
6. PLA AIR FORCE LOGISTICS AND MAINTENANCE: WHAT HAS CHANGED?

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“In the PLA Air Force headquarters’ Equipment and Technical Department, one can press a key on a computer keyboard and immediately know any Air Force plane’s maintenance conditions. If one stands at the meteorological center’s computer terminal, one sees changes in global meteorological conditions. All airfields in the country have been equipped with a multi-functional computerized and telecommunication command guarantee system that shows the Air Force flight guarantee system has reached a new standard. In order to meet the needs of modern air combat, the Air Force has made significant headway in developing a flight training guarantee system and relevant facilities and has maintained a quality flight training rate at and above 99.8 percent for several years running.”²

“The Chinese Air Force has reached world standards for its aircraft lifespan ascertainment technology, completing research on 17 aircraft models and their airborne equipment. This has saved almost 3 billion yuan and added almost three million hours in flight duration. The application of research results for assessing aircraft service life has better solved major, tough problems concerning structural fatigue and breakup of some 1,000 aircraft, which were endangering flight safety.”³

INTRODUCTION

During the 1990s, China’s People’s Liberation Army Air Force (PLAAF) has embarked on a long, uneven, but positive, journey to modernize its obsolescent force of 1950s and 1960s vintage combat aircraft. They have developed, produced, and purchased new aircraft, formed a rapid reaction force, trained with new combat tactics, computerized some of their command centers, and revised logistics and maintenance support capabilities, as noted in the two quotes above.

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²Li Dehua and Rong Qingxiang, “Air Force Training Guarantee Systems Being Modernized With Each Passing Day,” *Jiefangjun bao*, October 17, 1995.

³Sun Maoqing, “Air Force Technological Advances,” *Xinhua*, June 5, 1996. Sun Maoqing and Xu Zhuangzhi, “Aircraft Lifespan Technology Reaches World Standards,” *Xinhua*, May 12, 1998.

In order to modernize rapidly, the PLAAF and China's aviation industry have had to seek foreign assistance for entire weapon systems, subsystems, or technical support. For example, the Air Force has purchased two regiments of Russian-made Su-27 fighters and several IL-76 transports. They have also developed an airborne refueling capability and have been negotiating with Russia and Israel for airborne early warning aircraft. In addition, China's aviation ministry will soon begin co-producing around 200 Su-27s and is developing the indigenous F-10 fighter with Russian and Israeli assistance, as well as producing an upgraded F-8II with Russian equipment.

The Air Force has established a "Blue Army" aggressor unit, which has exercised with numerous units, and has also established a training base to develop new combat tactics, in order to fight in a future high-tech war. Besides new training techniques, one of the biggest challenges the PLAAF faces is providing logistics and maintenance support to keep its current fleet of aircraft flyable and integrating these new aircraft into the inventory. The PLAAF has set up computerized logistics and maintenance command centers at unit and higher levels, and has begun to develop logistics and maintenance support systems for a rapid deployment force. The PLAAF has also established a Davis-Monthan-like facility to store over 1,000 aircraft removed from the inventory. Most important, they are in the process of moving from concept to implementation in these areas.

It should be noted here that there are increasingly divergent views among PLA-watchers about the scope and pace of China's military modernization. For example, a 1997 publication entitled *Chinese Views of Future Warfare* includes the translation of about 40 authoritative articles written in China about the revolution in military affairs (RMA). This book, edited by Michael Pillsbury, provides a good look at where the Chinese would like to be in 10–20 years. In addition, Major Mark Stokes, a former U.S. Air Force assistant attaché in China, has produced an as-yet unpublished paper entitled "China's Strategic Modernization: Implications for U.S. National Security." This document is one of the most detailed studies of China's specific R&D programs designed to rapidly modernize the PLA in terms of information dominance, long-range precision-strike capabilities, and aerospace defense modernization.⁴ Both of these books point to major changes in the PLA's future weapon systems and war fighting capabilities.

