course of its 75 years of history, the PLA Air Force (PLAAF) has evolved from a limited force focused on homeland air defense to a "strategic air force" fielding advanced aircraft and missile systems. The PLAAF is now capable of conducting limited operations beyond the first island chain and deterring, coercing, delaying, or defeating most adversaries within the first island chain. Despite its lengthy history, the PLAAF has struggled to carve out a role and mission distinct from that of China's ground forces and navy. While the PLA Army (PLAA) is largely responsible for handling land-based territorial disputes and the PLA Navy (PLAN) is responsible for handling maritime disputes, the PLAAF is left without a similar mission set that is closely tied to political priorities of the Chinese Communist Party (CCP). Additionally, the establishment of the (now former) Strategic Support Force (PLASSF) in 2016 further restricted the PLAAF's mission set. This chapter will provide an overview of the history of the PLAAF, the PLAAF's current mission set, PLAAF modernization priorities, an outline of PLAAF forces and equipment, PLAAF force employment, PLAAF command and control (C2) and organizational structure,[iv] and trends in PLAAF leadership and personnel development.

In 2023, a shift in the PLA's priorities for PLA Navy Aviation caused the transfer of significant portions of PLAN shore-based fixed-wing combat aviation units and facilities, air defense units, and radar units to the PLA Air Force.[4] This shift has allowed for more unified command and control over the integrated air defense systems (IADS) network and the network of terrestrial air domain awareness radar that enables that system to function effectively.

[iii] Much of this section has been adapted from Allen, Kenneth W. and Garafola, Cristina L., *70 Years of the PLA Air Force*, (Montgomery, AL: China Aerospace Studies Institute, 12 April 2021). https://www.airuniversity.af.edu/Portals/10/CASI/documents/Research/PLAAF/2021-04-12%20CASI_70%20Years%20of%20the%20PLAAF_FINAL%20ALL.pdf?ver=hTom1CXAjt0VTGTJzJBGAQ%3d%3d.

[iv] Of note, the PLAAF, like the rest of the PLA, uses army-based terms like Division, Brigade, and Regiment to describe its units; these are loosely analogous to the U.S. Air Force (USAF) Wing, Group, and Squadron.

History

Figure 1: PLAAF Mig-15 fighter aircraft circa 1950[5]

Starting Period 1949-1955

At the time of the founding of the People's Republic of China (PRC) and the transition of the Red Army to the People's Liberation Army, the PLAAF was established and placed under command of PLA Army officers. It would take decades until officers, who began their career in the PLAAF, worked their way up the ranks to fill leadership billets across the board and achieve further autonomy from the PLA Army. During this period, the PLAAF established its own command structure, numerous flight schools, and purchased a large number of modern Soviet aircraft. At the time of its founding, the PLAAF had less than 3,000 trained aviation personnel including pilots, mechanics, and navigators, around 150 foreign made aircraft, and 542 airfields. In the PLAAF's first development plan, which outlined force expansion from 1950 to 1953, it sought to establish more aviation units, expand the size of the force in terms of both facilities and manpower, and construct more military factories to produce aircraft. While the PLAAF did not reach all of these goals, it did get involved in the PRC's military intervention in support of the Democratic People's Republic of Korea (DPRK) during the Korean War. PLAAF activities consisted primarily of combat operations and pilot training, providing the organization with valuable experience. Despite this, it is likely that the political environment of the time prevented the PLAAF, at least outwardly, from implementing many changes based on lessons learned from this experience. During this period, the PLAAF was also defeated by nationalist forces during the first Taiwan Straits Crisis. By the end of this period the PLAAF had an inventory of 4,400 Soviet aircraft, organized into 70 air regiments,[v] and pilots and maintainers to fly and service them. After the end of the war, the PLAAF absorbed the PLA Air Defense Force and integrated it into its organizational structure, conducting a reorganization resulting in six Military Region Air Force (MRAF) Headquarters (HQs).

[v] Though not a true comparison, a PLAAF Air Regiment is loosely analogous to a USAF squadron.

Homeland Defense 1956-1980s

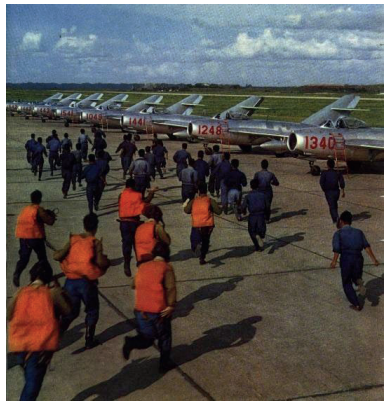

Figure 2: PLAAF airfield circa 1965[6]

This period started with a PLAAF that was still of limited capability continuing to struggle against the USAF and U.S. supplied forces. Beginning with the Second Taiwan Straits Crisis, the PLAAF began building more airfield infrastructures in eastern and southern China with confrontation with the Nationalists on Taiwan in mind. During the crisis, the PLAAF largely failed to overcome its technical disadvantage against the U.S.-supported Nationalist Chinese Air Force. During this time period, the Nationalists and the USAF would continually probe and intrude into PRC airspace, demonstrating the inability of the PLAAF to prevent these intrusions. These intrusions served as an impetus for the PLAAF to invest further in supersonic aircraft and increasingly capable surface-to-air missile (SAM) systems. With the launch of the Great Leap Forward and the eventual cessation of Soviet aid after the Sino-Soviet Split, PLAAF modernization was placed on shaky ground. Despite the fraying of PRC-Union of Soviet Socialist Republics (USSR) relations, the PLAAF did set up increasing numbers of anti-aircraft artillery (AAA), SAM, and radar units across the PRC in an attempt to further develop its ability to defend homeland airspace. Beginning in 1965, the PLAAF began deploying ground-based anti-air units to North Vietnam.

The Cultural Revolution was disastrous for the PLAAF. At the beginning of the Cultural Revolution, PLAAF commander Wu Faxian's close ties to Lin Biao resulted in Wu's arrest and imprisonment in 1971. The PLA did not appoint a new commander until 1973. Prior to the beginning of the Cultural Revolution, the PLAAF educational system was stagnating, despite overall growth in the force. During the Cultural Revolution, almost half of the PLAAF's schools were shut down, and in terms of manpower the size of the PLAAF was reduced by 20%. Additionally, training flight hours during this period of time were drastically reduced. Towards the end of this period, the PLAAF was attempting to overcome serious organizational and supply issues that prevented it from conducting air operations during the 1979 PRC-Vietnam war. Through the eighties, the PLAAF continued to be severely fuel restricted and was unable to field a fourth-generation aircraft like the USSR or United States. During the period between normalization of relations in 1979 and the 1989 Tiananmen crackdown and cessation of military cooperation, the U.S. developed substantial military relations with the PRC, including a program

known as Peace Pearl. This program involved the modernization of J-8 fighter aircraft with the integration of U.S. fire control systems and radar, but this arrangement was eventually cancelled as a result of the crackdown.

Border Defense 1990s-2003

Figure 3: First production J-10A combat aircraft landing after its initial flight[7]

The 1990s signaled the beginning of a long period of modernization and reorganization for the PLAAF, which enabled the PLAAF to broaden its mission set to prevent intrusions into mainland PRC airspace. After the Tiananmen massacre in 1989, all military cooperation between the PRC and United States ceased, which resulted in the need to further rely upon imported Russian aircraft as well as an, at the time, incredibly nascent domestic aircraft industry largely reliant on imported designs and components. During this time, the PLAAF began its initial efforts towards becoming a cross-domain "strategic air force" capable of operating across the air, space, and cyber domains. Moreover, the PLAAF began to expand its sensor network to include airborne early warning (and) command (AEW&C) platforms, airborne command posts, large phased-array radars, and aircraft-mounted synthetic aperture radar. In this period, the PLAAF also finally became capable of preventing intrusions into its airspace via a burgeoning IADS network and air defense fighter fleet. The PLAAF's increase in flight activity around Taiwan began in this era. The PLA closely monitored USAF activities over Iraq and Kosovo, recognizing an air force's capability to independently achieve strategic objectives as a vital component of a joint force and coming to prioritize the ability to conduct accurate strikes against enemy systems.

Integrated Aerospace 2004-Present

Figure 4: J-20 stealth fighters taxi and takeoff[8]

This last period sees the PLAAF further develop its ground-based SAM and radar network, AEW&C aircraft, bomber, and ground attack aircraft, and multirole fighter capabilities, while later facing a sort of identity crisis by having large portions of its multidomain capabilities and responsibilities stripped from it. In 2004, the PLAAF adopted a strategy of "Integrated Air and Space and Simultaneously Prepare for Offensive and Defensive Operations," which would later evolve into the "strategic air force" concept. The component of this strategy referred to as "integrated air and space capability" (*kongtian yiti*; 空天一体) was the product of earlier PLA observations of USAF combat operations as well as the acknowledgment of the increasing importance of multidomain operations to modern air force capabilities. The importance of this integration was outlined in the 2013 edition of the *Science of Military Strategy*: "in line with the strategic requirement of building air-space capabilities 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 informatized 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."[9] The founding of the PLA Strategic Support Force in 2016 stripped the PLAAF of these space and information domain responsibilities, restricting it to conducting air operations, related electronic warfare (EW) and early warning tasks, as well as surface strike operations.

Missions

The following four missions are the primary tasks of the PLAAF. They are presented in order of importance, though they are clearly closely related, especially counter-4intervention and the Taiwan mission set, as the PLAAF will be involved in operations preventing other militaries from intervening or providing materiel support to Taiwan. It is important to reiterate that the current role of the PLAAF in the PRC's nuclear triad is nascent at best due to technical limitations and the relatively small size of its nuclear-capable bomber fleet.

Taiwan

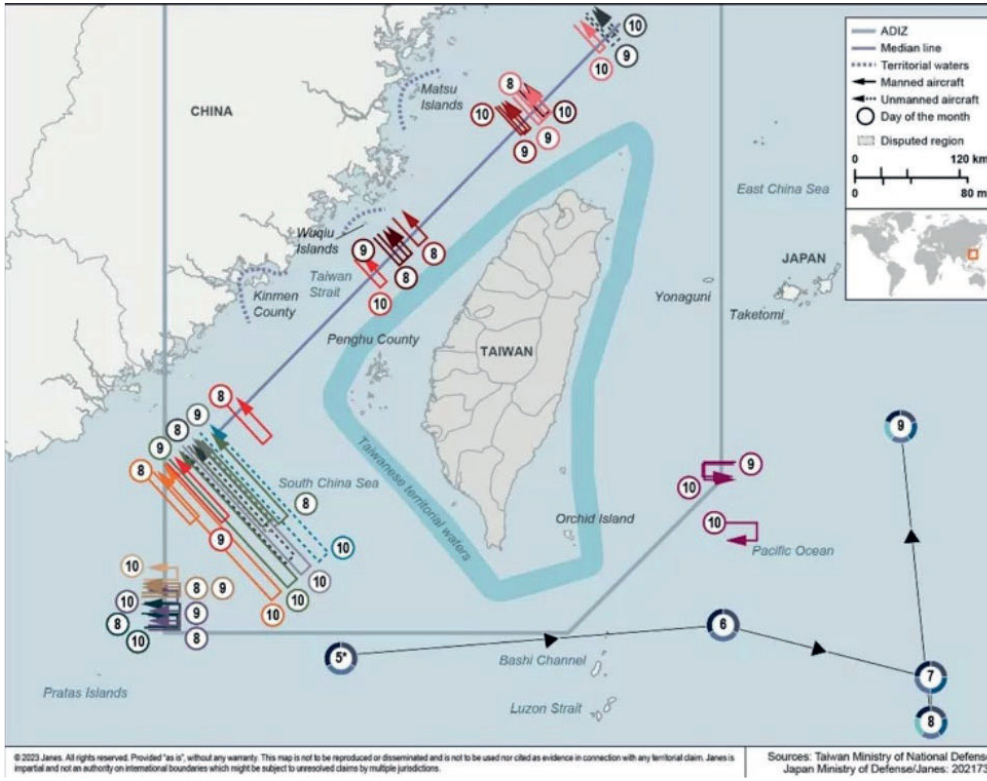

Figure 5: PLA incursions across Taiwan Strait median line and ADIZ during "Joint Sword" wargames, April 2023[10]

The PLAAF's primary mission is a Taiwan invasion. The PLAAF trains to conduct offensive counter air (OCA) and defensive counter air (DCA) operations to maintain air superiority over and around Taiwan, augment joint firepower strikes with air-launched cruise missiles and dumb bombs, conduct suppression of enemy air defenses (SEAD) and destruction of enemy air defenses (DEAD), support joint operations with aerial reconnaissance, and conduct airborne landings to seize key points. During peacetime, the PLAAF's flight activity around Taiwan's air defense identification zone (ADIZ) has the function of familiarizing PLAAF EW operators with the signatures and signals of Taiwanese air and missile defense systems as well as interceptor aircraft. These flights also serve the PRC's goals in cross-strait relations via by demonstrating the superiority of modern PLAAF capabilities' compared to those fielded by Taiwan's air force.

Air Defense

Figure 6: Blue Shield *air defense exercise*

As outlined previously, the PLAAF is largely responsible for maintaining the Integrated Air Defense System (IADS) tasked with defending the PRC. With the transfer of the PLA Navy's air defense units to the PLAAF, the PLAAF has become responsible for managing the comprehensive network of radar and SAM systems that constitute the cornerstone of air defense across the entirety of the PRC. In addition to traditional air defense, the PLAAF is also introducing more advanced systems with nascent ballistic missile defense capabilities, such as the HQ-19 and S-400, as well as counter-precision guided munition (PGM) and cruise missile systems like the HQ-11. It is important to note that the PLAAF will continue to train to coordinate with the PLA Army to conduct joint air defense missions.

Counter-intervention

Figure 7: H-6 bomber armed with cruise missiles[11]

The PLAAF's counter-intervention mission is married to the modernization of its longer-range strike capabilities, prioritization of developing capabilities to conduct operations beyond the first island chain, and the Taiwan invasion mission set. The PLAAF is expected to be a key component of joint counter-intervention strikes, which along with PLARF conventional missile units, create a robust and effective capability to sink U.S. Navy surface assets and strike U.S. bases

in the region. The PLAAF will also perform a counter-intervention function targeted at preventing the USAF from conducting operations in the region by striking its tanker fleet and airborne warning and control systems (AWACS), as well as conducting and OCA as far out as can be sustained by the PLAAF tanker fleet, which while limited today, will be more sizable in the future.

Nuclear Deterrence

Figure 8: H-6N bomber during the 2019 PRC 70th year anniversary parade [12]

When the PRC first developed deliverable nuclear weapons, they were initially air-dropped bombs delivered by PLAAF bombers. With the development of the then Second Artillery Force's longer-range ballistic missiles, the PLAAF's nuclear bomber capability slowly eroded. More recently, the PLAAF has created a brigade of midair-refuellable H-6 variants, the H-6N, to serve as a platform for an air-launched, nuclear-armed ballistic missile. While this platform's limited range restricts its utility to nuclear deterrence messaging and potential long-range conventional strike, the unit equipped with these bombers is thought to be crucial for developing tactics, techniques, and procedures (TTPs) for eventual more capable and survivable platforms that will become a more credible air-based component of a true nuclear triad.

Modernization Priorities and Current Forces

Modernization Priorities

As the PLAAF's mission set and strategic concepts developed through the late 1990s and early 2000s, its modernization efforts evolved from relatively un-coordinated purchases of a variety of foreign capabilities to a more concerted effort designed to supplement a developing domestic industry with foreign purchases. The PLAAF has been prioritizing the development and acquisition of long-range offensive strike capabilities, be that continued modernization of H-6 platforms to fly further and deliver longer-range cruise missiles, or fielding more multirole, cruise-missile capable 4.5 generation aircraft like the J-16.[vi]

[vi] There are several designations for fixed-wing aircraft in the PLAAF inventory: fighter/multi-role aircraft (J-class), fighter-bombers (JH-class), bombers (H-class), transport aircraft (Y-class), and reconnaissance aircraft (JZ-class). Special Mission Aircraft include airborne early warning and control, the KJ-class, and tankers, denoted by a U suffix (Ex: Y-20U).

In an effort to push more commanders into the air, the PLAAF has put commanders in both combat aircraft as well as AWE&C aircraft. The PLAAF traditionally has been reliant on ground-based radar for both early warning and directing aircraft to targets but has been undergoing a campaign intended to increase the number and further develop the capabilities of its airborne command platforms, most notably the KJ-500.

The PLAAF is continually seeking to procure more capable, longer-range SAMs to both provide a robust IADS network for homeland air defense, as well as establish a further bubble of shore-based air defense coverage, enabling fighters capable of operating at longer ranges to push farther out from the Chinese coastline. Beyond increasing the range of these systems, the PLA is seeking to procure more advanced radar systems to better find, fix, track, and target adversary air threats. Similarly, the PLAAF is also pursuing air defense systems that can employ missiles capable of intercepting incoming ballistic and cruise missiles.

Lastly, the PLAAF is procuring increasing numbers of its new, large transport aircraft, the Y-20. The PLAAF transport fleet is currently capable of transporting two light airborne brigades or one light mechanized airborne brigade if it uses its entire inventory of transportation aircraft, leaving limited extra capacity for emergency transport of materiel or other tasks. Given this relative weakness, the PLAAF is seeking to expand this fleet to provide it with more options for rapid logistics support for aviation units or to provide other cargo transportation services without putting the lift it needs for a Taiwan invasion scenario at risk.

Current Forces - Aircraft

The PLAAF currently fields a combat aircraft fleet composed of more modern aircraft and is broadening its ground attack and bomber inventories. As of early 2022, the PLAAF fighter fleet is thought to have three aviation brigades equipped with 5th generation aircraft,[vii] 14 aviation brigades equipped with 4.5 gen aircraft, 16 aviation brigades equipped with 4th generation aircraft, and 11 aviation brigades equipped with legacy 3rd generation aircraft. In terms of dedicated strike aircraft, the PLAAF maintains five aviation brigades of JH-7/JH-7A fighter-bombers and nine conventional bomber regiments equipped with a mix of H-6 variants. The PLAAF's primary lift is composed of six aviation regiments equipped with a variety of heavy and medium lift platforms. The PLAAF currently maintains nine special mission aircraft regiments and two VIP transportation units. Regiments and aviation brigades are typically composed of between 20 and 40 aircraft.

Aviation brigades equipped with fighter aircraft are typically composed of one type of aircraft. The PLAAF is continuing to phase out its legacy 3rd generation aircraft while also beginning to gradually replace its fourth-generation fighter units in coastal China, namely J-11 and J-10A units, with 4.5 gen aircraft. Central Theater Command (TC) units are predominantly equipped with 3rd generation or older 4th generation aircraft such as J-7 variants, J-11As, or J-10As. The Eastern, Southern, Western, and Northern TCs have all received newer 4.5 and 5th generation aircraft.

[vii] The PLA usually uses different designations for aircraft generations. In this publication we use U.S. numbering conventions.

Figure 9: PLAAF 3rd generation aircraft

Currently, the PLAAF inventory of active third-generation aircraft is largely composed of newer J-7 and J-8 variants, which are a modernized PRC-produced MiG-21 variant and variants of the indigenously developed J-8 interceptor, respectively. These aircraft primarily employ the older PL series of air-to-air missiles, namely the PL-5 and PL-8. Upgraded variants of the J-8 are potentially capable of employing the relatively modern PL-12.

Figure 10: Left to right J-10, J-11, and Su-30MKK 4th-generation aircraft[13]

PLAAF fourth generation aircraft include the J-10A, J-10B, J-11A, and J-11B. These aircraft consist of primarily domestically produced sub systems and are powered by a mix of Russian- and PRC-produced engines. These aircraft are primarily equipped with PL-9 and PL-12 air-to-air missiles (AAM). Additionally, the PRC imported several Su-30MKKs from Russia, which are equipped with a mix of Russian engines and munitions.

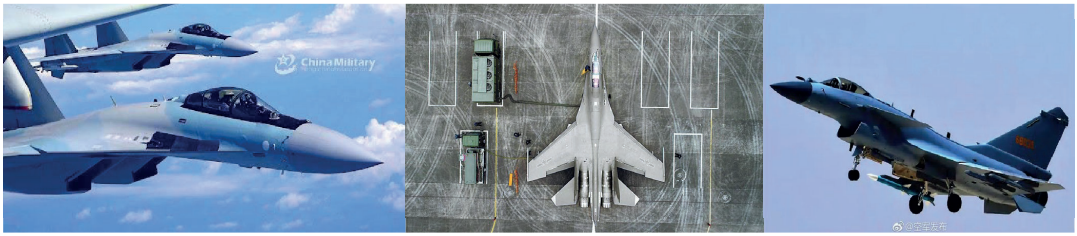

Figure 11: Left to right: Su-35, J-16, and J-10C 4.5th-generation aircraft[14]

PLAAF 4.5 generation aircraft include the domestically produced and powered J-10C and J-16. Additionally, the PRC has imported several Su-35s, which were also imported with Russian munitions. The J-10C and J-16 employ PRC-manufactured weapons such as the PL-10 and PL-15, which outrange their American counterparts, the AIM-9X and the AIM-120 Advanced Medium-Range Air-to-Air Missile (AAMRAAM), and are equipped with a mix of PRC-developed engines and imported AL-31s. The J-10B may also be considered a 4.5 generation aircraft, but is only able to field less capable PL-9s and PL-12s and is equipped with imported Russian engines. In addition to the PL-15, PLAAF 4.5 gen fighters, most notably the J-16 and imported Russian Su-30MKK and Su-35, can also employ the PL-17, an even longer-range radar-guided AAM (approximately 400km) intended to shoot down tankers and AWACS to limit the USAF's ability to project power.

Figure 12: J-20 stealth fighter

The PLAAF currently fields two active versions of its J-20 fifth-generation stealth fighter, the J-20 and the J-20A. The J-20 is equipped with imported Russian engines, while the J-20A is equipped with PRC-manufactured engines. Both are equipped with PL-10 and PL-15 AAMs. Additionally, the PLAAF appears intent on procuring the J-20S, a two-seat variant of the J-20 that incorporates more modern technologies. The PLAAF currently has at least seven aviation brigades operating J-20 variants in varying stages of transition, with at least one additional brigade potentially undergoing transition as of early spring 2024.

Figure 13: JH-7A attack aircraft[15]

The JH-7 and JH-7A are PRC produced dedicated attack aircraft, powered by licensed produced Rolls-Royce Spey Mk 202 engines. They can employ anti-ship cruise missiles, land attack cruise missiles, anti-radiation missiles, as well as laser-guided bombs, and other PGMs. With the adoption of 4.5 generation aircraft that are strike capable, the PLAAF now has additional multirole aircraft that are capable of supplementing its aging attack aircraft's strike function.

Figure 14: H-6K bomber[16]

The PLAAF currently fields a variety of H-6 variants, ranging from the older M variants, which have mostly been converted to trainers, to newer K variants. Older variants of the H-6 more closely resemble the Tu-16 design on which the aircraft is based, while the newer variants have redesigned wing roots, modern sensors and avionics, removed bomb bays, and can carry up to six cruise missiles as opposed to the four of the older variants such as the H-6M.

Figure 15: Top: (left to right) KJ-2000, KJ-200, and KJ-500 AEW&C aircraft; Bottom: Y-20 transport aircraft[17]

PLAAF special mission aircraft are primarily airborne early warning and control platforms, tanker aircraft, and electronic intelligence gathering aircraft. AEW&C aircraft include the KJ-2000, KJ-200, and the KJ-500. Additionally, the PLAAF fields electronic intelligence (ELINT) variants such as the Y-8CB. The PLAAF also fields dedicated standoff jammer aircraft, the older GX-3 and newer GX-11, which are based on the Y-8 and Y-9 airframes. In addition to these larger platforms, the PLAAF has begun procurement of the J-16D, a dedicated escort jammer. As of early 2024, the PLAAF has fielded around 35 tankers, a mix of Y-6Us, and Y-20Us.

Current Forces - Uncrewed Aircraft Systems

The PLAAF maintains several units that operate an array of unmanned aircraft systems (UAS) that vary in size, range, and mission type. PLAAF-operated systems include high-altitude long-endurance systems like the WZ-7 and WZ-10; medium-altitude long-endurance systems like the BZK-005, GJ-1, and GJ-2; and some longer-range systems. UAS are used for surveillance and reconnaissance, testing and training, targeting and battle damage assessment (BDA), logistics, data relay and communications support, and information operations, including suppression of enemy air defenses. The PLAAF has also begun fielding more systems capable of conducting what PLA academics refer to as “integrated reconnaissance and strike” and has begun actively experimenting with manned-unmanned teaming (MUMT).

Current Forces - SAM Systems

Figure 16: HQ-9 mobile SAM system[18]

Having transitioned its legacy AAA to the reserves, the PLAAF ground air defense branch is composed of a variety of modern SAM systems. On the indigenous side, the Chinese HQ-9B features mid- to long-range missiles with active radar-homing capability with ranges of around 250km. China also maintains a smaller inventory of imported Russian systems, including the S-300PMU2 and S-400. These Russian systems are believed to be primarily operated by units based in the Eastern, Northern, and Central Theater Commands, with a focus on the areas around and approaches to Beijing. The Beijing area has the highest concentration of fixed SAM sites.

Force Employment

Layered Air Defense and Offense

PLA military thought increasingly advocates a proactive approach to air defense, 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 to conduct air operations. PLAAF planning appears to give special priority to protecting the Beijing region, as well as coastal areas, from enemy air attacks. As currently conceived, air defense campaigns are typically organized geographically and employ layered defenses of fighter-interceptor aircraft, as well as long- and shorter-range SAM systems to provide defense in-depth. 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. Such a campaign can occur either independently or jointly as part of a larger military operation.

Combined Offensive Strike

PLAAF standoff strike capabilities have matured to a point where they would be an integral part of a joint firepower strike against an enemy surface formation or ground targets. By combining PLAAF air-launched cruise missiles with PLARF ballistic missiles, a joint strike becomes much harder for missile defenses to successfully intercept. With the reorganization of PLA Navy shore-based fixed-wing attack and bomber aircraft under the PLAAF, the PLAAF now holds the majority of fixed-wing aircraft capable of conducting anti-ship strikes from the air domain, and all of the long-range bombers that will contribute kinetic capabilities to a multi-domain joint fire strike against surface combatants, placing further stress on shipborne missile defense capabilities.

Airborne Campaign[viii]

PLAAF airborne campaigns seek to parachute troops behind enemy lines, either in support of joint operations or on independent missions. Once inserted, airborne forces could be directed to sabotage key enemy military and economic infrastructure, cut off enemy front lines from support or reserve forces, or seize other key infrastructure such as airfields. PLA "doctrine" seems to recognize that these campaigns can be extremely difficult to carry out successfully. Airborne campaigns would require the PLAAF to conduct 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.

Examples of Force Employment

A notional example of a PLAAF assault on targets on Taiwan would involve a mix of supporting intelligence, surveillance, and reconnaissance (ISR) and standoff jammers, air cover formations, and an assault force. Prior to this notional operation, PLARF fires would likely be used to degrade enemy-integrated air defenses and command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities to prepare the battle space for a PLAAF follow-on operation. The first line of an assault formation would be assault and cover formations of multirole aircraft covering the northern, central, and southern portions of the assault formation. Standoff jammers and potentially unmanned ISR platforms would be meshed into this frontline cover formation to provide ISR and EW support to the formation. Behind this cover force are Airborne ISR and EW platforms that are more critical to managing awareness of the battle space and coordinating operations within the area of operation (AO) such as AEW&C platforms. In the rear of the formation will be separate bomber assault groups that will launch standoff munitions, or if enemy air defense has been sufficiently destroyed, drop dumb bombs. Prior to this notional assault, the PLAAF will seek to secure information superiority by coordinating its own efforts with that of the Information Support Force, and perhaps the Cyberspace Force. Additionally, the PLAAF may choose to operate after preparatory fires are complete.

[viii] In the PLA, airborne forces/troops are in the PLAAF, unlike in the U.S. military where the troops are in the army with the USAF providing air lift only.

Training Priorities

Overall Priorities

The PLAAF's training regime has increased in tempo and adjusted to incorporate more training to employ the capabilities it has been seeking to acquire through its modernization campaign. In its routine training, the PLAAF has begun to prioritize training for long-range offensive strike, maritime strike missions, joint air defense, electronic warfare, and the sustainment of combat operations. Joint air defense training typically consists of SAM units from the different services working with radar units from different services to pass target information or track targets between different areas covered by the PLAAF and the PLAN.

Since 2015, the PLAAF has been undertaking longer-range bomber flights and maritime strike training into the Western Pacific and has begun conducting this training with fighter escorts. Given the PLAAF's counter intervention mission, this training is increasing in frequency. Similar to its efforts at improving maritime strike, PLAAF units have also been increasingly training to conduct long-range strikes. This can take the form of H-6 formations practicing simulated strikes on Guam, or strike capable multi role fighters or fighter-bombers flying trans-regional flights within the PRC to conduct simulated or live-munition strikes on training ranges.

The PLAAF has also begun training more frequently to employ EW assets in escort jamming and SEAD/DEAD capacities as well as training under contested electromagnetic conditions, especially during national training exercises. However, the ease with which the PLA can close off airspace and the electromagnetic spectrum for routine training allows the PLAAF to more frequently train to operate in a contested electromagnetic environment.[ix]

The PLAAF has long training with out-of-garrison operations, but more recently, it has also begun experimenting with various methods of sustaining operations out of garrison for longer periods. This has taken the form of testing the mobility and performance of smaller emergency support detachments from aviation brigade maintenance squadrons or slightly larger support units composed of both maintenance squadron and airfield station personnel. These groups have conducted limited training in attempts to generate estimates of the minimum sustainment needs of distributed operations and maximize the speed at which aviation support can be provided to disbursed units.

National Training Exercises

The PLAAF has continually improved its training exercises to better integrate its modern capabilities into its capacity to conduct operations. There are five major annual training events and competitions that best represent the PLAAF's contemporary training focus.

The exercises are Red Sword, Blue Shield, Golden Helmet, Golden Dart, and Qingdian.[x] Red Sword, the PLAAF's largest exercise in terms of participating units, is a force-wide exercise roughly similar to the U.S. Air Force's Red Flag. Blue Shield is an exercise designed to test the

[ix] In China, the PLA controls all of the airspace and grants it back to commercial airlines, while in the U.S. the civil Federal Aviation Administration (FAA) controls the airspace and grants portions back to the military.
[x] Qingdian has no official English translation, but we like to refer to it as Optimus Lightning.

capabilities of the PLAAF's ground-based air defense forces, specifically SAMs and supporting radar and information systems. The Golden Helmet competition is an air-to-air combat competition designed to improve and assess pilots' skills and capabilities in combat conditions. The Golden Dart competition focuses on air-to-ground attack by attack and bomber aircraft. The newest annual exercise, Qingdian, focuses on electronic warfare.

These exercises and competitions have grown increasingly complex, and now integrate a wide range of PLAAF assets. For example, Red Sword has begun integrating airborne forces, along with 5th generation aircraft, standoff and escort jamming, as well as airborne early warning capabilities. Additionally, joint and integrated air defense exercises are becoming more prevalent. This is exemplified by air defense units and radar units from different services passing target data to each other.

Organization and Command & Control

The PLAAF is organized into five theater air forces with radar, SAM, and fighter aviation brigades falling under Theater Command Air Force (TCAF) subordinate air defense Bases.[xi] Due to their operational nature and small numbers, others aircraft and units such as transport, bombers, and special mission aviation units are directly aligned under TCAFs. While air defense Bases are primarily responsible for air defense in their area of responsibility, major offensive strike and joint fires capabilities are subordinate to TCAFs. From a command perspective, the PLAAF, while historically reliant on ground-based commanders, is pushing primary command authorities into airborne command posts, be that command posts aboard AEW&C aircraft, or individual flight commanders in combat aircraft. Despite this, secondary command posts remain on the ground.

Air Defense Bases

In late 2011, the PLAAF abolished at least four air-division headquarters and created four Bases, namely the Dalian, Nanning, Shanghai, and Urumqi Bases. These Bases became Air Defense Bases in 2017. The PLAAF upgraded about 15 regiments to brigades and subordinated them under the four Bases. Each Base is responsible for C2 of the aviation brigades, SAM, and radar units in their area of responsibility (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 migrated the rest of its tactical air fleet into a brigade structure by converting its remaining fighter and fighter-bomber units into brigades. The PLAAF also abolished the relevant air division headquarters and created at least seven Bases from existing Command Posts and two former MRAF HQs. 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. Beginning in late 2017, at least two of the bases, Lhasa and Fuzhou, were renamed air defense Bases. 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.

[xi] In the PLA, a Base (with a capital B) is a standing organizational structure, which may include one or more physical locations, also known as a base (with a small b). This publication uses "Base" to denote the organizational structures and "base," or garrison, to denote a specific military geographic location.

Aviation Unit Organization

As mentioned earlier, the largest fighter unit formation in the PLAAF is called a "brigade." This formation has a similar number of aircraft as a U.S. Air Force fighter squadron, 24 to 36, but it also possesses its own support units that in the USAF would be subordinate to an aircraft group. A PLAAF aviation brigade consists of three USAF flight equivalents, a maintenance flight equivalent, a repair shop, and a unit that manages the physical airfield infrastructure called an "airfield station." The previously mentioned "flight equivalents" are battalion-level organizations and are called "flight groups" in the PLAAF and each group has roughly eight to ten airframes divided into two company-level "flight detachments," which they call "squadrons," so the nomenclature between the Mandarin and the English can be confusing. A similar structure exists for transport and special mission aircraft, however the largest formation for these units is a division. PLAAF divisions are slightly larger than a PLAAF brigade in terms of both personal and aircraft and maintain a similar structure of subordinate units. PLAAF divisions have subordinate flight regiments, maintenance elements, and airfield stations. PLAAF divisions are analogous to USAF groups. On average, each aviation unit, be that an aviation brigade or regiment, maintains a pilot-to-aircraft seat ratio of somewhere between 1.2 for fighter units and 1.5 for bomber and special mission aircraft units.

Airborne Branch

Figure 17: PLAAF paratroopers[19]

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 airborne units themselves. 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. The Airborne Corps is a corps leader-grade command[xii] and it

[xii] This is loosely analogous to a two-star command in the U.S. system.

oversees a force of six combined arms airborne brigades, an airborne special operations brigade, and a fixed-wing transport brigade. This one transport brigade serves predominantly to provide an organic lift capability for training purposes and some limited operations, with other PLAAF transport divisions providing the bulk of airlift for the Airborne Corps.

Radar Branch

Figure 18: PLAAF fixed radar[20]

When radar troops were first integrated into the PLAAF in 1950, they were charged with providing early warning capabilities for air defense. Today, the PLAAF has three basic types of radar sites. The first type is located at airfields and used primarily for air traffic control and for senior officers in the control tower to vector pilots towards their targets. The second type consists of radars located in key areas for long- and medium-range detection along China's borders. Most of these radars are located on mountaintops. The third type consists of over-the-horizon radars stationed near China's coastline that are used for early warning. Besides over-the-horizon, the PLAAF's aviation and SAM units have radars that are indigenous to those units and are considered specialized units.

Surface-to-Air Missile (SAM) Branch

The PLAAF maintains a SAM Branch that operates SAM brigades throughout the PRC. SAM brigades maintain subordinate battalions. SAM units have radar and technical support units. SAM units train to operate from both fixed sites as well as from dispersed locations. A battalion of HQ-9 SAM systems typically consists of eight launchers and associated support vehicles, but the size of the unit largely depends on the type of system it employs. SAM brigades are garrisoned mainly in urban areas, with fixed sites near key installations such as airfields.

Specialized Units

In addition to the five combat branches described above, the PLAAF also maintains specialized units for communications and chemical defense (as well as certain types of radar units discussed above). Communications troops perform functions related to communications, navigation, and automated command support to the PLAAF. Chemical defense troops, which

include nuclear, biological, and chemical defense, are charged with decontaminating PLAAF locations or assets affected by not only chemical but also radiological weapons. The PLAAF also has its own subordinate engineering units responsible for constructing and repairing airfields.

Leadership and Personnel

Leadership

Figure 19: Chang Dingqiu[21]

The PLAAF leadership structure is dominated by fighter pilots, especially command staff from the TCAF Deputy Commander level on up. Other pilots such as transport and bomber pilots traditionally top out as division leader-grade officers, while other officers such as radar branch officers can only top out as brigade leader-grade officers.