Although there are divergent views about the PLAAF's future capabilities, the purpose of this paper is to review information available on current changes in the PLAAF's logistics and maintenance systems in response to general guidance from the General Logistics Department (GLD) and to changes in the Air Force's tactical training concepts and techniques. The paper begins by defining exactly what is meant by the terms "logistics and maintenance" in the PLAAF. Next, there is a discussion about a set of general guidelines, which were laid out by the General Logistics Department in 1995, for modernizing the overall People's Liberation Army's (PLA) logistics system. In order to understand how and why the PLAAF is trying to

⁴Michael Pillsbury (ed.), *Chinese Views of Future Warfare*. See also Mark A. Stokes, "China's Strategic Modernization: Implications for U.S. National Security," Maxwell AFB, AL: USAF Institute for National Security Studies, October 1997.

change its logistics and maintenance practices, there is a discussion of some of the changes in PLAAF aviation training. Having laid out these changes, there is a discussion of how the various Military Region Air Force (MRAF) logistics departments have responded to the new challenges.

WHAT IS PLAAF LOGISTICS AND MAINTENANCE?

The best way to understand what is meant by the terms logistics and maintenance in the PLAAF is to examine the logistics and maintenance organizational structure.

The PLAAF's Logistics Department's basic mission is to provide supplies for construction, operations, training, and daily life. The Logistics Department's command staff includes a director, political commissar, two deputy directors, a chief of staff, and two deputy chiefs of staff.

The Logistics Department has 18 subordinate departments, bureaus, divisions, and offices that are responsible for individual aspects of the overall logistics system. These include the Headquarters, Political, Finance, Quartermaster, Health, Armament, Transportation, Fuels, Materials, Airfield Construction, Airfield and Barracks Management, Air Materiel, and directly subordinate Supply Departments; the Audit, Engineering Design, and Research Bureaus; the Administrative Division; and the Production Management Office. Each of these 18 offices is represented throughout the chain of command from the General Logistics Department (GLD) through the Headquarters Air Force all the way down to the lowest unit level.

The PLAAF's Equipment and Technical Department, which combined the Aeronautical Engineering Department and the Equipment Department in 1994, is responsible for determining how much and what types of equipment should be procured; for general management of equipment; for aircraft and engine maintenance, repair, and procurement; for aviation maintenance/repair research; and for aircraft ground-support equipment. The Logistics Department, not the Equipment and Technical Department, is responsible for maintenance of equipment belonging to anti-aircraft artillery (AAA), surface-to-air missiles (SAMs), radar, communications, or airborne troops/units. Although the Equipment and Technical Department is not responsible for SAMs or AAA maintenance, it is responsible for air-to-air missiles. Of note, within the PLAAF, the term technical merely refers to maintenance.

The Equipment and Technical Department has a director, at least two deputy directors, and at least seven second-level departments/offices/divisions: General Office, Political Department, Equipment Department, Field Maintenance Department, Procurement Department, Factory Management Department, and Administrative Division. Each of these offices has a mirror-image element down to the lowest unit level.

Whereas the PLAAF's Headquarters, Political, and Logistics Departments have always been subordinate to a higher-level PLA department (i.e., the General Staff Department/GSD, General Political Department/GPD, and General Logistics Department/GLD, respectively), the Equipment and Technical Department, and its

predecessor Aeronautical Engineering Department, did not have an equivalent higher-level department until the establishment of a fourth general office—the General Equipment Department/GED—in April 1998.

The PLAAF has 21 repair factories which employ 40,000 workers and carry out major aircraft and engine overhaul, as well as major and intermediate repairs. The aviation units also have repair factories, which are responsible for intermediate and minor repairs.

Maintenance personnel are trained in several ways, depending upon their rank (officer or enlisted). Officers are trained at the Aeronautical Engineering College in Xi'an, or at one of two Maintenance Technical Training Schools. There are eight Aviation Maintenance Training Regiments to train new enlisted maintenance troops.

Finally, there are PLAAF academies, schools, and training units to train logistics and maintenance personnel. In addition, the Logistics Department and the Technical and Maintenance Department also have several subordinate research institutes, such as the Maintenance, Aviation Medicine, Fuels, Clothing, Aviation Munitions, Four Stations Equipment, Capital Construction, and Aviation Repair Research Institutes.

General Logistics Department Guidance

The PLA's GLD conducted extensive analysis of logistics operations during the 1991 Gulf War and has tried to implement those portions that meet Chinese capabilities and requirements. While most open-source PLA articles on logistics are short on substance, a May 1995 article in the *Liberation Army Daily* by Major General Yang Chengyu, Director of the GLD's Headquarters Department, did a good job of laying out the challenges and concepts of a modernized logistics system for the PLA.⁵ In the article, General Yang stated:

The widespread application to the military arena of modern high-technology has brought many new features to local wars. These can be seen mainly in areas such as the rapid mobility of combat operations, the tight coordination of participating service arms, and the intensity of the logistics defense struggle. These new features of high-tech local wars are putting new and greater demands on logistical support. Technology determines tactics, with combat determining logistics. In order to adapt to the logistical demands of high-tech local wars, the PLA must adapt to the needs of rapid mobility combat by raising our contingency mobility support capacity. In rapid mobility operations by support units, communications and transportation are the keys.⁶

General Yang specified that:

laterally, the PLA needs to set up a joint logistics support system for all service arms, combining centralized supply with specialized supply. Vertically, the PLA needs to set

⁵Yang Chengyu, "On Adapting to the Demands of High-Tech Local Wars by Striving to Improve Our Military Logistics Support Capability," *Zhongguo junshi kexue* [*Chinese Military Science*], No. 2, May 20, 1995, pp. 95–98.

⁶*Ibid.*

up a three-grade reserve supply system combining strategic, campaign, and tactical logistics. In order for the PLA to set up joint logistics, we will need to act in line with our realities, having our own features and distinctions. In recent years, we have tested a network-type support division for our three service arms, achieving good results and accumulating the necessary experience. Grounded in that, we still need to create terms in all areas for gradually expanding our centralized supply status and factors. While our general need and model for all three service arms is centralized supply of interchangeable materiel, centralized repair of interchangeable materiel, centralized repair of interchangeable equipment, centralized reception and treatment of all wounded, and centralized organization of communications and transportation, all service arms need to preserve their individuality premised on adhering to generality.

General Yang continued, “While China is a great nation, our economy remains undeveloped. So with such glaring conflicts between military spending supply and demand, how are we to intensify our logistical combat readiness to raise our sustained support capability during wartime?”

- First, we need to solidly establish an overall concept. The only way that the defense establishment will have a solid material base and the PLA’s logistical support will have sustained follow-up support is if the national economy continues to grow.
- Second, our logistics personnel need to establish a firmer sense of management efficiency.
- Third, we need to give precedence to supporting priority force building.
- Fourth, we must have the capacity to effectively defend rear areas in order to protect our logistics survivability.
- Fifth, the matter of a centralized but flexible and discretionary logistics organization and command merits conscientious study.”

Finally, in a special *Liberation Army Daily* report in February 1996, an unidentified author stated that joint operations under high-tech conditions is a brand-new issue for the PLA, which lacks practical experience in this area. The PLA is also exploring theory, and there are many problems it needs to study and solve. Specifically, the PLA must emphasize research on basic theory of joint operations, then sum up, put in order, and disseminate the results. Based on the operational ideas of “overall operations and key strikes,” the PLA must establish, under high-tech conditions, the basic idea of “three service arms united for joint-force logistics support,” and mutually adapt it to guiding principles, command strategy, coordination and combat, and other theories, and gradually make it systematic.⁷

The essence of these articles is that the PLA intends to integrate the individual services’ logistics systems into a joint, coordinated logistics system as much as possible. However, before it can do this, it has to first understand the theory, decide how it fits into the PLA, disseminate the information, then test it out in small areas before it implements the concepts PLA-wide.

⁷Xu Genchu, “On Logistics Support in Joint Operations,” *Jiefangjun bao*, February 6, 1996.

CHANGES IN PILOT TRAINING LEAD TO LOGISTICS CHANGES

The PLAAF has definitely made progress in many of the areas General Yang described, but lags behind in others. While there is little information available about the PLAAF's logistics and maintenance support, most open-source Chinese articles discuss the PLAAF's history, operational concepts, aircraft, and training.