The current commander of the PLAAF, General Chang Dingqiu, is the youngest general to assume command of the PLAAF. His career experience heralds a change in the force. Not only is Chang the first 4th generation aircraft pilot to command the PLAAF, but he also has the most joint command experience. This joint experience includes serving in the CMC Joint Staff Department and as a deputy commander of the Southern Theater Command. In addition to his more modern career experience, Chang is also a proponent of modernizing the PLAAF's pilot training regime as well as providing more comprehensive care to pilots, such as mental health services, to improve performance.

NCO Corps and Education

The PLAAF recruits non-commissioned officers (NCOs) either from candidate pools of highly skilled civilians or promotes them out of the ranks of two-year conscripts.[xiii] While it has always been reliant on a core of NCOs, the NCO corps began to expand in 2009 as part of an intentional program to shift the enlisted force to be predominantly composed of NCOs instead of conscripts. Depending on their specialty, NCOs can receive formal training at one of the PLAAF's universities or academies that have a specific NCO program. For example, the PLAAF Engineering University has an NCO program. However, only one PLAAF institution is dedicated to educating NCOs: the PLAAF Communications NCO Academy. Ultimately, many of these NCOs will already have or will earn a college-level degree, although frequently this degree will be equivalent to a three-year degree similar to an associate's degree in the United States.

Officer Education

Officer education is primarily conducted by the five undergraduate academic institutions that provide the bulk of the PLAAF's officers. Those institutions are the PLAAF Engineering University, Aviation University, Early Warning Academy, Medical University, and Service College. Most of these officers will receive degrees in a STEM-related field, with a growing emphasis on fields relevant to information technologies.

Once an officer commissions into the PLAAF, they will periodically return to one of these institutions to receive a graduate degree in their specialty. However, if they are what is called a "commanding officer," which means anyone who has any leadership position, they return to the PLAAF's Command College in Beijing for mid-level professional military education and receive only a certificate. At the more senior levels, PLAAF officers will attend the PLA's National Defense University (NDU) for additional joint professional military education, where they also receive only a certificate.

[xiii] In the PLA, all junior enlisted members are referred to as "conscripts" even if they join voluntarily.

PLA Naval Aviation

Overview

The PLA Navy (PLAN) has used a variety of aircraft and other aerospace-related forces to support coastal defense and gradually venture further from shore to pursue strategies of "near seas defense"[xiv] and "far seas protection" of China's interests. As PLAN vessels have traveled further from China's shore-based defenses, they have become increasingly reliant on aviation forces for situational awareness and defense.[22] This chapter will focus on PLAN aerospace-related forces, such as fixed and rotary wing aircraft, aircraft carriers, and air defenses. Most PLAN forces fall under one of the three Theater Command Navies (TCN) in the PLA's main coastal TCs (Eastern, Southern, and Northern).

History

From the PRC's founding in 1949 until the mid-1980s, China's strategic concept for PLAN operations was limited to "coastal defense," which emphasized protecting China's coast from amphibious invasion, presumably by Taiwan and U.S. forces.[23] The PLAN created a Naval Aviation Branch in 1952 to incorporate aviation forces into this strategy.[24] During the Vietnam War, PLAN aviation forces were tasked with defending PRC airspace and engaged U.S. aircraft when they intruded on that airspace.[25] PLAN bombers and fighters also reportedly participated in air assault and escort missions during the 1955 Battle of Yijiangshan Islands in the first Taiwan Strait Crisis. PLAN officers consider these successful island seizures an early example of joint operations.[26]

Beginning in the late-1980s, the PLAN established a strategy of "near seas defense," which focused on regional goals and deterring a modern adversary from intervening in a regional conflict.[27] Near seas defense is often associated with operations in the Yellow Sea, East China Sea, and South China Sea. As this strategy developed, PLAN aviation forces gradually improved their ability to operate over water in some of these areas to offer limited support to surface vessels. By the late 1990s, PLAN aircraft began to fly sorties over the Taiwan Strait. PLAN aviation forces, along with the PLAAF, began flying frequent sorties across the Taiwan median line and into Taiwan's ADIZ, between Taiwan and Pratas (Dongsha) Islands in the South China Sea, in February 2020.[28]

In the 2010s, the PLAN expanded its naval strategy to "near seas defense and far seas protection" to reflect and emphasize its already increasing reach. As its surface vessels reached further from China's shores, so did its aviation forces. In 2013 and 2014, PLAN bombers and anti-submarine warfare (ASW) aircraft conducted their first flights into the Western Pacific through the Miyako Strait and Bashi Channel. China's first aircraft carrier, commissioned in 2012, signaled a new age for PLAN aviation, heralding the transition from an almost exclusively land-based force to one with a sea-based component.[29] The PLAN has actively expanded this component with a second carrier commissioned in 2019 and a third launched in 2022, rapidly strengthening its ability to project air power into the far seas.[30]

[xiv] The term "near seas defense" is also translated as "offshore defense."

Some official sources within the PLAN indicate the service may transition to a new strategy of "near seas defense, far seas protection, oceanic presence, and expansion into the two poles" by 2030, but the PLAN has not publicly announced or acknowledged the change as of early 2024.[31] If pursued, such a strategy may entail more significant change for the PLAN's surface fleet, but its shipborne aviation component would also be key to the effort. Indeed, the PLAN's transfer of most shore-based aircraft to the PLAAF in 2023[xv] may allow it to focus on developing shipborne aviation, and particularly on its carrier-borne fleet.[32]

Missions

The PLA has broadly described PLAN aviation missions as maritime airspace protection and support of surface ship operations in coastal and maritime areas.[33] However, PLAN aviation would likely be expected to play a role in several of the strategic missions associated with the PLAN as a whole, such as various Taiwan-related scenarios, coastal defense, and protecting maritime sovereignty, including in disputed areas in the East and South China Seas.[34] The PLAN is expected to be prepared for a variety of Taiwan-related scenarios, from simply deterring Taiwanese moves toward independence to large-scale invasion. In an invasion and occupation contingency, carrier-based PLAN aviation forces could be involved in firepower strikes, blockade establishment and enforcement, and countering intervention from third parties such as the U.S. The PLAN has continued to develop its maritime strike and anti-submarine warfare (ASW) capabilities, which would be expected to play a role in the coastal defense and potentially the maritime sovereignty mission. As the PLAN pushes its aircraft carriers further from shore and becomes increasingly comfortable operating from its airfields in the South China Sea, PLAN aviation could conceivably expand involvement in other PLAN missions, such as protecting sea lines of communication (SLOCs) and perhaps even the PRC's overseas interests.

Figure 20: PLAN Yushen landing helicopter assault ship (LHA)

Modernization Priorities

As part of recent initiatives for broader PLAN modernization,[35] PLAN aviation has benefited from many developments, with much priority given to carriers, carrier-based aircraft, and air defense.

In 2022, China launched its third aircraft carrier, the *Fujian*.[36] This carrier is being outfitted as of early 2024 and may still be on track to enter PLAN service in 2024. The *Fujian* features an electromagnetic catapult launch system, which should allow it to operate with various types of fixed-wing aircraft for missions such as airborne early warning (AEW) and EW.[37] This is an

[xv] See "2023 PLA Naval Aviation Reorganization" section below.

improvement from China's first two carriers, whose ski-jump configuration has thus far limited them to operating with only J-15 fighters.[38]

The PLAN is also working to improve and expand its contingent of carrier-based aircraft. This includes upgraded versions of its carrier-based J-15 fighter, including modifications for catapult takeoff and a version designed for electronic warfare (EW).[39] While China's first two carriers have thus far operated with only the J-15, the *Fujian* and future catapult-enabled carriers should be able to support KJ-600 AEW aircraft and an upcoming carrier-based version of the FC-31[xvi] stealth fighter.[40]

In recent years, the PLAN has also focused on improving air defense for its surface fleet. Newer ships, such as the Luyang-III class destroyer and Renhai class cruiser "feature modern combat management systems and air surveillance systems such as the Sea Eagle and Dragon Eye phased-array radars."[41] These systems allow one or two vessels to provide air defense for an entire task group, enabling surface forces to more safely operate outside of shore-based air defenses. These vessels also feature vertical launch cells that increase the number and variety of missiles available for air defense and other PLAN missions.

Forces

2023 PLA Naval Aviation Reorganization[42]

In 2023, the PLA transferred a majority of PLAN aviation units to the PLAAF, including most of its land-based fighter, bomber, radar, and air defense units as well as some airfield units. This wholesale transfer of units, personnel, equipment, and facilities marked a major shift in the PLAN's aerospace force makeup, paring its fixed-wing component to mainly carrier-based fighters, special mission aircraft, and unmanned aerial vehicle UAVs. It also maintains its helicopter units, several aviation training units, headquarters aviation elements, and select airfield stations. Neither the PLA nor PLAN have explicitly explained this major reorganization, but a major factor may have been allowing (or forcing) the PLAN to focus more on building a mature carrier-based aviation force.

This reorganization has significant implications for the PLA operations. The PLAN's loss of significant maritime strike platforms will require it to leverage joint partners for those capabilities. This may put more stress on the theater joint command system, but also likely indicates the PLA's growing trust in that system. The transfer of H-6 bomber variants and JH-7 fighter-bombers aircraft also stripped the PLAN of most of its aerial minelaying capability, although it retains a growing fleet of KQ-200 ASW aircraft that train in minelaying. It is not yet clear whether the PLAAF will integrate minelaying into its H-6 or JH-7 training.

The PLA's transfer of all PLAN ground-based air defense and radar units to the PLAAF also unified regional air defense under theater command air forces. Most regional air defense was already handled by PLAAF units prior to 2023, but PLAN units appeared to be responsible for limited areas in the Eastern and Southern TCs. By aligning all of those capabilities under theater

[xvi] Many outlets use the unconfirmed designator "J-35" to refer to the carrier-based variant developed from FC-31 demonstrators, mostly to distinguish it from those FC-31 demonstrators and a land-based variant potentially under development.

command air forces, the PLA simplified air defense responsibility and may have minimized the potential for problems handing targets off between service components.

Special Mission Aircraft and Unmanned Aerial Vehicles

The PLAN retained its ground-based special mission aircraft and UAV units after the 2023 reorganization. The PLAN continues to operate a variety of special mission aircraft for activities such as maritime patrol (MP), AEW&C, surveillance, and ASW. Many of these have been modifications of the Y-8, a Chinese license-produced version of the ex-Soviet An-12 Cub.[43] In recent years, they have been joined by various modifications to the newer Y-9. Notable examples of these special mission aircraft are the KQ-200 and the KJ-500.

The KQ-200, also known as the Y-8Q, Y-9Q, or GX-6, is a maritime patrol/ASW variant that has been consistently observed monitoring maritime chokepoints in the South China Sea.[44] The PLAN received the first of these aircraft as early as 2015,[45] and by 2023, over 20 appear to be fielded across all three theater command naval components.[46] The KQ-200 provides the PLAN with higher speeds, longer ranges/endurance, and greater capacity for ASW equipment and crew compared to rotary-wing ASW platforms. It can reportedly reach speeds of up to 600 km/h, operate for eight-plus hours, and has a range of about 5,000 km.[47] The KQ-200's key ASW components include a surface search radar, a large magnetic anomaly detector (MAD) in the tail, sonobuoy system, and an electro-optical turret.[48]

The KJ-500 is based on the Y-9 airframe and is the PRC's most advanced AEW&C aircraft. It features a stationary dorsal radome that provides 360 degrees of coverage[49] and a variety of antennae to enable its airborne control mission, likely via voice and datalink.[50] At least one prototype seen at a PLAN operational unit has been fitted with an aerial refueling probe, which would allow it to provide more persistent coverage.[51] These and other special mission variants provide PLAN combatants an increasingly clear and persistent picture of the surface and air environment at progressively greater ranges.

Figure 21: KJ-500 AEW&C aircraft

To supplement these manned aircraft, the PLAN has developed, tested, and operated a variety of UAVs for ISR missions. The PLAN has tested various smaller vertical take-off and landing (VTOL) UAVs such as the SD-40, CSC-005, S-100 Camcopter, and AV-500 from various surface combatants.[52] The PRC also operates fixed-wing medium to large size UAVs from land bases, including the high-altitude long-endurance Xianglong and medium-altitude long-endurance BZK-005.[53] These fixed-wing platforms have deployed to a variety of locations, including PLAN-operated facilities in the South China Sea.[54]

Aircraft Carrier Program

The PLAN is committed to developing a multi-carrier force, and as of mid-2024 has two commissioned and one outfitting. The first carrier is a Soviet Kuznetzov class purchased from Ukraine and then rebuilt and commissioned into the PLAN as the *Liaoning* (CV-16) in 2012. This vessel spent most of 2023 being refurbished and reportedly embarked for sea trials in February 2024.[55] A second carrier, the *Shandong* (CV-17), is a domestically produced variant akin to the *Liaoning* that was commissioned in 2019. These carriers utilize a ski-jump configuration for aircraft takeoff, which restricts takeoff weight, limiting ordnance loads, and preventing them from operating with larger specialized support aircraft.[56]

The PLAN launched its third aircraft carrier, the *Fujian*, in 2022. This carrier features a catapult launch system that should make it capable of operating with various types of specialized fixed-wing aircraft for missions such as AEW and EW. As of mid-2024, outfitting on the *Fujian* continues and it may still be on track to commission in 2024.

The Shenyang J-15 fighter is currently the only fixed-wing aircraft operating with China's carriers. 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, a strengthened landing gear, a tailhook under a shortened tail stinger, a two-piece slotted flaps, canards, and a retractable in-flight refueling probe on the left side of the nose.[57] Ski-jump takeoff likely limits ordnance or fuel loads on these fighters, but the PLAN also appears to be developing a catapult-capable variant known as the J-15T for use on its future carriers.[58,59] Another variant, the J-15D, is a dedicated EW version equipped with wingtip electronic support measures / electronic intelligence gathering pods and several conformal antennas.[60]

Figure 22: J-15 fighter ski-jump takeoff from the Shandong

The PLAN is also pursuing development of a carrier-capable fifth-generation stealth fighter[61] developed from earlier FC-31 demonstrators.[62] Prototypes of this FC-31-based carrier-capable variant featured modifications for catapult-assisted takeoff, indicating they were designed with the PLAN's future carriers in mind.[63] The PLAN has not specified whether it will also operate from the its ski-jump carriers, but in February 2024, the aircraft carrier *Liaoning* embarked after refurbishment with what appeared to be a full-scale model on deck, indicating it may be planning to operate it from that vessel at least.[64]

The PLAN is also developing a carrier-based AEW&C aircraft, the KJ-600, which is reportedly similar to the U.S. E-2 Hawkeye. The KJ-600 will likely be limited to only newer catapult-enabled carriers,[65] but will be a significant improvement over the current carriers' reliance on shorter-range rotary-wing AEW platforms.[66]

Helicopters[67]

The PLAN operates three main helicopter variants: the domestically produced Z-9 and Z-8/Z-18 as well as the Russian-built Helix (both Ka-28 and Ka-31). 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 as the Z-9C. The Z-9C is capable of operating from any helicopter-capable PLAN combatant.

Figure 23: PLAN Z-9C helicopter ASW variant with dipping sonar

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. The Z-18 is similar in dimensions to the Z-8 and 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, although in recent years the PLAN has expanded those options by introducing Yushen amphibious assault ships (also referred to LHAs) and Renhai guided-missile cruisers (CGs).[68]

Variants of the Helix were the first 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 Ka-27PS Helix-Ds. An additional nine Helix-As have been delivered, and all 17 are operational. As with the Russian-origin Ka-27s, the imported Ka-28s can perform several mission sets but are usually used for ASW. The Ka-27PSs are optimized for search and rescue (SAR) and logistic support missions. The Ka-28 is fitted with search radar, and dipping sonar, and can employ sonobuoys, a towed MAD,[69] 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-31have provided the PLAN with a serviceable sea-based AEW capability to help fill this critical gap until newer catapult-equipped aircraft carriers and catapult-capable fixed-wing AEW aircraft like the KJ-600 enter service.

The PLAN is also developing naval variants of the multi-role Harbin Z-20, such as the ASW-focused Z-20F. This variant will provide the PLAN with an indigenous helicopter that is small enough to be compatible with most helicopter-capable surface combatants (unlike the Z-18) but large enough to employ more significant ASW capabilities than the Ka-28. The Z-20F will be used on the PLAN's Renhai cruisers, Luyang-III destroyers, and possibly its growing fleet of Yushen LHAs.[70] Four of these LHAs have been completed since 2019, each reportedly capable of

carrying an aviation component of up to 30 helicopters, 900 troops with heavy equipment, and landing craft.[71]

Surface Air Defenses and Electronic Countermeasures

The PLA divested the PLAN of any regional air defense responsibility in 2023 when it transferred PLAN ground-based radar and air defense units to the PLAAF. However, the PLAN's fleet of large surface combatants will still likely play a significant role in the PLA's larger integrated air defense system. Large combatants like Luyang destroyers and Renhai cruisers have multipurpose vertical launch systems (64 and 112 cells, respectively) that can launch a variety of missiles, including SAM varieties.[72]

A naval variant of the HQ-9 SAM known as the HHQ-9 is fielded by the PLAN's larger and more advanced surface vessels, likely with similar ranges of about 250km. These combatants feature modern combat management systems and air surveillance systems such as the Sea Eagle and Dragon Eye phased-array radars.[73] These systems allow one or two vessels to provide air defense for an entire task group, allowing surface forces to more safely operate outside of shore-based air defenses.

In addition to airborne and shipborne self-protection jammers, the PLAN also operates electronic countermeasures (ECM) brigades in each of its three TCNs. PLA reporting has highlighted these brigades training with various ground-based mobile equipment to track and jam simulated "enemy" aircraft and counter missiles.[74] Although public information on ECM and EW equipment is limited, these are presumed to be modern EW systems capable of targeting large portions of the electromagnetic spectrum.

Force Employment

General Warfighting Concepts

PLAN aerospace forces play a role in both aspects of the PLAN's "Near Seas Defense and Far Seas Protection" strategy. PLAN special mission aircraft act as key information enablers integrated into overall efforts for anti-access and area denial (A2/AD) in China's near seas. PLAN ASW variants have been consistently observed monitoring key maritime chokepoints as the PLAN pursues undersea superiority within the first island chain.[75]

As the PLAN further develops its aircraft carrier force and operating concepts, carrier formations and their aviation forces will be central to its ability to project power into far seas. The carrier *Liaoning* has led formations outside the first island chain,[76] and in 2023 the *Shandong* deployed into the Western Pacific at least three times, including for a training exercise in the Philippine Sea during which it deployed J-15 fighters into Taiwan's ADIZ.[77,78] As noted above, future catapult-equipped carriers will provide carrier formations with better options for AEW&C, ASW, and more advanced fighters. During wartime, well-equipped and coordinated carrier formations could help the PLAN counter adversary interdiction of its key sea lines of communication (SLOC) and potentially be a component of strikes on high-value targets inside the adversary's "strategic depth."[79]

Training Priorities

PLAN aviation training priorities have generally aligned with the warfighting concepts described above. Much focus is given to carrier training, and the two current carriers have frequently conducted simultaneous but separate drills. In late 2021, the *Liaoning* conducted a replenishment exercise in the Western Pacific with one of the PLAN's new Fuyu fast combat support ships (also referred to as Auxiliary, Oil, Explosives, or AOEs), which were built specifically to support extended aircraft carrier operations.[80,81]

Figure 24: Liaoning *aircraft carrier replenishment*

Although the PLAN continues to emphasize joint operations and PLA media has highlighted examples of coordinated training between PLAAF and PLAN aircraft, such training still appears to be somewhat rare. However, the 2023 reorganization likely had some impact on this joint training. First, much of it would no longer be considered joint at all with nearly all land-based fighters and bombers aligned under the PLAAF exclusively. On the other hand, joint information sharing may have been improved, as PLAN aviation's land-based component now consists exclusively of information enablers that had previously supported units that are now transferred to the PLAAF. That formerly single-service support would now be joint and those existing processes and relationships could help institutionalize more joint information sharing.

Organization and Command & Control

Operational and administrative control of PLAN aviation forces lies with the three TCNs (Eastern, Southern, and Northern), each of which maintains its own corps leader-grade naval aviation headquarters. Within each TCN aviation headquarters are subordinate aviation divisions, brigades, and regiments.

Most fixed-wing combat aircraft (although greatly reduced in number in 2023) are assigned to aviation brigades, which in turn have subordinate flight groups. Helicopters and UAVs are assigned to independent air regiments that appear to report directly to the TCN aviation HQ. Special mission aircraft are organized into regiments subordinate to naval aviation divisions within each TCN.[82] At each level, support organizations subordinate to the divisions, brigades, and regiments exist to provide aircraft maintenance and support. Within each theater navy, several regiment-grade airfield stations provide basic airfield services to home-based and visiting aircraft.

PLAN aircraft carriers are division leader-grade organizations subordinate to corps-level aircraft carrier task groups, which in turn are directly subordinate to their respective TCN HQs. As of early 2024, the carrier *Liaoning* falls under the Northern TCN, while the *Shandong* is under the Southern TCN. Shipboard aircraft are assigned to an element subordinate to the task group to which their ship is assigned. For carriers, this is probably a regiment-sized element consisting of

both fighters and helicopters subordinate to the carrier task group. For other formations operating with helicopters, the aviation element would be subordinate to the task group command post.

Operational control of PLAN surface forces and associated aviation elements can be adapted as needed. Most large combatants (aside from carriers) are administratively assigned to division-level Flotillas.[xvii] However, the TCN may assign operational control of individual vessels (and their aviation elements) to task groups as required by mission needs.

PLAN Marine Corps Aviation[83]

The PLAN also maintains a subordinate Marine Corps (PLANMC) with an aviation component. While previously the PLANMC had to rely on other parts of the PLAN for the use of helicopter assets, it now boasts its own 7th Aviation Brigade, which the PLAN established in 2017.[84] The PLAN expects these aviation forces to support vertical landing operations into the adversary's depth. Its pilots appear to be a mix of former PLAA helicopter pilots transferred to shipborne operations and PLANMC cadets who graduated from the Army Aviation College. The PLANMC has been equipped with a limited number of Z-8 and Z-9 helicopters, likely transferred from the PLAN, and has begun training with PLANMC air assault capable units. Other helicopter types could join the force in the future. The brigade contains at least two flight squadrons and an aircraft maintenance group but will gradually grow as more helicopters and pilots are delivered. These may include the Z-20 medium lift helicopter to provide a flexible multi-mission platform and the Z-10 for close air support. PLANMC pilots have been observed training with a PLAN Yuzhao amphibious transport dock (also referred to as a landing platform dock, or LPD) in day and night operations, including nighttime hot refueling. The PLAN's new Yushen LHAs are also expected to be essential platforms for PLANMC air assault and vertical landing operations.

Initial and Professional Military Training

Initial Training of Naval Aviators

Most PLAN aviators attend the PLAN Naval Aviation University [85] (NAU) for undergraduate education and training, and all receive NAU flight training. The pipeline for naval aviators has changed several times, but generally consists of three years of academic theory with the subsequent three years being mostly dedicated to flight training.[86]

A major source of NAU cadets is the Naval Teenagers Aviation School program, which provides early aeronautical classes to students in 14 high schools nationwide.[87] In 2021, 38.6% of NAU-admitted pilot candidates came from the Naval Teenagers Aviation School (NTAS) program.[88] A select few NAU cadets participate in a dual-enrollment program (DEP) and receive three years of academic training at civilian universities, followed by two years of aviation theory and flight training at NAU.[89]

In 2023, the PLAN further broadened its recruitment pool for naval aviation student pilots to include civilian university graduates for the first time and invited applications from both men and women.[90] Upon selection, these student pilots would complete two months of initial entry

[xvii] Like the term "Base" in the PLAAF, the term "Flotilla" in the PLA is a standing organization which may, or may not, have actual ships assigned to it.

training and then 3-4 years of aviation theory study and flight training in initial trainer, intermediate/advanced trainers, and combat aircraft transition training. This initiative may indicate that the PLAN was having trouble developing enough qualified pilots with previous pipelines and is especially interesting given its launch precisely as the PLAN was losing many of its aircraft to the PLAAF.

Training for Carrier-borne Fighter Pilots

The PLAN especially emphasizes training for its carrier-borne fighter pilots. Carrier-borne fighter pilots were once mainly sourced from seasoned pilots in PLAN units, but in 2020, the PLAN began recruiting high school students as cadets bound for these aircraft.[91] After completing their bachelor's degrees, these cadets complete land-based flight instruction and then transition to carrier-based training.[92] During flight instruction, the student-to-instructor ratio is usually between three and four to one, but may reach as high as six to one.[93] Occasionally, PLAAF pilots will also transfer from PLAAF aviation brigades to one of the PLAN's carrier-based fighter units.

Training for Shipborne Helicopter Pilots

In 2020, the PLAN reported it had begun to include shipborne operations training to its pipeline for helicopter pilots, including ship landings within their first year of flight training.[94] Prior to this, NAU only provided basic skills training for helicopter pilots, and training for shipborne operations was conducted after pilots arrived at operational units. This placed a burden on operational units, impacted combat readiness, and led to different standards of training depending on units. Shifting these items to the curriculum at NAU reportedly alleviated these issues.

Professional Military Education

As with the overall PLAN, aviation officers receive professional military education (PME) at the battalion, regiment, division, and potentially, corps levels. PLAN aviation officers complete tactical-level education below the division level and thereafter attend PME back at the source of their commissioning, which for PLAN aviators is NAU. At about the corps level, officers may attend PLAN command college or joint PME at the PLA's National Defense University (NDU). In either case, this is likely their first PME experience alongside students from other warfare disciplines as earlier experiences would have kept them within their skill community. In recent years, PLAN PME has begun to focus more on science, technology, engineering, and math fields as opposed to a previous system of majoring only in the warfare discipline to which an officer was assigned.

PLA Rocket Force

Overview

History

The PRC formed the PLA Second Artillery Force in 1966. The Second Artillery Force (renamed the PLA Rocket Force [PLARF] in 2016) commanded China's humble inventory of land-based missiles. China's strategic nuclear weapons were developed because of the belief that hegemonic powers would continue to use nuclear threats and nuclear blackmail. As early as 1956, Mao Zedong stated: "We…need the atomic bomb. In today's world, if we don't want to be bullied, we have to have this thing."[95] China perceived the need for a powerful national defense and its own strategic nuclear weapons. Chinese Communist Party senior leadership made a decision to develop China's strategic nuclear weapons independently. This decisive and timely step paved the way for developing strategic nuclear weapons.

These first-generation missiles were largely categorized as unsophisticated and of limited range and capability. The story of the PLARF, however, has been one of steady and progressive growth in both size and capability. In the 1960s and 1970s, the Second Artillery Force developed longer-range systems. In the 1980s, the Second Artillery Force introduced the DF-5, the first intercontinental ballistic missile capable of striking the United States. The 1980s were a seminal decade for the Second Artillery Force in two other ways: first, through its development of the DF-21, the PLA's first road-mobile ballistic missile system; and second, through its decision to field conventional as well as nuclear missiles, leading to the introduction of the DF-11 and DF-15 short-range ballistic missiles in the early 1990s, enhancing active containment and effective counterattack against enemy forces.[96]

The steady diversification of platforms and improvement in capabilities assigned to the Second Artillery Force was matched by its equally steady growth in size. Four new brigades were stood up between 1980 and 2000, three of which were equipped with the latest weapons systems. This expansion accelerated in the 2000s. Between 2000 and 2010, the Second Artillery Force stood up as many as eleven new brigades equipped with its growing array of weapons, including its first ground-launched cruise missile, the CJ-10, and its first self-contained road-mobile ICBM, the DF-31, as well as the DF-21D anti-ship ballistic missile. The pace of growth intensified between 2010 and 2020, as the Second Artillery Force (and, following its name change in 2016, the Rocket Force) added 13 new brigades, as well as the longer-range and more capable DF-41 road-mobile ICBM, the dual nuclear-conventional DF-26 IRBM, and the DF-17 hypersonic glide vehicle.[97]

Incredibly, between 2017 and late 2019, the PLARF added at least ten new missile brigades. This unprecedented expansion from 29 to 39 brigades represents a more than 33% increase in size in only three years.[98] The PLARF has also emerged as the major winner of the PLA's 2015 reforms, being upgraded to a full service at the same time that the other services were either being reduced in size or losing direct control of their forces to the new joint theater commands. Thus, the PLARF has evolved from a small, unsophisticated force of vulnerable, short-ranged ballistic missiles to an increasingly large, modern, and formidable force with a wide array of both nuclear and conventional weapons platforms.

Missions

The PLA Rocket Force is responsible for the PLA's land-based nuclear and most of the PLA's surface-to-surface conventional missiles. The PLARF has a dual mission set of both nuclear deterrence and counterattack and conventional strike and deterrence in support of PLA military operations.

Nuclear deterrence and counterattack are intrinsically connected. The ability to conduct effective nuclear counterattack is the foundation for effective nuclear deterrence. Without a credible counterattack capability, which is survivable in the event of a conflict, deterrence will fail. Some analysts have characterized this idea as "assured retaliation."[99] For decades, CCP leadership did not seek parity with other nuclear powers, as they believed if they could sufficiently absorb a first strike and retaliate, even with only a few warheads, an adversary would be unlikely to decide that the risk of attacking China was worth the benefit.

Officially, PLA military thought dictates that the PLA has a nuclear "no first use" (NFU) policy.[100] This entails that only after China suffers an enemy's nuclear attack can it conduct nuclear retaliation and nuclear counterattack operations. However, a recent annual threat assessment conducted by the U.S. Intelligence Community described the PLA as pursuing "the most rapid expansion and platform diversification of its nuclear arsenal in its history."[101] There has been some speculation that the nuclear mission is evolving, or perhaps, simply upgrading to maintain a credible nuclear deterrent.

Conventional capabilities in peacetime can work well with other strategic forces in the PLA to play a deterrent role and contain the outbreak of war. In wartime, these capabilities can ensure the implementation of key strikes against an enemy to disable their warfighting capability. Just as with a nuclear deterrent, having a capable and survivable force is crucial to maintaining a credible deterrent. Conventional missile forces would no doubt play a critical role in any potential conflict between China and its neighbors, with capabilities aimed at Taiwan, the South China Sea, the Korean Peninsula, Japan, India, and the United States.

Modernization Priorities

Modernization priorities can be broken down into five main categories: rapid response, system penetration, long-range strike, comprehensive damage, and survival. Rapid response refers to the speed at which the strategic missile force can implement combat operations. Many factors contribute to being able to respond quickly, including reconnaissance, commanders' rapid judgment of enemy actions, command and control communication capabilities, troop training levels, and comprehensive support capabilities. Constant alertness to potential attack is critical to ensure effective operating time to deploy weapons and equipment. For example, if the PLARF wants to target a ship, such as an aircraft carrier, they need to be able to react quickly, have the correct coordinates, and launch a missile to ensure they hit the target. To improve communication response time the PLARF has made significant improvements to its C4ISR infrastructure in recent years, laying thousands of miles of fiber optic cables.

System penetration is the ability to comprehensively use various technical and tactical measures to break through the enemy's missile defense system. Technical measures include warhead maneuvering, stealth, decoy deception, electronic jamming, and multiple warhead

penetration. Tactical measures include timing of nuclear counterattacks, the destruction of the enemy's defense system, and the coordination of multiple forces, which mainly depend on the use of forces during combat. Effective system penetration capability is critical for counterattacks and particularly strategic deterrence. If the adversary knows their missile defense system could be penetrated, they are less likely to attack. This is why there has been a growing shift from ballistic to hypersonic missile development.

Long-range strike refers to the ability to guide a missile deep into an enemy's territory in order to hit important strategic targets. Generally speaking, many of the most critical nodes of an adversary are well protected and deep within their territory. An effective long-range strike must have both sufficient number of missiles and the requisite range to hit its target. Because of the need for long-range capabilities the PLARF continues to develop more capable missiles with ever increasing accuracy such as the intercontinental ballistic missiles (ICBMs) like the DF-31 and DF-41 that can strike most of the continental United States.[102]

Comprehensive damage capability requires the missile warhead to meet the damage requirements of different targets. For example, an aircraft carrier and a runway require different capabilities. The end goal for both targets is loss of function. Warheads with different performances and mechanisms are needed to achieve loss of function for different types of targets.

Survival is critical to success because it means being able to function even after an enemy attack and the ability to counterattack. Important factors include defensive capabilities of the position, the degree of concealment and the maneuverability of the troops. In the event a launch unit takes casualties, PLARF soldiers train to take on multiple roles. Reports indicate a battalion can lose upwards of 40% of its personnel and still be able to maintain a minimal launch capability.[103] Moreover, the PLARF is particular about its choice of underground facilities, ensuring the rock they are built under is sufficient to survive counterattacks.

Forces - Missile Capabilities

The PLARF fields a diverse and growing array of ballistic and cruise missiles supporting a range of strategic and operational objectives. The PLARF's missile inventory can be broken up into five broad categories: short-range, medium-range, intermediate-range, and intercontinental ballistic missiles, as well as ground-launched cruise missiles.

Short-range ballistic missiles (SRBMs) generally have a range of under 1,000 kilometers. The PLARF currently has three SRBMs in its inventory: the older DF-11 and DF-15, which entered service in the early 1990s and have since been periodically upgraded with new variants, and the newer and more capable DF-16, which entered service around 2011. All of these missiles are road mobile and deployed with conventional warheads. According to the Department of Defense's "China Military Power Report," the PLARF has approximately 200 SRBM launchers and 1,000 SRBMs.[104] Currently, there are four SRBM Brigades.

Medium-range ballistic missiles (MRBMs) generally have a range of 1,000 to 3,000 kilometers. The PLARF is currently equipped with two road-mobile MRBMs, the DF-21 and DF-17. The DF-21 is utilized in a regional nuclear strike role as the DF-21A, a conventional strike role as the DF-21C, and an the anti-ship role as the DF-21D. The DF-21, which dates back to the 1980s, is being slowly replaced by newer missile types such as the DF-26. The PLARF may have one to

two nuclear DF-21A brigades still in service although the PLARF appears to be phasing the DF-21A out of frontline service. As of 2019, all DF-21C brigades have likely converted to new missiles, and there is recent evidence that the PLARF's two DF-21D brigades may have already converted to new missiles as well. The newer DF-17 is the PLARF's first hypersonic missile, with the attached DF-ZF hypersonic glide vehicle.

Intermediate-range ballistic missiles (IRBMs) generally have a range of 3,000 to 5,000 kilometers. The PLARF is currently equipped with a single road-mobile IRBM, the DF-26, which entered service around 2015. According to DoD estimates, the PLARF has approximately 200 IRBM launchers and 500 missiles in service.[105] The DF-26 is capable of firing nuclear, conventional, or anti-ship warheads. Additionally, in 2021, the deployment of the DF-27 with a range up to 7,000 km was first reported.[106] Some analysts believe it was developed to strike the U.S. mainland. The PLARF currently operates approximately 12 MRBM and IRBM brigades.

Intercontinental ballistic missiles (ICBMs) generally have a minimum range of 5,500 kilometers. The PLARF is currently equipped with one silo-based ICBM, the DF-5, and two road-mobile ICBMs, the DF-31 and DF-41, all of which are capable of striking most of the continental United States. The silo-based DF-5 first entered service in the 1980s, but has been upgraded with A, B, and C variants. The B variant is capable of carrying up to five warheads. The DF-31 and newest DF-41 are notable for being road mobile and solid-fueled. The DF-41 is also Multiple Independently-targetable Reentry Vehicle (MIRV) capable, possibly carrying three to five warheads, although this is still a matter of debate. Notably, the PLARF has begun a dramatic expansion of its ICBM silos in recent years, with construction on as many as 260 new silos in three new locations. The PLARF currently operates 19 ICBM brigades.

Finally, the PLARF is equipped with two types of conventional ground-launched cruise missiles (GLCMs). The CJ-10 entered service around 2006 and has a range of around 1,500 kilometers. It is likely deployed to two brigades. The newer supersonic CJ-100 was deployed to its first brigade around 2020. There are no known official statistics for the range of the CJ-100, and given that it maintains supersonic speeds that require greater fuel consumption, it is unclear whether it has a greater range than the CJ-10.

In addition to its new missile systems, the PLARF has also worked to improve the infrastructure needed to support these missiles, including over-the-horizon radars, satellites, and other sensors to enable long-range precision strikes. Development of these systems will be especially critical to realizing the full potential of the PLARF's anti-ship missile systems, which will be unable to successfully locate and strike far-off ships without these sensor networks. The PLARF also employs limited organic intelligence, surveillance, and reconnaissance capabilities.