On the training and operational side, the PLAAF has established a "Blue Army" aggressor unit to simulate hostile forces against the "Red Army" both offensively and defensively. Furthermore, PLAAF pilots have intensified their training under different weather conditions, at lower altitudes, and, most significantly, over water. They have also practiced rapid deployment to fixed and auxiliary airfields. As a result, the Air Force has had to adjust its logistics and maintenance training and operations to meet these new challenges. These include computerizing individual logistics and maintenance operations, and then networking the computers within the unit and among different units at the same and higher levels. It also has meant establishing small logistics and maintenance teams capable of deploying by rail or air at a moment's notice to accompany the unit's aircraft deployment. As a result, the Air Force has had to adjust its philosophy concerning acquisition, storage, and distribution of spare parts. Therefore, before discussing the logistics and maintenance changes, it is appropriate here to first discuss the major trends in pilot training and where these trends are taking the PLAAF.

According to PLAAF commander Liu Shun Yao, Air Force aviation units during 1996 exceeded their annual training plan requirements by 1.8 percent and flight safety has remained up to the world's advanced level for 16 consecutive years.⁸ The A-class regiments, which have higher combat capability, now account for approximately 90–95 percent of the flight units' combat regiments, and 75 percent of pilots have now been trained to fly in all types of weather.⁹ In addition, all air division and regiment leaders are special-grade or first-grade pilots, and one-half of the pilots in the flight units are college-educated. Flight units generally carry out training in difficult subjects, including night-time flight in complicated weather conditions, guided-missile targeting practice, shooting missiles, operating marker lights, training over the ocean, low-altitude and super low-altitude flight, and emergency mobility maneuvering. The overwhelming majority of the flight units' combat regiments

⁸One has to take comments about the PLAAF's annual training plan and safety record with a grain of salt. For example, the PLAAF was involved in the huge joint exercises opposite Taiwan in early 1996, which obviously increased the planned flight training. In addition, according to a 1996 *Xinhua* report, a series of arresting cables was installed at various units, which safely arrested more than 140 aircraft that either aborted takeoff or overshot the runway during landing. This report indicates that there were numerous accidents that took place before the arresting cables were installed. In addition, General Cao Shuangming, the PLAAF's commander from 1992–1994, was relieved of duty because of an excess number of aircraft accidents during this time.

⁹Training at the "transition training bases" lasts for one year (100 to 120 flying hours). The pilots begin flying the F-5 for basic airmanship, then transition to the F-6 or F-7. Upon graduation, the pilots are expected to be capable of flying in "three weather conditions" (i.e., day and night visual flight rules [VFR], and day instrument flight rules [IFR]). "Four weather conditions" adds night IFR flights. Thereafter, annual flying hours vary according to the type of aircraft: bombers (80 hours), fighters (100–110 hours), and the A-5 ground-attack aircraft (150 hours). See *Dangdai Zhongguo kongjun* [Contemporary China's Air Force], Beijing: Zhongguo shehui kexue chubanshe, 1989, pp. 503–504.

conducted live-ammunition targeting practice in a combat environment. This type of training accounted for 45 percent of the planned annual training time.¹⁰

General Liu stated that the Air Force recently built and put into operation a modern, comprehensive air tactical training base marked by an actual combat environment and advanced facilities. This is of great significance to rapidly improving the air force's tactical training quality and fighting capacity and signals a new stage in China's Air Force tactical training. A salient characteristic of this tactical training base is that it enables training for Air Force units under actual combat conditions and on a real battlefield. The training base has air and ground tactical training ranges, simulated runways built to scale, a surface-to-air missile base, anti-aircraft gun positions, radar and radar support vehicles, and simulated "enemy" command posts, ammunition depots, and oil depots that look like real ones. There are also a large number of simulated tanks deployed in groups in combat positions. During an early-1997 live-fire exercise involving various types of planes, command posts of eight air divisions studied, tried, and explored tactics and conducted training on the base's advanced training systems and facilities.