Force Employment

General Warfighting Concepts

The PLARF's long-range and strategic strike capabilities enable the disruption and destruction of vital targets in contested environments that other types of weaponry would be unable to penetrate. With this capability to exert force over long distances there has been a growing push to target key nodes in multiple domains including land, air, sea, and space. Rarely does the PLARF act as a single service, but rather typically is employed as part of a larger joint firepower system. An example of which is during a joint fire strike in which conventional missile units would be used for preliminary strikes against the enemy's reconnaissance and early warning systems, EW systems, air-defense/anti-missile positions, and aviation force bases, to paralyze the enemy's operational "system of systems" and suppress their operational strength. With an adversary in a weakened state, the necessary conditions for the PLA's other services to conduct follow-up operational activities would be met. Moreover, the PLARF is also heavily reliant on other services for support infrastructure such as over-the-horizon radars, satellites, and other sensors to enable long-range precision strikes.

Training

The PLARF lacks a centralized institution for training enlisted personnel, such as Lackland Air Force Base or Parris Island in the U.S. Rather, new enlisted personnel are typically assigned to one of the nine PLARF Bases, and then are trained by that base's training regiment for three months before being assigned to an operational unit under that base, where they will receive further on-site training in their specialty.

The PLARF, as with the rest of the PLA, has in recent years placed great emphasis on more realistic training scenarios, including more frequent use of force-on-force exercises. Traditionally, PLA confrontation exercises have suffered from being highly formulaic and always ensuring a friendly force victory. However, in recent years, the PLA has worked to remedy this situation and make these exercises more realistic and difficult. The PLARF has at least one dedicated Opposing Force (OPFOR) regiment, which was at least partially modeled on the equivalent American unit at Fort Irwin. It also maintains four test and training districts through which launch units regularly rotate for realistic training. These districts allow for training in a range of difficult weather and terrain conditions, including cold weather and desert conditions. PLARF Bases also seem to have their own indigenous OPFOR units, of perhaps company or battalion strength, to allow for additional confrontation training.

The PLARF has also increased training in joint operations with the other services. One major training event is the annual *Tianjian* or "Heavenly Sword" exercises, which feature joint cooperation with the other services, as well as extensive use of OPFOR.

In recent years, the Rocket Force Command College has also held a new annual training exercise called *Jianfeng* or "Sword Edge." In this exercise, brigade commanders are tested on problem solving, strategic thinking capabilities, and deepening operational designs and tactical innovations, with an emphasis placed on real world combat scenarios.

A close reading of PLA and PLARF media suggests that the PLARF has singled out several training areas for particular emphasis. These include nighttime training, as well as defense against enemy satellite surveillance, electronic warfare, nuclear-biological-chemical attacks, and special operations raids, ad-hoc launch sites, multi-role personnel, as well as the ability to remain highly mobile through rapid "shoot-and-scoot" tactics to avoid being targeted by an enemy. Units assigned to silo-based missiles frequently conduct sealed off underground silo training which can last up to 30 days.

Organization and Command & Control

The PLARF is directly subordinate to the Chinese Communist Party's Central Military Commission, the PRC's supreme national defense authority. Conventional and nuclear forces have semi-unified C2.

Like all other PLA services, PLARF Headquarters consist of four major departments. These are the staff department, the political work department, the logistics department, and the equipment department. There is also a Party oversight entity in the form of the discipline inspection committee.

Figure 25: PLARF organization

The PLARF commander and political commissar (PC) are co-equals in leading PLARF Headquarters. However, formal decision-making authority regarding force-wide manpower, training, and equipment issues resides with the PLARF's Standing Party Committee. This party committee typically consists of the PLARF political commissar as the secretary, the PLARF commander as deputy secretary, along with their deputies, the heads of the four major departments, and the secretary of the PLARF discipline inspection committee. Collectively, these individuals must reach a consensus for all major decisions related to the PLARF.[xviii] PLARF leaders usually have experience commanding units with both nuclear and conventional missions, and time leading warhead handling units is not unusual. In general, PLARF HQ includes officers with a diverse mix of backgrounds, including those with careers in space launch and intelligence.

[xviii] This organization and Party committee structure is fairly standard throughout the PLA in general.

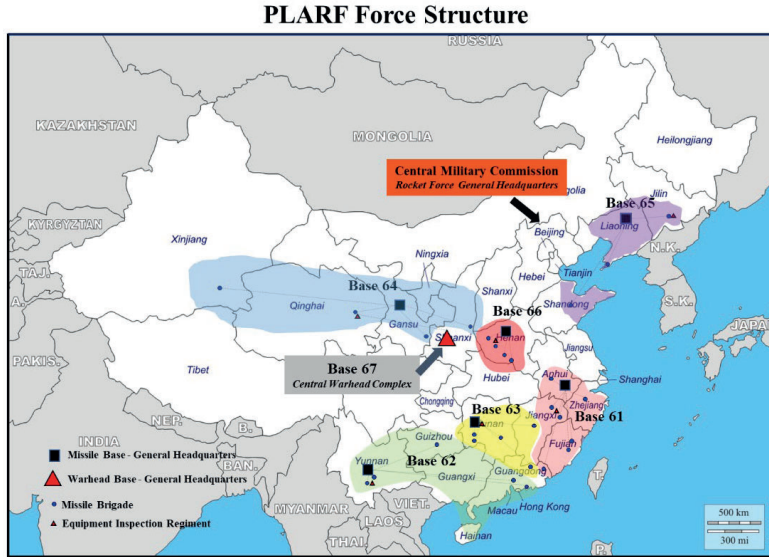

Figure 26: PLARF bases

The PLARF oversees nine Bases. A Base is usually equivalent to a corps or corps deputy-grade unit, one level above a division, and is relatively self-sufficient with a highly unified command structure.

Six of the PLARF's nine Bases, numbered sequentially 61 to 66, are responsible for missile operations, while the other three, Bases 67 to 69, conduct support missions. Each of the six operations Bases cover discrete geographical areas. The missile brigades of Base 61, which cover eastern and some of southeastern China, would be the primary forces tasked with operations against Taiwan. Base 62 covers the rest of southeastern China, Base 63 covers inland southern China, Base 64 covers northwest and north-central China, Base 65 covers eastern and northeastern China, and Base 66 covers central China. Each Base oversees both nuclear and conventional forces and features a unique makeup of nuclear and conventional capabilities depending on their individual missions and strategic needs.

Unlike its PLA Army, Navy, and Air Force counterparts, the PLARF does not have theater Rocket Force commands within each theater command, which is likely due to the relatively small size of the service and the split between conventional and nuclear assets. The six operations Bases serve a similar role as a theater rocket force, but given their smaller size, are a tier lower than the other services. Further, the Bases do not map perfectly with each theater command. For example, there are six Bases and only five theater commands, with some Bases covering multiple theater commands.

Command authority of the Base's nuclear and conventional missile forces can be somewhat difficult to grasp. In peacetime, nuclear forces are administratively subordinate to their individual

Bases. In wartime, Bases likely still stay in the chain of command for nuclear operations, but theater commands are not part of the nuclear decision-making process. As seen in the wartime organization chart following, conventional missile forces would be integrated into the joint operations command center as Bases shift to conventional missile operations groups. During peacetime, units are stationed at a garrison, which would be a likely target of enemy attack in the event of a crisis. On strategic warning of an adversary attack, the unit will rapidly deploy to hardened shelters, a holding area, or proceed directly to a launch site. Ad-hoc sites can also be used in the event of a conflict.

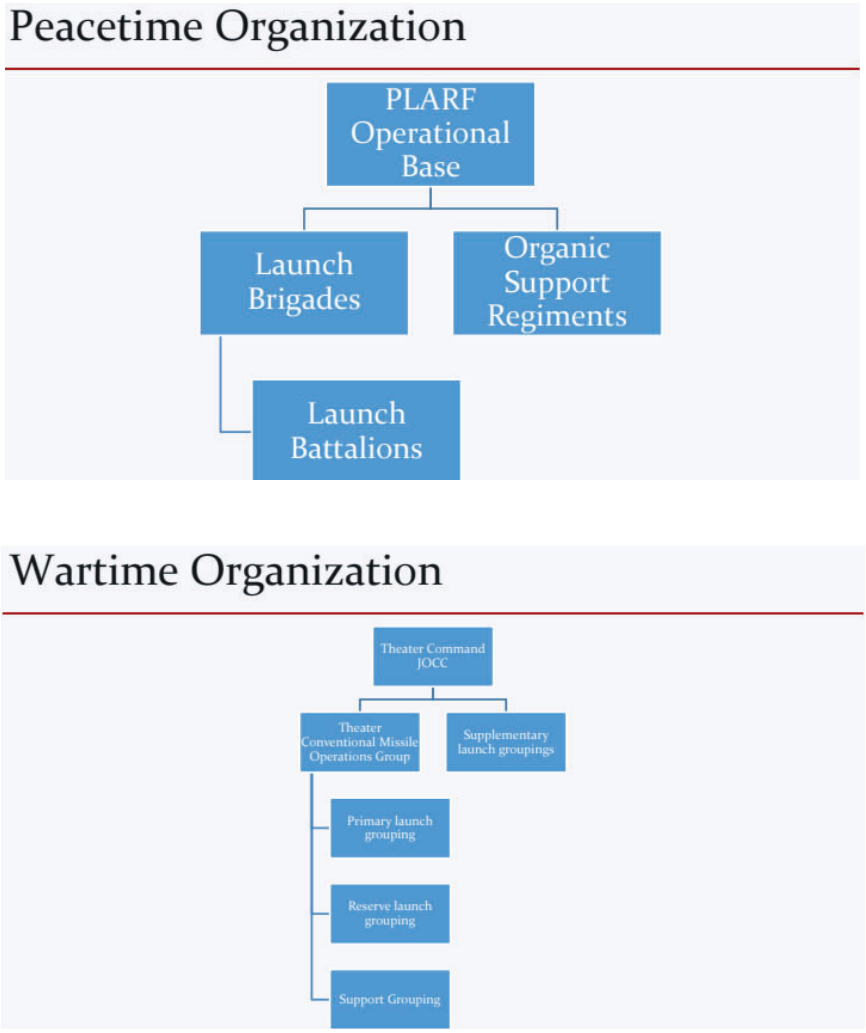

Figure 27: PLARF peacetime versus wartime organization

Moving down a level, each Base controls six to seven missile brigades, along with several support regiments responsible for training, communications, operations support, maintenance and logistics, and nuclear warhead management. Each missile brigade typically oversees six launch battalions, as well as four to five support battalions. Each launch battalion in turn oversees two launch companies. Battalions can be widely dispersed and appear capable of independent launch. Official and comprehensive estimates of missiles and launchers per brigade are lacking, but knowledgeable observers have given estimates ranging from 6-12 launchers per brigade for certain ICBMs, 12-24 for MRBMs, 18-36 for IRBMs, and up to 36-48 launchers per brigade for SRBMs and cruise missiles.

Along with the six operations Bases, there are three support Bases. Base 67 is responsible for oversight of the PRC's central nuclear warhead storage depots. It ensures safe and secure storage, maintenance, and transport via specialized road, rail, and air assets, of nuclear warheads. It also oversees assets dedicated to ECM, air defense, and nuclear disaster response.

Base 68 is the PLARF's engineering support Base responsible for construction of physical infrastructure. It likely consists of six Engineering Brigades, at least two of which specialize in installation of key infrastructure such as electricity, ventilation, and blast and radiation shielding, a Communications Engineering Regiment responsible for constructing the PLARF's communications infrastructure, a Communications Repair and Maintenance Regiment, and at least four other support regiments. A critical task of the Base is the construction of underground facilities (UGFs). It is unknown how many miles of underground tunnels the PLARF possesses, and stories of a contiguous 3,000 mile "underground great wall" are likely overblown, but the number is certainly significant.

Finally, Base 69 acts as a testing and training facility for the Rocket Force. This Base provides high-end testing facilities for the research and development of new systems and training facilities for operational forces. Although much remains unknown about Base 69, it comprises four Test and Training Districts (created from three former PLARF training Bases), as well as several regiments supporting testing and training missions.

In addition to these nine Bases, the PLARF also oversees two independent commands. The first is the PLARF's Research Academy. Like all other PLA service research academies, this organization is responsible for conducting and integrating early-stage applied research on both technology useful to the PLARF as well as operational concepts. The second independent command is known as the Golden Wheel Engineering Project in which the PLA sold Saudi Arabia DF-3s in the 1980s and the DF 21A in the 2010s. In late 2021, media reports indicated that the U.S. intelligence community has concluded that Saudi Arabia is manufacturing ballistic missiles, with Chinese assistance.[107]

Leadership and Personnel

PLARF's officers graduate from the Rocket Force Engineering University in Xi'an. As part of its drive toward a more educated force, the PLARF has also begun recruiting officers from civilian academic institutions.

The year before an officer cadet graduates, or immediately upon graduation, at least some PLARF officers spend several months at an operational unit in a student capacity. This is most likely to provide the individual with some operational familiarization. They will then be officially commissioned as officers and serve for four years at the company level, first as a company deputy commander and then as a company commander. In this capacity, they will oversee a team of enlisted personnel who operate anywhere between one to four launcher units. The number of launchers per company is dependent on the type of weapon system. In addition to ensuring that the launch systems for which they are responsible execute orders as required, PLARF company commanders regularly train to take on battalion command responsibilities. This is almost certainly due to PLARF's desire to cross-train personnel to fulfill multiple functions, such that a launch unit can maintain minimal operational capability despite heavy personnel losses.

It is at the battalion level that PLARF launch officers begin to gain a degree of authority and independence. Unlike launch companies that will typically be deployed alongside a battalion headquarters, PLARF launch battalions will often operate far from the brigade headquarters. In essence, the PLARF launch battalion is typically the lowest-level maneuver and fire unit for the PLARF.

After serving as a company commander, PLARF officers will frequently spend a year or two in a brigade or higher-level staff assignment before landing in a battalion deputy commander position. They will then spend roughly four years as a deputy battalion commander and then battalion commander. In this capacity, a PLARF launch officer is expected to interpret and execute brigade commands in the field. This frequently involves taking initiative and making decisions without verification from upper echelon command elements. This authority and independence is likely tied to the PLARF's expectation that its launch battalions will be under constant threats from adversary fires, and thus, may need to be able to act without having communications with the brigade headquarters.

PLARF officers will sometimes spend a second tour after the battalion level serving in a staff assignment. Typically, this assignment will be at a level higher than the brigade - usually at the Base or service headquarters level.

At the brigade level, PLARF officers will finally exercise leadership over both launch and support units. Launch officers will first serve in a deputy commander or brigade chief of staff position for roughly three years prior to becoming full brigade commanders. In this capacity, they will become familiar with the wider range of responsibilities associated with brigade command.

Once an officer becomes a full brigade commander, they will be responsible for overall unit management and operations. They will also act as the interface for higher echelon commands, typically at the joint level. In a wartime environment, this translates to the brigade commander ensuring that his unit's standing plans and procedures remain valid and that his unit's subordinate battalions are prepared to support a larger firepower strike.

NCO leadership focuses on survivability of their force as a critical goal. Among the NCO and enlisted ranks, much like the rest of the PLA, the PLARF has traditionally suffered from a relative dearth of "quality" well-educated personnel. While this situation was acceptable when the PLA relied primarily on overwhelming manpower, it has become increasingly untenable as the PLA attempts to transform itself into a force relying on cutting edge technologies and complex

joint operations. Despite frequently being placed into technically demanding roles, including those that involve handling delicate explosive or nuclear materials, a significant proportion of the PLARF's enlisted and NCO forces have only a middle school education and often struggle to meet the technical requirements of these roles. The PLARF, and PLA as a whole, is well aware of this issue and has taken steps to improve the recruitment of personnel with high school and college education in its enlisted and NCO ranks, with some apparent success.

In addition to slowly improving the quality of its recruitment, the PLARF has begun a variety of pilot programs to improve the education and technical skills of its existing personnel at all levels. These programs include short-term education at PLARF academic institutions, as well as partnerships with local civilian colleges, state owned companies, and factories, where personnel can take classes or learn new skills.

As with the rest of the PLA, the PLARF views the creation of a professionalized NCO corps as an essential component for building a modernized force. The Rocket Force NCO School is the primary institution tasked with training this force, and annually trains approximately 20,000 NCOs. This includes training both new and existing personnel to become NCOs, as well as a newer training program to turn recent college graduates into NCOs, as part of the PLARF's drive toward a more educated force.

PLA Information Domain Forces

On April 19, 2024, Xi Jinping, Chairman of the Central Military Commission (CMC) of the Chinese Communist Party, attended a ceremony where he established a new 'force' of the People's Liberation Army, the Information Support Force (ISF).[108] The ISF appears to have been cleaved from the former PLA Strategic Support Force (PLASSF), which was essentially disbanded at the same ceremony.

In the official announcement, the PLA announced that there are now "four services, namely the Army, the Navy, the Air Force, and the Rocket Force, and four arms, including the Aerospace Force, the Cyberspace Force, the Information Support Force, and the Joint Logistics Support Force." This is one of the most significant and the largest reform since the 2015-16 round of reforms which established the Strategic Support Force in the first place.

According to PRC Ministry of National Defense spokesperson Senior Colonel Wu Qian: "Establishing the Information Support Force through restructuring is a major decision made by the CPC Central Committee and the Central Military Commission…. This is of profound and far-reaching significance to the modernization of national defense and the armed forces and effective fulfillment of the missions and tasks of the People's military in the new era. The Information Support Force is a brand-new strategic arm of the PLA."[109]

It is important to note that the PLA adheres to a fairly strict protocol order in formal announcements, so it appears that the Aerospace Force (ASF), which commands the PLA's space forces, is now the senior force. The ASF was formerly the Space Systems Department (SSD) of the Strategic Support Force. Next in order would be the Cyberspace Force (CSF), which was formerly the Network Systems Department (NSD) of the PLASSF. The ASF and CSF will have a new organizational relationship with the ISF, Theater Commands, and the CMC itself. Next in order is the newly created Information Support Force, which is followed by the Joint Logistics Support Force (JLSF). All of these forces appear to be deputy Theater Command leader-grade organizations, which is just one step below the four services and the five theater commands, but that has yet to be confirmed as of April 2024. Further enhancing the importance of the new force, the Ministry of National Defense noted that, "According to the decision of the Central Military Commission, the newly formed Information Support Force will be directly led and commanded by the Central Military Commission."[110]

The Chinese see the "information domain" as a domain of war unto itself, equal to the physical domains of air, land, sea, and space.[111] In fact, the CCP's PLA talks about conducting operations in those physical domains in order to support operations in the information domain. In military speak, the information domain would be the "supported" domain, which is to say, the focus of effort. This is different from the typical view of the United States and its allies. The fact that Xi Jinping personally attended the ceremony and delivered the new official flag for the ISF emphasizes just how important the information domain is to him, the CCP, and its People's Liberation Army.

As for the leadership of the new organization. The ceremony announced that Lieutenant General Bi Yi, who was previously a deputy commander of the PLASSF, will be the new Commander of the ISF. General Li Wei, who had been the Political Commissar (PC) of the

PLASSF, was named the Policial Commissar of the ISF. Of note, former Strategic Support Force General Ju Qiansheng was rumored to be under investigation for corruption, and was absent from the ISF ceremony.

The roles, responsibilities, forces, and capabilities of the new ISF are still to be determined (perhaps in China as well, but certainly to those on the outside looking in) but may involve communications networks and network defense.[112]

The remainder of this chapter is dedicated to the SSD and NSD as they existed until April 2024. While things are in flux, we can expect the missions and capabilities to remain, regardless of the eventual organizational or C2 structure that emerges from this latest round of reform.

Overview

The former PLA Strategic Support Force (PLASSF) was established on December 31, 2015, as the most decisive and forward-looking high-end force, a "hidden card that will deliver ultimate victory."[113] After the creation of the PLASSF, PLA commentators described the types of weapons that the PLASSF would absorb from the CMC and other services as being "information warfare weapons." PLA military writings had called for merging strategic cyber and electromagnetic spectrum (EMS) capabilities, which had been embedded within different organs of the PLA and the CMC. The PLASSF integrated elements of former General Staff Department (GSD), Third (3PLA), and Fourth Department's (4PLA) responsibilities for the cyber and EMS domains, and it included technical collection functions of the former GSD Second Department and tactical/operational psychological warfare from the former General Political Department (now the Political Work Department).

As part of the PLA's drive for information dominance, the PLASSF also absorbed the General Armaments Department's (GAD) satellite launch and missile test ranges, as well as satellite telemetry, tracking and control (TT&C), only part of which supported the PLASSF's information warfare operations. The vast majority of the PLASSF's support to PLA military space operations was in improving services' access to space-derived information and services. While better space information support is a goal for improving joint warfighting with advanced technology generally, this improvement also can support the integration of network [cyber] and EMS weapons. Some of these weapons use space information and potentially operate in space. In 2020, the PLA National Defense University's (NDU) *Science of Military Strategy* (SMS) stated that, "Because of the decisive influence of space control on cyberspace and other military spaces, it will become the key to defeating the enemy in information warfare." The other areas where the PLASSF's space capabilities supported PLA strategic and tactical information operations was in its role in training and perhaps operating select counterspace weapons.

The PLASSF had reported directly to the CMC, and the PLASSF Commander and Political Commissar were both Theater Command (TC) grade leaders, equivalent to other PLA service leaders. It is unclear if the ISF, SSD, and NSD will retain their TC deputy-grade status or not.

However, the other military services and TCs continue to operate their own electronic countermeasure (ECM) brigades and retain operational control over electronic warfare platforms in air, maritime, and ground operations, even though former PLASSF units had been forward postured across each of the TC areas of responsibility. Other services also operate counterspace

weapons with reversible effects, such as mobile platforms for satellite laser dazzling, ground-based satellite jamming, and probably network-electronic countermeasures, i.e. spectrum-enabled cyber operations.[114]

China's *National Defense White Papers* have raised the importance of cyber, EMS, and space over the last two decades. The 2008 and 2010 White Papers stated the PRC's national strategic guidelines included "maintain[ing]" maritime, space, electromagnetic space, and cyber space security. The 2012 version shifted from "maintain" to "protect." The 2015 version elevated the role of international competition and referred to space and cyber as new "security domains," where China needed to "safeguard" both its security and interests. The interests noted include economic and societal interests. The most recent white paper in 2019 further described China's interests in the space and cyber domains.

Missions

The PLASSF had collected, processed, integrated, and provided information derived from space, cyber, and electromagnetic spectrum (EMS) assets to all PLA services and the five TCs to facilitate joint operations. It is not clear if all of those responsibilities will now simply transfer to the ISF, or if some will be retained by the ASF and CSF. The PLASSF had sought to create synergies between various information warfare capabilities in order to carry out specific strategic missions that Chairman Xi Jinping and other senior CCP leaders believe will be decisive in future wars. In some cases, the PLASSF also directly supported tactical missions. Echoing the 2019 *National Defense White Paper*, the PLASSF was described as serving functions ranging from "battlefield environment support (战场环境保障), information communications support (信息通信保障), information security protection (信息安全防护), and new technology testing (新技术试验)." Beyond information support, the establishment of the PLASSF paralleled the Chinese recognition of space, cyberspace, and the EMS as warfighting domains in their own right to carry out China's information warfare missions. In this capacity, the PLASSF carried out strategic and some tactical information operations, such as network espionage, space-based satellite communication jamming, and, with other services, network-EMS attack. The PLASSF's role within the PLA had been to provide critical means to enable smooth and sophisticated joint operations, as well as paralyze the enemy's joint operational capabilities, in advance of and throughout a conflict.

Force Employment

The U.S. Defense Intelligence Agency's Challenges to Security in Space said in 2022 that the PLASSF formed the "core of China's information warfare force, supports the entire PLA, and reports directly to the CMC."[115] For the PLA, information operations include network operations, space information operations, electromagnetic spectrum operations, and psychological operations. The 2020 SMS describes information operations as:

"The organiz[ation of] military and local information attack forces to attack the enemy's command, early warning, air defense, and anti-missile systems. The main methods are: the use of electronic jamming drones… the use of satellite communication jamming forces to interfere with enemy communication satellites and maritime satellites; the use of electronic warfare aircraft to detect and guide the enemy's early warning radar…use [of] various interference forces to interfere

with enemy early warning aircraft and data links; organize network [cyber] warfare forces as appropriate to attack the enemy's potential target network for war."[116]

The above SMS caption includes "as appropriate" when including cyber operations in information attacks, which is important to note because the text later states that, "It is necessary to develop strategic guidance for active defense in cyberspace," indicating that wartime cyber attack plans, at least as of 2020, were not fully fleshed out. Towards that effort, the SMS says the PLA will, "take the development path of comprehensive integration and build a cyber and electromagnetic spectrum combat force system that integrates reconnaissance, offense and defense."

In an explanation of how "An outer space battlefield and a network-electromagnetic battlefield are the basis for an informationized battlefield," a 2015 PLA NDU book called *Study on Asymmetric Operations* states:

"In informationized warfare, the status and roles of such domains as the land, sea, air, outer space, electromagnetics, the network, and knowledge differ. Of these, the electromagnetics domain and the network domain are the intermediaries that link the weapons platforms that are spread all over the natural spaces—the land, sea, air, and outer space—and people. These two domains have a linking and controlling role for the various spaces of the land, sea, air, and outer space; they are the foundational domains. By attacking these two domains and targets in their related domains, it is possible to deprive the enemy of the use of these two domains; to damage the links in the enemy's land, sea, air, and outer space combat domains; and to thus greatly reduce the enemy's overall combat capabilities."[117]

PLA sources state that the PLASSF has "actively integrated the joint operations system and carried out multiple force-on-force drills and contingency training." However, actual reports involving the PLASSF training for information operations remain extremely scarce. Here is a list of selected drills and exercises that may have involved the PLASSF's role in information operations, for both information support and potentially attack:

April 2023 – The PLASSF participated in the "Joint Sword" (联合利剑) exercise, which simulated an all-service joint exercise for island-encirclement in the sea and airspace near the island of Taiwan. The exercise simulated joint precision strikes against key targets on Taiwan and the surrounding waters, including opposition to the intervention from "external forces." The exercise tested the PLA's ability to seize air, sea, and information dominance.[118]

July 2022 – The PLASSF and potentially another service conducted a red-on-blue training, where the red team simulated a "launch," the satellite-supported navigation for which was jammed by the blue side.

January 2021 – A PLASSF unit stationed in Shaanxi province participated in the national 2021 Training and Mobilization Order. This unit trained on network attack and defense confrontation.

January 2021 – A PLASSF surveying and mapping emergency support unit, probably from the PLASSF Base 35 for battlefield environmental support located in Wuhan, Hubei province trained on providing images of the exercise area and various geographic information data, such as the simulated artillery strike area. The evaluation parameters, such as the damage in the artillery

strike area, were displayed in front of the commander to provide a basis for implementing operational command decisions.

September 2020 – A PLASSF Base 35 surveying and mapping emergency support unit's UAV team participated in a live exercise from a theater joint command center. Under the leadership of Tang Aibo, director of the technical data room, five officers and soldiers maneuvered more than 1,000 kilometers and successfully completed the UAV aerial photography task in four days, and carried out data processing and calculation overnight, providing accurate data support for the actual exercise.

March 2019 – An unidentified unit conducted a drill likely related to searching for and tracking "enemy" targets. According to Engineer Hou Yikun and Party Secretary Ma Hongchao, the main purpose of the drill was to strengthen the command capability of the unit.

March 2018 – Three *fendui* (units at the battalion level and below) from different PLASSF units participated in an actual-combat exercise that took place in the Gobi Desert. A total of 138 personnel participated in this three-day, two-night exercise in a desert region under adverse weather conditions. The exercise covered 12 training subjects and seven impromptu subjects including emergency evacuation and grouping, rapid relocation of command post, and emergency response to a sandstorm. Representatives from five different organizations participated in the evaluation process. The unit's chief of staff was named Liu Hao.

Figure 28: PLASSF personnel participate in exercise

February 2019 – An unidentified unit participated in a long-range Southern TC Navy joint exercise along with PLA Air Force and Rocket Force units.

2018 – Sometime in 2018, a PLASSF unit from the new science and technology base in Kaifeng city, Henan province (Base 36) participated in the Cuihuo Luoyang exercise (淬火·洛阳). This exercise trains participants in an anti-air scenario with electronic countermeasures. It has been held at least three times.

February 2018 – A report described a PLARF training event in Xinjiang in which a PLARF targeting officer selected a navigation satellite to provide targeting data for a ballistic missile defense brigade and subsequently sent a request for the satellite's availability to the PLASSF unit participating in the training.

Chinese New Year / February 2018 – Probably PLASSF Base 35 for battlefield environmental support located in Wuhan city, Hubei province deployed its mobility supporting *fendui* or crisis response *fendui* to carry out a support mission.

Organization and Command & Control

The PLASSF was composed of two Theater Command deputy leader-grade departments: the Space Systems Department and the Network Systems Department. As of mid-April 2024, the SSD (now ASF) and NSD (now CSF) seem to remain as organizations, and retain some of their previous roles and responsibilities they had under the PLASSF. However, some of these missions and capabilities will certainly transfer to the new ISF.

In wartime, select units will likely be converted to operational forces, which will be directly commanded by the Joint Operations Command Center (JOCC) under the CMC. Depending on the function of the unit, some may directly support, and receive tasking from, Theater Commanders.

The now-ASF is mainly involved in the PLA's space-derived information and communication satellite operations, space launch, satellite telemetry, tracking & control, positioning & navigation, ground & space-based space situational awareness of space objects and ballistic missiles, and some counterspace operations.

The now-CSF is mainly involved in terrestrial network [cyber] and EMS, information and communications support through a dedicated base, and terrestrial signals intelligence (SIGINT) collection. The CSF also has a role in some counterspace operations.

Both the ASF and CSF are headquartered in Beijing. The CSF headquarters is situated in the former 3PLA headquarters compound in northwestern Beijing. The ASF and CSF Equipment Departments may serve as focal points for the military space and network system-related research, development, and acquisition (RD&A) enterprise; and thus, will likely be retained after this reorganization is complete.

The ASF took on the space-related roles previously performed by the former GAD and probably the former GSD as well. GSD responsibilities included tasking military space-based assets and analyzing space-derived information, while the GAD managed the orbital management of the national, including military satellite infrastructure, research and development for Chinese military satellites and launch vehicles, and operated China's satellite launch and satellite on-orbit control centers. From an organizational perspective, the ASF now commands China's four land-based space launch centers: Jiuquan Satellite Launch Center, Taiyuan Satellite Launch Center, Xichang Satellite Launch Center, and Wenchang Satellite Launch Center. 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, or 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. The Taiyuan Center launches meteorological, remote sensing, and communications satellites into sun and geosynchronous orbits. The Xichang Center focuses on meteorological, broadcast, and communications satellites in geosynchronous orbit. Wenchang's location on China's Hainan Island limits 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 10-15% and satellite life by 2-3 years. The Taiyuan Satellite Launch Center is also supporting launches by

Chinese national, mixed-ownership, and commercial space companies on its sea-based platforms. The first such launch was in 2019 with a LM-11.

The ASF also had integrated both land-based and sea-based TT&C centers, including the Xi'an Satellite Control Center (XSCC) and China Maritime Satellite Tracking and Control Department in Jiangyin, Jiangsu. The XSCC is tasked with routine telemetry, orbit control, and breakdown diagnosis and maintenance of satellites. It is able to support simultaneous launch of satellites from multiple Chinese 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. China Satellite Maritime Tracking and Control Department manages China's Yuanwang space-tracking ships. As of 2024, there are four operational Yuanwang ships and two cargo ships, the Yuanwang-21 and Yuanwang-22, commissioned in 2012 and 2013, respectively. They have been used for transportation of rockets such as China's Long March-5 and Long March-7. Yuanwang-7, the most advanced Yuanwang ship that entered service in 2016 has made more than 20 voyages and performed multiple tasks in the Pacific Ocean and the Indian Ocean, including maritime tracking of China's second space lab Tiangong-2, the Chang'e-4 lunar probe, and BeiDou satellites.

The establishment of the PLASSF, backed with the consistent long-term advocacy of concepts such as "integrated network and electronic warfare" and "networked EMS warfare," led to the creation of strategic and operational synergies between the PLA technical reconnaissance, ECM, cyberspace, information and communications systems, and spectrum management communities. Today, the CSF is composed of former GSD Third and Fourth Department requirement development as well as operational elements.

Figure 29: General Ju Qiansheng seen standing alongside Chairman Xi Jinping during his promotion in July 2021[119]

The CSF Equipment Department is likely responsible for network and electromagnetic spectrum force planning, program validation, and acquisition management. The CSF maintains several facilities in Henan province. Headquartered in Luoyang, Henan, the Electronic Equipment Test Center, also known as Base 33, is an important component of the CSF. It is a division leader-

grade test and training complex. The center oversees radar, communications, and infrared countermeasure test ranges scattered throughout the city's northern suburbs. Together with the National University of Defense Technology (NUDT), the center co-hosts a national-level lab on measuring complex electromagnetic effects. Since 2009, the center has managed an electronic countermeasures training group to support opposing force training. Base 33 also carries out directed energy testing and evaluation.

The ASF manages Base 36 in Henan province, likely to facilitate the deeper integration of the PLA's electromagnetic spectrum weapons research, which includes both directed energy weapons and electronic jamming weapons for ground and space targets.

Education and Training

There are two key educational institutions from the former PLASSF, namely, the Space Engineering University (航天工程大学) in Beijing and the Information Engineering University (信息工程大学) in Zhengzhou, Henan.

The Information Engineering University (IEU) in Zhengzhou, Henan province, absorbed the former PLA Information Engineering University and the Luoyang Foreign Languages Institute of the former GSD Third Department. According to the university website, IEU covers an area of nearly 8,000 acres and integrates studies in science, engineering, military, literature, and management. IEU awards eight types of doctoral degrees and 18 master's degrees. It has one national key laboratory, two national engineering laboratories, one national engineering technology research center, two national experimental teaching demonstration centers, and 18 military (provincial) key laboratories, experimental teaching demonstration centers, and engineering technology research centers.

The Space Engineering University (SEU) is in Beijing. It is currently composed of three main campuses in Beijing utilizing more than 3,000 acres of land and has been actively recruiting additional civilian instructors and researchers. SEU houses at least two defense-related national key labs: the National Key Laboratory of Laser Propulsion and Applications and the National Laboratory of Electronic Information Equipment Systems. The State Key Lab for Laser Propulsion and Applications, which focuses on the intersection of laser and aerospace, is equipped with advanced launch validation system and China's only state-of-the-art, unified, whole-system, full-process research platform for laser propulsion. A space test and training center and a space monitoring and control station are reportedly part of the university.

Leadership and Personnel

Due to the technical nature of the various tasks assigned the ASF and CSF, these forces are generally manned by troops and civilian personnel who have acquired relatively high-level science, technology, engineering, and mathematics (STEM) education. The ASF and CSF have likely achieved a high-level of military-civil integration in the domain of talent management. Their PME programs remain unclear at this point, but most likely involve graduate-level study or training at one of the key educational institutions, the Academy of Military Sciences. Almost all the current ASF and CSF senior leaders are graduates or received some form of education from the PLA National Defense University.

Since 2019, the Network Systems Department (now the Cyberspace Force) Equipment Department has been recruiting civilian personnel to fill positions in information maintenance, IT and communications, equipment information support, construction management (electronics engineering). All of its civilian billets require CCP membership. It also seeks to recruit multiple military representatives specializing in network/cyberspace security and electronic engineering in Shenzhen, Wuhan, Chengdu, Tianjin, Beijing, Shanghai, and Nanjing.

On July 5, 2021, General Ju Qiansheng attained the rank of full general and assumed the role of the commander of the People's Liberation Army Strategic Support Force, marking the third change in leadership within a span of almost six years. He succeeded General Li Fengbiao and General Gao Jin, who took command in 2019 and 2015, respectively. Notably, General Ju was previously acknowledged in 2019 reports as the commander of the PLASSF Network Systems Department, a position that likely involved dual responsibilities as a deputy commander of the PLASSF. Unverified information from Chinese media suggests that General Ju, born in May 1962, served as a deputy director in the former PLA General Staff Department Technical Reconnaissance Department. In the 2009-2010 timeframe, General Ju Qiansheng directed the 12th Bureau of the former GSD Technical Reconnaissance Department, a division with a probable focus on space missions. At the time of the dissolution of the PLASSF in April 2024, General Ju had not been seen in public for some time and was rumored to be under investigation for corruption.