General Liu described a command and control center at the training center, where training directors and air division commanders received air combat reports, directed air battles, communicated with combat planes in the air, monitored units in the exercise, and directed units' deployment and movement in a timely fashion through use of the base's advanced facilities. A monitoring, control, and appraisal system installed in the base's central command hall received timely information about planes, including flight path, course, speed, altitude, and other parameters through monitoring, automatic video recording, radar, and flight orientation systems, so as to provide training directors with accurate information for training results appraisal.

According to an April 1997 Liberation Army Daily article, since its founding in the late 1980s, a PLAAF unified "Blue Army" aggressor unit, composed of special-grade and first-grade pilots and equipped with advanced equipment, has "fought" numerous air battles with each and every Air Force fighter plane and attack plane unit on "battlefields" in the blue sky, in order to help improve the PLAAF's high-tech combat effectiveness and improve their knowledge of tactics. The specialized "Blue Army" has emerged as a strong "enemy unit" in simulated air battles and brought about a lot of changes to the Air Force's tactical training. In light of China's training realities, the specialized "Blue Army" unit has launched both fierce offensives and sudden raids, created true-to-life modern air fighting situations, provided no fighting

¹⁰Sun Maoqing, "Training Improves Air Force Combat Effectiveness," *Xinhua*, March 26, 1996. Sun Maoqing and Man Dongyan, "Air Force Flight Units Fulfill Training Mission," *Xinhua*, December 23, 1996. Neither of these articles attributed the excess training to the exercise conducted opposite Taiwan during March 1996 and the large exercise in the Gobi Desert in September, but this is the most likely cause. Sun Maoqing, "Make Efforts To Build Modernized People's Air Force," *Liaowang*, No. 15, April 14, 1997, pp. 20-21. Zhang Nongke and Zhang Jinyu, "Air Force Builds Modern, Comprehensive Tactical Training Base," *Jiefangjun bao*, October 28, 1996. There are often conflicting stories that relate the amount of training that PLAAF flying units receive. For example, an article in Volume 5 of the 1995 *Zhongguo Kongjun* [Air Force] magazine, discusses the number of sorties flown (54,506) over the eight-year period of 1987 through 1994 by an unidentified air division on the Leizhou Peninsula. However, assuming the division has at least 72 aircraft, this equates to 6,813 sorties per year or 94 sorties per aircraft per year and less than two sorties per week.

procedures or clues beforehand, and conducted simulated true-to-life confrontations.¹¹

The concepts developed at the training base and through the “Blue Army” are now being moved to the unit level, where several units have begun to turn these new combat theories and concepts into live-ammunition exercises. According to the Liberation Army Daily article, the PLAAF has obtained some initial results in important combat study areas, such as maneuverable combat, air attack, fighting for air supremacy, and night attack and defense. A new training syllabus has taken shape characterized by adaptability to combat situations based on future high-technology developments. The development of flight simulators as a means of efficient, high-technology training has also been fruitful. The simulation capabilities of the Air Force have evolved from electromechanical simulation to laser, electronic, and computer simulation; from technical simulation to tactical and campaign simulation; and from the simulation of a single armament or aircraft type to integrated simulation of the main battle arms combined with multiple aircraft types and various forms of weaponry. The modern scientific training methods have replaced the traditional ways of military training.

On several occasions, Air Force units have formed offensive and defensive exercise teams with Navy, Army, and Air Force anti-aircraft, radar, and missile troops to conduct exercises modeled on future warfare. According to one article, “Flying low-altitude bombing raids over the sea is usually thought of as deadly, since the sea and the blue sky look almost the same to the pilot. Pilots have flown large bomber groups less than 100 meters above the vast sea, which is indistinguishable from the sky by color, and have achieved good results in hitting all targets that were spotted. Some troops have successively organized experimental learning projects, such as flying close to strategic points at sea, launching surgical air strikes against enemy troops, waging offensive air campaigns, conducting over-the-horizon air combat, and imposing air and sea blockades.”¹²

In his interview, General Liu pointed out that a large two-day “offensive-defensive” exercise utilizing the PLAAF’s “Blue Army” unit was held in the Gobi Desert during September 1996. It was made clear from the very beginning that this exercise was to be conducted under unknown conditions, almost all the subjects in this exercise were new to its participants, including the “multi-typed aircraft joint offensive-counteroffensive against battlefield targets under electronic confrontation conditions” and the “coordinated attacks against airport targets and air interceptions in an multi-typed aircraft composition formation.” According to a prescribed principle, anything related to an exercise would not be leaked to either party in confrontation, including the deployment during different stages of the exercise, combat tasks, battlefield targets, or flight routes. The exercise, which began with the crash of a fighter en route, included mid-air fights to seize control of the air, air raids

¹¹Zhang Nongke and Zhang Jinyu, “‘Grindstone’ Confronts ‘Iron Wings’ in Blue Sky—Air Force Forms Unified ‘Blue Army’ Unit for First Time To Confront Airmen Units in Rotation,” *Jiefangjun bao*, April 28, 1997.

¹²Sun Maoqing, “Training Improves Air Force Combat Effectiveness.”

by attack planes and bombers after avoiding enemy intercepting planes, and airborne landing operations and anti-airborne landing operations.¹³

According to a May 1998 Xinhua report, the PLAAF recently completed producing the first full set of aviation lifesaving equipment for pilots flying over five different types of combat environments—sea, desert, tropical forest, cold zones, and plateaus. Because of China's vast territory, its complex climate and geographical environment, and its various aircraft models, accommodating a wide variety of lifesaving supplies in a small combat aircraft cockpit is a difficult problem. For a long time, there were no full sets of specialized aviation lifesaving equipment for Chinese military pilots flying over various geographical regions. As a result, pilots who were forced to parachute lacked a reliable guarantee for their safety. This new full set of aviation lifesaving equipment consists of specially prepared survival rations; a device for sterilization, purifying water, and producing heat; a multipurpose survival knife; other daily necessities; and communications apparatus such as a survival radio set, a signal flare, a target indicator, and various monitoring devices. In addition, according to the needs of different regions, the set is provided with protective emergency supplies such as a cold-proof sleeping bag, an inflatable rubber boat, an oxygen cylinder, snake and shark repellents, emergency energy-preserving pharmaceuticals, and a helicopter hoisting rescue device. Besides meeting the needs of future high-tech battlefields, this functionally steady and reliable survival equipment has widened the safety margin for the survival of Air Force pilots who bail out. It also has extensive applications for civil aviation, rescue and relief operations, and open-country surveys.¹⁴

The Air Force tested this survival equipment in its first aerial rescue test on the Qinghai-Tibetan Plateau in early 1998. The rescue operation involved parachuting onto the plateau, then conducting self-rescue and survival until the pilots were rescued. The exercise showed that the new equipment could help pilots survive three days after parachuting, making it possible for them to wait for the arrival of rescuers. According to the report, the PLAAF has also conducted rescue tests in jungles, deserts, frigid zones, and on the sea.¹⁵

THE PLAAF'S LOGISTICS AND MAINTENANCE CHALLENGE

As the Air Force moves toward a leaner force with rapid deployment capabilities, it is in the process of trying to diversify its logistics patterns in several areas, including emergency resupply, prepositioning of supplies at key airfields, cooperation among front-line and rear area airfields, and cooperation among the different arms and

¹³Zhang Nongke and Zhang Jinyu, "Summary of the Air Force's Pioneering Offensive-Defensive Confrontation Exercise With Participation of Varied Types of Aircraft (Arms of the Service) Under Unknown Conditions," *Jiefangjun bao*, September 25, 1996.

¹⁴Xu Zhuangzhi and Zhu Liang, "China: Military Develops Survival Equipment for Pilots," *Xinhua*, May 22, 1998.