In December 2020, Li Wei was named Political Commissar of the PLASSF. Previously, he served as Political Commissar of the Xinjiang Military Region in 2016, and as a member of the Standing Committee of the Party Committee of the Xinjiang Uygur Autonomous Region and Political Commissar of the Xinjiang Military Region in 2018. In April 2024, he was named Political Commissar of the ISF.

Bi Yi served as the Deputy Commander of the Strategic Support Force. Previously, he was appointed commander of the Hunan Provincial Military Region and in 2022 served as Deputy Directory of the Training Management Department of the Central Military Commission. In April 2024, he was named the Commander of the ISF.

Zheng Junjie was Commander of the Network Systems Department, now redesignated as the Cyberspace Force. Previously, he served as the former deputy director of the GSD's 3PLA and the President of the People's Liberation Army Information Engineering University.

Hao Weizhong is the current Commander of the Aerospace Force, assuming the role in 2023. Before rising to this position, he served as the Deputy Commander of the SSD. Previously, he was the Chief of Staff and Commander of the Taiyuan Satellite Launch Center.

PLAA Aviation Branch

Overview

The aviation branch of the PLA Army (PLAA) is relatively new. The PLAA began planning to establish an aviation branch in 1986, and it was not until 1988 that it established its first helicopter unit within a group army in Northern China.[120] However, by the end of the first decade of the 21st century, the branch had grown to include an aviation regiment in each military region except the Nanjing Military Region, which had two regiments. The PLAA's aviation branch has grown at an even faster pace in the past decade.

The mission of the PLAA's aviation branch is to provide close air support and reconnaissance, as well as airlift for air assault operations and the infiltration and exfiltration of special operations forces. Of course, the aviation branch also conducts noncombat missions, such as medevacking injured personnel and transporting personnel and materiel for deployments or disaster relief operations.

The development of the PLAA's aviation branch is key to the modernization of the PLAA. The PLAA's modernization program initially focused on rationalizing and modularizing the structure of the force; now its focus is on improving its capability to conduct combined-arms operations in multiple domains and environments, for which the aviation branch is essential. The PLAA's aviation branch is still in the process of modernizing its fleet of helicopters. Perhaps attesting to the difficulty of developing aircraft, almost all the PLAA's helicopters are either fully of foreign design or are based on foreign designs. For the first two decades of the aviation branch's existence, the branch did not even have a proper attack helicopter, relying instead on a modified French civilian helicopter to fulfill that role. However, this was just a stopgap; throughout the past three decades, the PLA has worked to develop more appropriate designs, which have rapidly been operationalized in the last decade and are being fielded at a steady pace.

Types of Helicopters Operated by the PLAA Aviation Branch

Transport

Variants of the Mi-8

Figure 30: PLAA helicopter from Mi-8 series

The PLAA has acquired perhaps as many as 400 of the export variants of the venerable, medium-lift Mi-8: the Mi-17; the Mi-17-1V, Mi-17V-5, and Mi-17V-7, which are all optimized for high-altitude flight and can also be armed; and the Mi-171Sh and the Mi-171E, which is the most numerous variant in the aviation branch.[121] The PLAA's airborne EW and AEW&C platforms are based on these variants. Because of these helicopters' versatility and reliability, it is likely that the PLAA will operate most of them until the end of their service lives.

Figure 31: Z-8B helicopter

The Z-8A and Z-8B are variants of the PLAN's Z-8, a reverse-engineered version of the medium-lift Aérospatiale's SA 321 Super Frelon.[122] The Z-8B is recognizable by its faired engine cowlings (see above image). The Z-8A/B has appeared as a hand-me-down from units receiving newer designs, likely indicating that the PLAA seeks to eventually replace these types.

Figure 32: Z-8G helicopters

The Z-8G is a derivative of the Z-18, which is itself an improved variant of the Z-8. The Z-8G is optimized for flight at high altitudes, which is necessary in Western China.

Figure 33: Z-8 L helicopter

The Z-8L, a derivative of the Z-8G, is the PLAA's first heavy-lift helicopter. It is wider than the Z-8G, so it can possibly accommodate small all-terrain vehicles.

Figure 34: Z-20 helicopters

The Z-20 appears to be a reverse-engineered version of the medium-lift Sikorsky UH-60. It is rapidly replacing the Z-8A/B and is likely to become a mainstay of transport in the PLAA's aviation branch, along with the Z-8G and Z-8L.

Attack

Figure 35: Z-9 helicopter

The Z-9, an armed variant of the license-built Aérospatiale SA 365, is a medium-lift transport helicopter. It was the PLAA's primary attack helicopter until the Z-10 began to supplant it in the last decade. It is still in use in about half of the PLAA's aviation units, but its inappropriateness for attack and even reconnaissance roles will likely drive the PLAA to replace it as soon as possible.

Figure 36: Z-10 helicopter

The Z-10 is an entirely original design, though it was initially designed by Kamov. It is the PLAA's first proper attack helicopter and is quickly supplanting the Z-9.

Reconnaissance

Figure 37: Z-19 helicopter

The Z-19 appears to be derivative of the Z-9. It is designated as an attack helicopter, but lacks a cannon and is sometimes seen with a mast-mounted radar. It has been observed to cue targets for the Z-10 in training exercises, raising the possibility that it is intended to function primarily as a reconnaissance helicopter.

Force Employment

The PLAA's aviation branch routinely trains to execute its range of missions. Aviation brigades rotate to training grounds in different regions of the PRC in order to practice operating in different climates and altitudes. They provide airlift in the PLAA's special operations forces' training and regularly train with elements from other combat arms, such as infantry and armor. However, the variety and tempo of all this training is a recent phenomenon, only beginning within the latter half of the past decade. Therefore, the aviation branch's proficiency in these subjects is not likely to be very high at present, but the branch's efforts are serious, and its proficiency will almost certainly improve over the next several years.

Overwater flight training has become more frequent in the past two years. Not only are pilots practicing individual skills in these training events, including nighttime flight and attacking targets at sea, but their units are also practicing operating from improvised airfields, and the participation of air defense units in these training events has helped the aviation branch refine its tactics for avoiding detection while flying above the sea.[123] This will be essential if the aviation branch is to support a PLA invasion of Taiwan. In such a scenario, the aviation branch is expected to support the infiltration of special operations forces, conduct air assaults to seize key terrain or facilities, and provide close air support to the invading forces, perhaps even against maritime targets, all of which will require its pilots and aircraft to crisscross the featureless Taiwan Strait.

Organization and Command & Control

The PLAA's largest operational formation is the group army, which is roughly equivalent to a corps of the U.S. Army. Each of the PLAA's group armies has an aviation brigade. The Xinjiang and Tibet Military Regions, regional commands in the Western Theater Command, are organized much like group armies themselves, and each has its own aviation brigade. Therefore, the PLAA has a total of 15 aviation brigades. Two of the PLAA's aviation brigades are air assault brigades. Except for these two air assault brigades and the Xinjiang and Tibet Military Regions' units, the designation of each unit follows its parent unit's designation.[124]

The PLAA's Aviation Brigades

Theater	Group Army	Aviation Brigade
Eastern	71st Group Army	71st Army Aviation Brigade
	72nd Group Army	72nd Army Aviation Brigade
	73rd Group Army	73rd Army Aviation Brigade
Southern	74th Group Army	74th Army Aviation Brigade
	75th Group Army	121st Air Assault Brigade
Western	76th Group Army	76th Army Aviation Brigade
	77th Group Army	77th Army Aviation Brigade
	Xinjiang Military Region	84th Army Aviation Brigade
	Tibet Military Region	85th Army Aviation Brigade
Northern	78th Group Army	78th Army Aviation Brigade
	79th Group Army	79th Army Aviation Brigade
	80th Group Army	80th Army Aviation Brigade
Central	81st Group Army	81st Army Aviation Brigade
	82nd Group Army	82nd Army Aviation Brigade
	83rd Group Army	161st Air Assault Brigade

The PLAA's aviation brigades are administratively, and usually operationally, subordinate to their parent group armies. Group armies are administratively subordinate to the theater armies and are operationally subordinate to the theater commands. However, group armies seem to be primarily, but not exclusively, administrative formations themselves, and they may not always exercise operational control over their subordinate units in wartime. Therefore, if a theater

Figure 38: WZ-6 unmanned aerial reconnaissance vehicle launch

command gives a group army responsibility for operations in a certain sector during a campaign, then the group army is likely to retain operational control over its aviation units. But it is also conceivable that it would attach an aviation unit to a task force or place an aviation unit under the direct command of the theater's land component commander for more limited operations.

The exact composition of the PLAA's aviation and air defense brigades varies depending on modernization priorities and local requirements. The aviation brigades generally include four transport battalions, two attack battalions, and one reconnaissance battalion, and they have been observed to have at least two attack battalions and four battalions of another type, as well as a maintenance battalion.[125] Air assault brigades may have as many as six transport battalions and as many as three infantry battalions. Each battalion is estimated to have, or eventually have, 8 to 12 helicopters. Aviation brigades have also been observed to have unmanned aerial vehicle (UAV) companies that operate reconnaissance drones,[xix] primarily the WZ-6 tactical reconnaissance UAV, and are likely subordinate to a combat support battalion or a combined combat and combat service support battalion.[126]

The following table lists the types of helicopters that have been confirmed to exist in each of the PLAA's aviation brigades within the past four years. It has been observed that older types of helicopters are redistributed to brigades operating even older types as newer types are introduced, so it is likely that brigades in the following table possessing a mix of older and newer types have shed or will soon shed their older types. The lack of confirmation that a brigade operates the Z-19 should not be interpreted to mean that it does not operate the Z-19 or that it does not have a reconnaissance battalion. The PLAA categorizes the Z-19 as an attack helicopter, so it is also possible that the Z-9, for example, fulfills the role of reconnaissance in those brigades operating the Z-10 but not the Z-19. The types marked with an asterisk are those whose existence was last confirmed more than two years before and whose continued existence in the brigade is increasingly unlikely due to the introduction of newer types in the same brigade.

[xix] Aviation brigades are not the only units in the PLAA that operate UAVs, so they are not solely responsible for providing UAV-based support. Artillery brigades operate UAVs for spotting, and it is very likely that other types of units, such as special operations forces, have organic UAV assets.

Types of Helicopters Operated by Each PLAA Aviation Brigade

Theater	Aviation Brigade	Helicopter Types		
		Transport	Attack	Reconnaissance
Eastern	71st Army Aviation Brigade	Z-8A, Z-8B, Z-20	Z-9	Z-19
	72nd Army Aviation Brigade	Mi-17, Z-20	Z-9*, Z-10	
	73rd Army Aviation Brigade	Mi-17, Z-20	Z-10	
Southern	74th Army Aviation Brigade	Mi-17	Z-9*, Z-10	
	121st Air Assault Brigade	Z-8B*, Z-8G, Z-20	Z-10	Z-19
Western	76th Army Aviation Brigade	Mi-17, Z-8G	Z-10	
	77th Army Aviation Brigade	Mi-17	Z-9*, Z-10	
	84th Army Aviation Brigade	Mi-17, Z-8G, Z-20	Z-10	
	85th Army Aviation Brigade	Mi-17, Z-8G, Z-20	Z-10	
Northern	78th Army Aviation Brigade	Mi-17	Z-9	Z-19
	79th Army Aviation Brigade	Mi-17	Z-9, Z-10	Z-19
	80th Army Aviation Brigade	Z-8A, Z-8B, Z-8G	Z-9*, Z-10	Z-19
Central	81st Army Aviation Brigade	Mi-17	Z-9*, Z-10	Z-19
	82nd Army Aviation Brigade	Z-8A, Z-8B	Z-9*, Z-10	Z-19
	161st Air Assault Brigade	Mi-17, Z-8G, Z-8L, Z-20	Z-10	Z-19

Leadership and Personnel

The PLAA's pilots are all officers. The PLA does not have warrant officers. The PLA does not separate officer and technical training; officer candidates generally undergo officer training in the same schools where they undergo training in a particular field. However, the PLAA's flight academy does not conduct its pilot candidates' officer training. Instead, there appear to be at least two paths to becoming a pilot in the aviation branch. Apparently, prospective pilots can undergo perhaps as many as four years of officer training and aviation education at the PLAA's Engineering University before undergoing one and a half years of flight training at the PLAA's Aviation Academy.[127] Alternatively, prospective pilots may first enter the PLAAF's Aviation University, where they undergo almost four years of officer training and education in aviation before transferring to the PLAA's Aviation Academy, where they undergo one and a half years of flight training.[128] Pilot candidates fly 180 hours during this period.[129]

Until 2022, all new pilots were likely to undergo another year of transition and combat training in their assigned units after graduating from the Aviation Academy. In early 2020, it was reported that an unspecified, but limited, number of pilot candidates at the academy were training to operate the Z-10 and the Z-19 helicopters.[130] This facilitated a new program at the academy, the "two levels with operational aircraft" program. The "two levels with operational aircraft" program certifies pilot candidates to operate the academy's basic trainers,[131] as well as "advanced" types such as the Z-9, Z-10, and Z-19.[132] Consequently, new pilots graduating from the program do not need to undergo transition training for these types of helicopters after being assigned to an operational unit, reducing the burden of training in those units.[133] The program was implemented from the academic year of 2020 on, and every pilot candidate in every class since then has trained in the program.[134]

Most of the "military" leaders of the PLAA's aviation units are aviators themselves: people who have earned the special-class flight rating. As one would expect, then, the commanders of helicopter battalions, too, are aviators, generally those who have earned the first-class flight rating. Unlike in the PLAAF and the PLAN, it is not unusual for at least political instructors, political officers at the company and battalion levels, in the PLAA's aviation branch to be aviators themselves, judging from the fact that they often wear flight suits and have earned flight ratings. Political officers in the PLA are expected to serve as counselors as well as commanders, so these political officers' operational experience should help them better connect with their troops and make better operational decisions when the need arises.

PLAA Air Defense Branch

Overview

In contrast to its aviation branch, the PLAA has had air defense units since the late 1940s, but until the reforms beginning in 2016, the PLAA's air defense branch was not rationally organized for modern warfare, mostly consisting of large and separate anti-aircraft artillery (AAA) and air defense formations. The reorganization of the PLAA that began in 2016 resulted in the amalgamation of AAA, air defense, and even electronic warfare (EW) elements into single air defense and combined-arms brigades. The PLA has also had EW units for decades, with its first being established in 1958.[135] However, like its air defense units, until the reforms of the last decade, the PLAA's EW units were direct-reporting units of the military regions, so they functioned independently and were therefore not well integrated into the training and operations of the PLAA's other units.

The mission of the PLAA's air defense branch is to provide point defense of PLAA units and facilities from aerial threats. Those air defense elements of the PLAA's combined-arms brigades are more narrowly focused on the defense of the brigade from the same. PLAA air defense units may also support the PLA's overall integrated air defense system. However, the shorter range of the PLAA's air defense systems compared to those found in the PLAAF and the PLAN is a substantial limiting factor.

The PLAA's air defense units are well equipped with a variety of mobile, modern weapons systems. Air defense brigades generally operate a mix of the HQ-7B short-range surface-to-air missile system, the HQ-16 medium-range SAM system, and the HQ-17 (tracked) and HQ-17A (wheeled) short-range SAM systems, in addition to the PG-99 towed AAA system. The air defense battalions of the PLAA's combined-arms brigades seem to be primarily armed with the HQ-17 or HQ-17A and the PGZ-04 or PGZ-09 self-propelled AAA systems. Both types of units are also equipped with man-portable air defense systems (MANPADS).

Figure 39: HQ-7B SAM system

Figure 40: HQ-16 SAM system

Figure 41: HQ-17A SAM system

Figure 42: PGZ-09 AAA system

Force Employment

In the past, the PLAA's air defense branch was hindered more by its organization than its armament and equipment. The post-2016 reorganization of the PLAA's air defense units has helped promote better integration with other branches for combined-arms operations. Moreover,

of all the branches of the PLAA, the air defense branch seems to most frequently participate in joint training, mostly with the PLAAF's air defense units. The PLAA's air defense units have digitized their maintenance of the air picture and have established joint datalinks with the PLAAF's air defense units. They have also fully integrated EW into their training.

Organization and Command & Control

Like the aviation branch, each of the PLAA's group armies had an air defense brigade, and the Xinjiang and Tibet Military Regions each have an air defense brigade. However, in 2022, the 72nd Group Army's air defense brigade was reorganized into a long-range artillery brigade. Therefore, the PLAA has a total of 14 air defense brigades. In addition, each group army has six combined-arms brigades that each have an air defense battalion. Except for the Xinjiang and Tibet Military Region units, the designation of each unit follows its parent unit's designation.

The PLAA's Air Defense Brigades

Theater	Group Army	Air Defense Brigade
Eastern	71st Group Army	71st Air Defense Brigade
	73rd Group Army	73rd Air Defense Brigade
Southern	74th Group Army	74th Air Defense Brigade
	75th Group Army	75th Air Defense Brigade
Western	76th Group Army	76th Air Defense Brigade
	77th Group Army	77th Air Defense Brigade
	Xinjiang Military Region	84th Air Defense Brigade
	Tibet Military Region	85th Air Defense Brigade
Northern	78th Group Army	78th Air Defense Brigade
	79th Group Army	79th Air Defense Brigade
	80th Group Army	80th Air Defense Brigade
Central	81st Group Army	81st Air Defense Brigade
	82nd Group Army	82nd Air Defense Brigade
	83rd Group Army	83rd Air Defense Brigade

The PLAA's air defense brigades are also administratively and, usually operationally, subordinate to their parent group armies, but just as with the aviation branch, whether an air defense brigade is controlled by its parent group army is a situational matter. A group army may control its own air defense brigade as it works to secure a sector over which it has responsibility,

or an air defense brigade may be placed under the direct command of the theater's air component commander for more limited operations.

Just as with the aviation branch, the exact composition of the PLAA's air defense brigades varies based on modernization priorities and local requirements. The PLAA's air defense brigades have been observed to have four missile battalions and at least one antiaircraft artillery battalion, as well as one electronic warfare battalion, one combat service support battalion, and even one quartermaster battalion.[136]

China's Defense Industrial Base

While it is necessary to focus on the elements of China's military forces, a complete understanding requires knowledge of the support infrastructure, industrial base, and Military-Civil Fusion (MCF) that equips, deploys, enables, and sustains China's capability and capacity to employ military force. The following section has two parts: the first examines key aspects of China's defense industrial base (DIB) and the second describes their support of the PLA's requirements for the research, development, and acquisition of air and space platforms.