¹⁵"PRC Air Force Performs Plateau Aerial Rescue Test," *Xinhua*, June 10, 1998.

services. The Air Force calls these concepts logistics and maintenance “guarantee” systems, and has divided them into six categories as follows:¹⁶

1. **Providing emergency guarantees.** In order to fulfill combat tasks, the Air Force has established an emergency mobile supply system. As a result, airfields can receive emergency logistics support once their own logistics guarantee systems are knocked out. Moreover, emergency guarantees can be extended to such areas as setting up temporary airfields, repairing damaged key airfields as well as damaged aircraft takeoff and landing facilities within a short time, and guaranteeing field oil supply and emergency air transport.
2. **Providing partial guarantees in advance.** To fight a high-tech air battle, the Air Force has to supply key combat goods and materials to the front-line and backbone airfields in advance. Since it takes a long time for air units stationed in front-line airfields to prepare for the second round of operations and to receive emergency goods and materials, and since transport lines are often vulnerable to enemy attack, the Air Force has to supply key combat goods and materials, all types of aircraft maintenance equipment, high-tech weaponry repair instruments, and so on in advance, in order to gain the logistics initiative and save time.
3. **Providing guarantee to key airfields.** All types of aircraft are involved in a modern air battle, and various types of aircraft are to be assigned to, or temporarily landed at, key airfields. The Air Force’s logistics departments should supply necessary personnel, technology, goods and materials, instruments, and equipment to key airfields that undertake to maintain various types of combat aircraft to ensure maintenance and combat effectiveness.
4. **Providing independent guarantees to different areas.** The Air Force should divide a combat zone into independent guarantee areas in light of its jurisdictional and topographical characteristics and supply routes; clearly define responsibilities, tasks, and requirements for independent guarantee areas; properly strengthen logistics force of independent guarantee areas; and organize guarantee operations on the basis of independent guarantee areas under normal circumstances.
5. **Providing guarantees among departments concerned.** To ensure effective guarantees to the front-line and second-line airfields, airfields located in the hinterland should cooperate with the front-line (and second-line) airfields. The front-line and second-line airfields and airfields located in the hinterland should “help each other” by establishing either permanent or temporary relations of mutual guarantee and support. In peacetime, the two types of airfields should cooperate with each other in training and clearly define tasks of mutual guarantee and support. In wartime, they should provide timely and mobile guarantee and support to each other in light of actual needs. Moreover, they should provide either specific or comprehensive guarantee and support to each other with regard to personnel, goods and materials, instruments, and equipment.

¹⁶Liu Youfeng and Wang Bin, “Diversified Logistics Pattern,” *Jiefangjun bao*, February 27, 1996. The term guarantee (*baozheng*) literally means all of the necessary people, support, and supplies from any part of the logistics or maintenance organization.

6. **Providing guarantees based on overall cooperation.** To provide logistics guarantees to a high-tech air battle, logistics departments of all arms and services should closely cooperate with one another and with the localities concerned in providing combined logistics guarantees. To this end, the Air Force's logistics departments should seek and rely on the unreserved support of the Army's and the Navy's logistics departments with regard to common goods, materials, and services. Once they land at the Army's or the Navy's airfields, the Air Force units should rely on logistics support provided by those airfields. The Air Force units should also seek the cooperation of the Navy's logistics departments in searching for or rescuing aircraft crew at sea.

TESTING THE CONCEPTS

One of the PLAAF's biggest challenges has always been moving from concept to implementation. In this regard, it has probably accomplished more in the 1990s than it has at any other time in its history, especially in terms of computerizing its operations. The following paragraphs discuss how the Nanjing Military Region and the Guangzhou, Lanzhou, and Chengdu Military Region air forces have dealt with various logistics issues over the past couple of years.

According to a January 1996 Liberation Army Daily interview with Wang Chuanwu, Director of Nanjing Military Region Logistics Department, the logistics departments of the Nanjing Military Region, the Navy, and the Air Force, as well as the units of the 2d Artillery and the State Commission of Science, Technology, and Industry for National Defense (COSTIND) have adopted a prearranged task method and instituted a theater unified logistic command system for the first time in the history of the PLA. In two major exercises held in the Nanjing theater in 1995, the logistics departments and affiliated organizations of the three services were placed under the unified logistics command for logistics support to all exercise units.¹⁷

General Wang stated that since the beginning of 1995, the logistics departments and affiliated organizations of the three services in the Nanjing theater conducted extensive studies of the situation, based on guidance from the Central Military Commission. Because the present tri-service situation is characterized by barriers between departments and regions, duplicate functions, scattered forces, and reverse flow of materials, Nanjing Military Region logistics officials spent a month jointly inspecting the warehouses, hospitals, and material supply depots of the three services in the theater. The officials also looked at local support elements in terms of the principle of tri-service joint support, army-civilian integration, and close proximity and convenience to facilitate logistics support. As a result, they set up a number of "joint support areas" so that the "lines" of the navy, the "points" of the air force, and the "surfaces" of the ground forces could be integrated and complement one another.