The scale and growth of China's economy mean that military production has probably not yet imposed an undue economic burden. In fact, the share of gross domestic product (GDP) spent on the DIB, along with other costs associated with military modernization, has remained under 2% of GDP from 2003-2022 in the official defense budget. While actual defense expenditures are hard to determine, in higher estimates, China's defense spending still only accounts for around 2.3-2.4% of GDP. Moreover, China's defense expenditures have slowly decreased from 9-10% of its total national budget in the 1990s to about 6% in 2023, indicating the CCP may have room to increase this proportion again if necessary. More broadly, from 1980-2022, China's economy grew 9.1% annually in real value terms. By 2022, China's GDP reached $18.0 trillion, second only to that of the United States at $25.5 trillion.[137]

A large economy alone does not guarantee innovation nor a strong DIB. Developing an ecosystem for linking and resourcing companies, research organizations, and universities throughout the development pipeline across industrial and service sectors is a complex endeavor for any country. In terms of the DIB in particular, Chinese and Western researchers note that while China could once focus its resources on modernization, it has now reached a level at which it faces difficult choices between investment in modernization and force readiness and sustainment, a choice that peer military powers have faced for some time. The choices China regarding the organization of its DIB will have long-term impacts due to the time necessary to build relationships across sectors and the potential for delays from policy uncertainty.

Military-Civil Fusion[138]

With an awareness that the DIB can be a driver of economic development and military strength, Beijing has leveraged the DIB to spur the broader civilian economy through its Military-Civilian Fusion strategy (MCF). MCF has gone through various iterations, starting with Deng Xiaoping's focus on keeping the defense sector alive during peacetime and economic reform in the 1970s. Starting in 2017, Chinese leaders and scholars have tried to further articulate how MCF should support national defense and economic strategies. Chinese media have reported on Xi Jinping's speeches at the 19th Party Congress:

> The ultimate goal of MCF is to build up China's unified military-civil system of strategies and strategic capability, that is, to achieve a balance between national development and national security, to unify building a prosperous nation and a strong military…to form a strategic posture that enables the integrated deployment of politics, economy, military, science and technology, diplomacy, and culture to enhance the country's overall strength and strategic competitiveness...[139]

Military-Civil Fusion seems like a counterpart to the American term civil-military integration (CMI), but in reality, it is far deeper and more complex. Whereas, according to the U.S. Congressional Office of Technology Assessment, America's CMI is "cooperation between government and commercial facilities in research and development (R&D), manufacturing, and/or maintenance operations," China's Military-Civil Fusion strategy is a state-led, state-directed program and plan to leverage all levers of state and commercial power to strengthen and support the armed wing of the Communist Party of China, the People's Liberation Army (PLA). China's Military-Civil Fusion program is not new. Every leader since Mao Zedong has had a program to compel the "commercial" and "civil" parts of Chinese society to support the PLA. These efforts have gone by different terms, Military-Civil Integration, Military-Civil Fused Development, etc. General Secretary Xi Jinping has elevated the concept to Military-Civil Fusion. But is all cases, it is the "Military" that comes first. Whereas in the United States there is a partnership for spin-off and spin-on technologies, with the goal of assisting commercial companies as well as the military, this is simply a happy coincidence when, and if, it happens in China. Since Xi Jinping's assumption of power, the role of the military and the importance of MCF have markedly increased. General Secretary Xi has clearly switched the emphasis from Deng Xiaoping's famous statement. While most remember the first part of Deng's saying, *taoguang yanghui* ("韬光养晦"), which is generally translated as "bide your time, and hide your capabilities," most Americans, and westerners, seem to forget there was more in his dictum. The full quote is: "冷静观察, 稳住阵脚, 沉着应付, 韬光养晦, 善于守拙, 决不当头, 有所作为." It is the last four characters that now seem to have the emphasis, loosely translated as "to achieve some goals" or "get something done." This explains China's growing assertiveness and emphasis on the final piece of Deng Xiaoping's "Four Modernizations," the military.

As the name suggests, the strategy hopes to achieve a state of "deep fusion" through the integration of the two essential building blocks: the "military" and the "civil." The "military" includes every aspect of the national defense and force-building endeavor, including the armed forces, national defense technology, industry, facilities, mobilization, education, resources, as well as the major operational domains. The "civil" refers to fields in the economic and social system that are closely related to national defense and force-building, such as the national science and technology and industrial system, the national talent education and training system, the national social services system, and the national emergency management system, as well as emerging domains and nascent technological areas such as maritime, space, cyberspace, and artificial intelligence that are closely linked to the generation of "new type combat capabilities." The optimization of national resource allocation and the generation of combat readiness and economic benefits are near-term, basic goals of the strategy. Its ultimate goal, according to Xi and Chinese experts, is the "gradual build-up of China's unified military-civil system of strategies and strategic capability." From Chinese writings, MCF is clearly not a simple addition to China's other national strategic priorities, but rather a strategy whose components are to be woven into China's system of national strategies to form an organic, powerful, and comprehensive national strategic system that will advance the PRC's overarching security and development goals.

Industrial organization in China is characterized by a mix of state-owned enterprises (SOEs), mixed-ownership enterprises (MOEs, private and government investment with the government controlling a 51% or higher ownership stake), and privately owned enterprises. The latter continue to be the principal driver of China's growth and efficiency, but the SOEs have

retained the most state support. Eight SOEs form the DIB's backbone: AVIC,[xx] China Aerospace Science and Technology Corporation (CASC), China Aerospace Science and Industry Corporation (CASIC), China North Industries Group Corporation (NORINCO), China South Industries Group Corporation (CSGC), China State Shipbuilding Corporation (CSSC, merged with China Shipbuilding Industry Company [CSIC] in 2019), China National Nuclear Corporation (CNNC), and China Electronics Technology Group Corporation (CETC). Over the past ten years, the revenues and assets of these firms increased by over 150%, a slower rate than the economy as a whole but sufficient to now rank among the likes of Raytheon, BAE, and Northrop-Grumman as some of the world's largest defense companies.

China's leaders understand that the lofty goals of MCF are currently within reach and has set up intermediate milestones to keep the enormous number of players on the same path. According to Chinese documents on MCF strategy, the near-term goal is to improve and deepen cross-sectoral integration between the national defense and economic systems to ensure the optimal use of resources, in addition to accelerating the development of military capability and capacity. China has prioritized several areas for priority access to resources in the near and medium term (see Figure 43 below).[140]

Central and local government procurement is a large contributor to the DIB but alone cannot account for its growth. SOEs have raised private capital by creating publicly traded and privately owned subsidiaries and MOEs.

[xx] For more information on AVIC, see J.J. Long, Thomas Corbett, and Dan Shats, *Organization and Structure of the Aviation Industry Corporation of China (AVIC),* (Montgomery, AL: China Aerospace Studies Institute, 2020), https://www.airuniversity.af.edu/CASI/Display/Article/3643494/organization-of-the-aviation-industry-corporation-of-china-avic/.

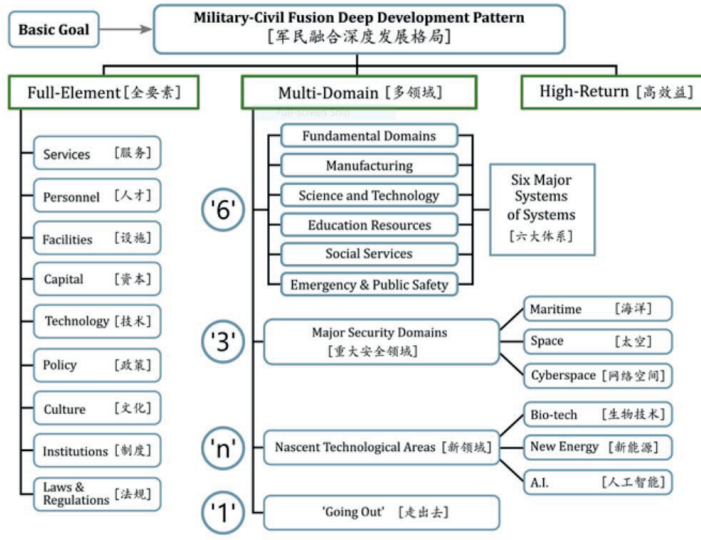

Figure 43: MCF development pattern

China is the fifth-largest arms supplier in the world, exporting a variety of equipment including UAVs, fixed-wing aircraft, and precision-strike weapons, primarily via SOEs such as AVIC and NORINCO.[141] Chinese DIB firms have also raised capital by issuing asset-backed securities and have benefited from "government guidance funds," set up by central and local governments. Other types of government support include tax breaks, free land, free utilities, and in some cases, even free facilities.

The logic of efficient resource use is wrought with difficult decisions and ongoing debates. In the opinion of key MCF academics, NUDT professors He Kun [贺坤] and Zeng Li [曾立], the core of the "MCF deep fusion" strategy lies in the need to continuously enhance efficient resource allocation, which, they argue, is essentially an economic issue. They make this argument because of concerns about the sustainability of defense spending and China's continuously slowing economic growth. This tension between the competing demands is likely to be even stronger in the near future, given that China's armed forces "are moving towards informatization and shouldering arduous tasks in following the trends of worldwide Revolution in Military Affairs." Central government R&D funding mechanisms have also been reformed to improve information and resource sharing.

China's Aerospace Sector

Shifts in the civilian market and military requirements are having a major impact on the Chinese aviation industry. Airport sharing between the PLA and the Civil Aviation Administration of China (CAAC) dates back to 1985. According to information provided by CAAC, as of 2017, China had a total of 64 military-civilian airports in operation, accounting for over 28% of all transport airports. Among them, 59 airports were shared by civil aviation and the PLAAF, accounting for more than 92%. The remaining five are believed to be shared with other services. *PLA Daily* reported in August 2019 that these 59 airports had jointly completed over 1 million flights and transported 92.21 million passengers since 2018, accounting for 7.3% of the national total.[142] In addition to sharing spaces, the industries have some natural cross-pollination as civilian aircraft manufacturers leverage new advanced techniques and meet the demand of the growing middle class for air travel.

The civilian aviation industry, working in tandem with the central government, is attempting to meet domestic demand with indigenously-produced aircraft. Broader manufacturing sector improvements, particularly the use of computer integrated manufacturing systems, which include a full range of processes and tools such as computer-aided design, modelling, quality control, 3D printing, and computer numerical control milling and lathing, have dramatically improved quality. Manufacturers are using new materials such as composites, carbon fiber, and titanium, which reduce radar cross-sections, save weight, and allow faster speeds in the construction of new airframes.

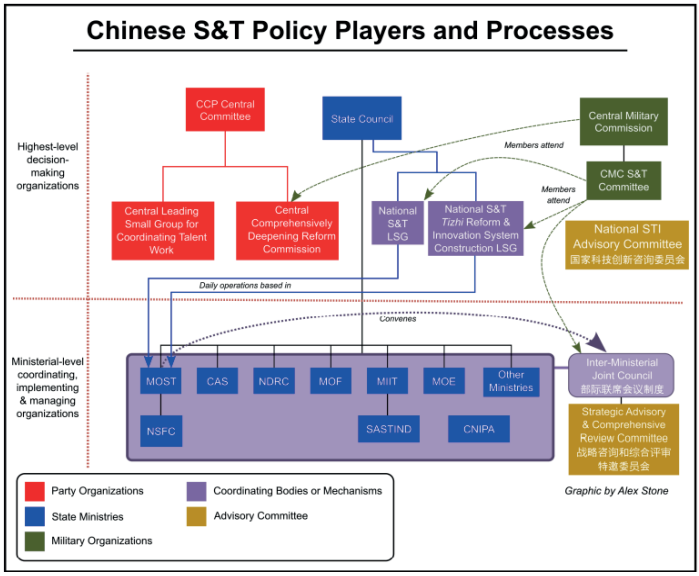

Figure 44: Science and technology policy landscape

PLA requirements, together with shifts in the operational use of aviation by the Naval Aviation and Army Aviation branches, drive the direction of military aviation R&D. One example of these requirements is the transition to a "strategic air force" in 2014. In an interview with *People's Daily*, Air Force Command College Professor Wang Mingliang [王明亮] described a "strategic air force" as necessarily possessing three capabilities: strategic defense capability across all domains; strategic attack capability, including the ability to conduct deep strikes against enemy positions regardless of terrain; and strategic power projection. 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.

Both the PLA Navy's aviation branch and the PLA Air Force have been the recipients of major upgrades over the past decade. Indigenous production of the Y-20 heavy-lift transport aircraft, the introduction of advanced variants of the H-6 bomber, and the ongoing development of an "H-20" bomber can all be understood as responses to this strategic guidance. As a result of advances in manufacturing and the use of other advanced systems, since 2000, projects appear to be completing their conception-to-test-flight phases more rapidly than before. AVIC's Hongdu Aviation Industry Group and CASIC's Hubei Sanjiang Aerospace Honglin Exploration Control Company are among the top-ten Chinese military companies based on the number of patents as of 2019, and, at present, large aviation factories are largely consolidated under the banner of the AVIC.

China has historically been overwhelmingly reliant on imports of foreign technologies, including for PLA modernization, but in recent years its DIB has made significant progress toward technological self-sufficiency. This process was well under way in the 2010s as part of MCF, but mounting trade restrictions on critical technologies and the global responses to Russia's invasion of Ukraine likely further pressed Beijing to rapidly reduce dependence on imports. In 2023, the DoD recognized that the PLA had reached a point of "minimal reliance" on imports and was capable of developing systems "comparable to the most advanced U.S. and Russian equipment."[143] In aviation specifically, China's DIB has continued to make progress on its domestically produced WS series of jet engines, making it much less reliant on imported technology for the PLA's most advanced aircraft.

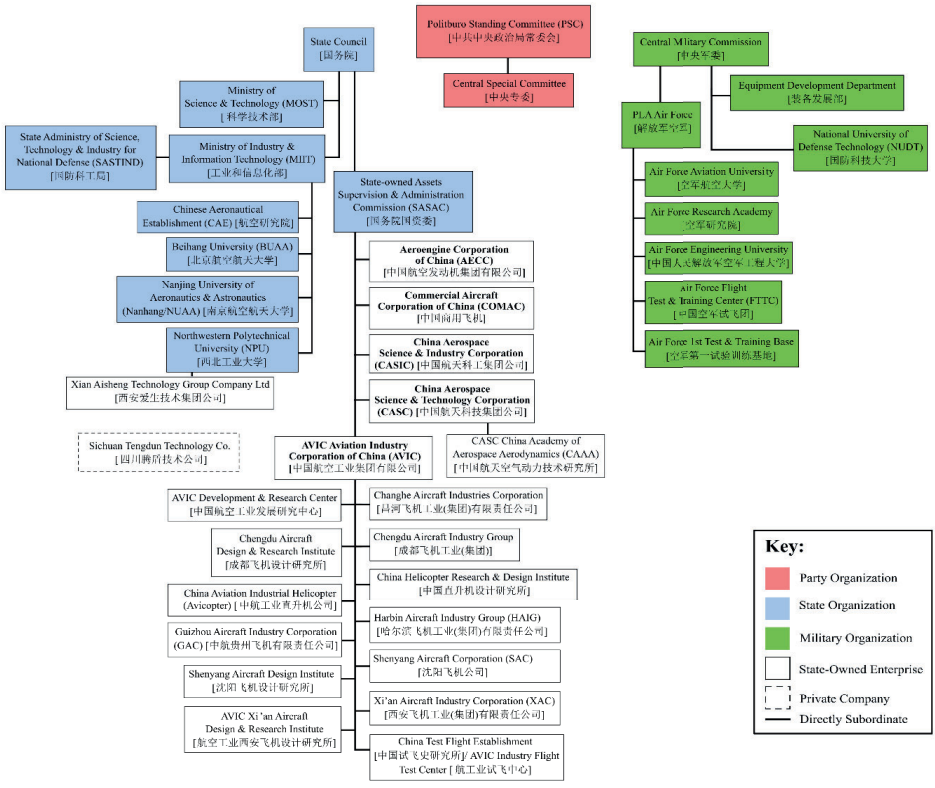

Figure 45: China's aviation industry

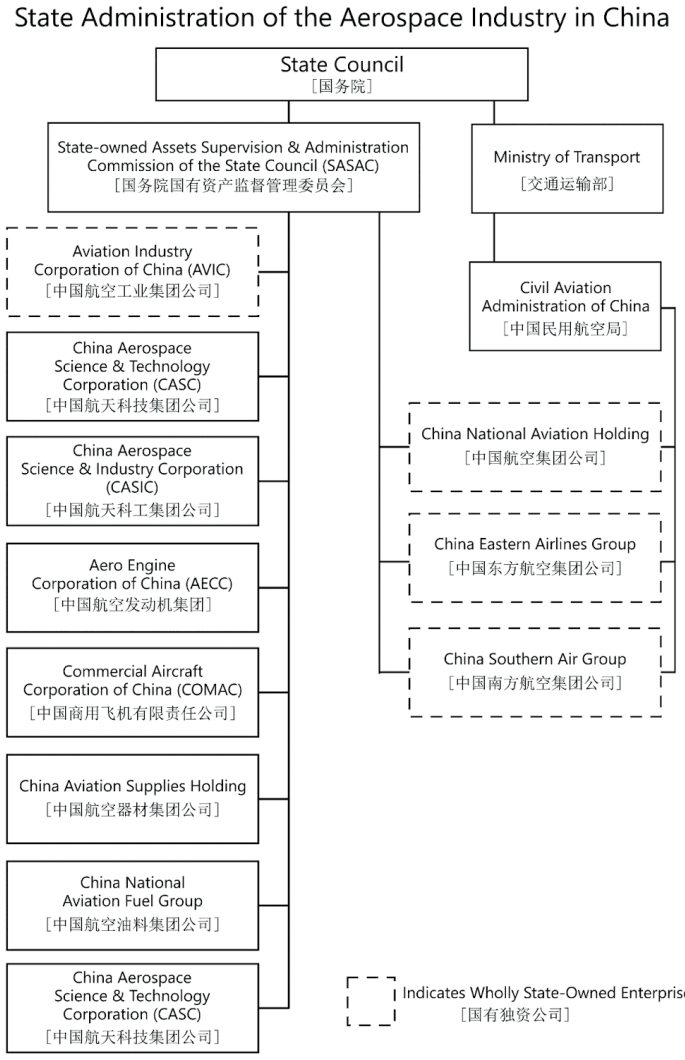

Figure 46: State administration of the aerospace industry in China

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