¹⁷Ding Jianwei and Yan Jinjiu, "Nanjing Theater Exercises Unified Command Over Logistic Service of Three Armed Services To Effect Joint Support," *Jiefangjun bao*, January 8, 1996.

During 1995–1996, the Guangzhou Military Region Air Force (MRAF) Logistics Department party committee focused on the features of coming wars, investing more human, material, and financial resources to build a modern battlefield support system faster. Between 1993–1996, the Logistics Department performed the support mission for six crucial exercises, with its flight support success rate at a reported 99.9 percent. By early 1996, it was using over 20 scientific and technological achievements, such as an automated campaign logistics command system, an automated computerized rapid receive-and-send flight data system, a computerized rapid fuel supply and refueling system, and a night-flight power-failure emergency power-generation system.¹⁸

The Guangzhou MRAF Logistics Department also allocated a million yuan (USD120,000) in 1995 to build a modern administration and command system. Its automated command system consists mostly of a battlefield logistics command room networked within the headquarters. The unit also has a visual band-wave network for a long-range point-to-point and point-to-multiple-point visual conferencing function. The command room's major control workstation and the three-tier (high, medium, and low) long-distance communications network is used for jobs such as data transmission and graphics faxing, as well as giving the battle logistics command micro-networking and unit visual dialogue for better command support. At the end of 1995, the Logistics Department carried out a large-scale logistics support graphic projection exercise. This exercise generally takes two days, but was completed in only three hours, being more efficient than manual operations.

The region's logistics warehouses have also instituted a microspeed on-line network for providing flight data and material. In 1993, the Guangzhou Air Force Logistics Department upgraded the low-capacity computer system used by its grass-roots flight data warehouses, renewing and replacing all of its flight data unit microcomputers. As of 1996, all battlefield station flight data units in the region, from flight data [navigation material] planning, preparation, and supply to maintenance and management, were using micro-automated multipurpose management, achieving five times better efficiency. Support units such as ordnance, fuel, and transport were also all using micro-multipurpose management, having a counterpart network with logistics units, which forms an integrated support network for command and operations.

The Air Force has made efforts to transform airfield and support stations that provide ground service only into those that provide services to both Army and Air Force units. To meet the needs of air fleets on long-distance, mobile combat missions, all major airfield and support stations have several times organized air transport support personnel and railroad transport support personnel to hold three-dimensional, joint air-ground support exercises on the basis of existing equipment.¹⁹

¹⁸Fan Qilin and Xia Hongqing, "On Demanding Support from Science and Technology—the Guangzhou Air Force Logistics Department Is Having Marked Success in Building a Modern Battlefield Support System," *Jiefangjun bao*, April 1, 1996.

¹⁹Zhao Xianfeng and Zhang Jinyu, "Lanzhou MR Air Force Improves Logistics Support for High-Tech Air Battles," *Jiefangjun bao*, December 6, 1995.

As a result, during 1995, the Air Force for the first time ordered that large transport planes carry support personnel and equipment to accompany air fleets in emergency mobile combat support exercises. Previously, virtually all of the Air Force personnel and equipment were moved by road or rail. Of the two Air Force transport divisions, one supports operations out of Beijing, and the other, which has acquired several new Russian-built IL-76s, supports the Air Force's 15th Airborne Army. To provide better mobile accompanying support, the Air Force has set up 11 emergency support teams specializing in nine types of support, including rapid airfield construction, emergency airfield facilities repair, battery charging, oxygen production, refrigeration, and so on. These teams can either individually set out to provide support by whatever transport means are available (air, ground, or rail) or set out to provide mobile support as a large support team.

Aviation units have made efforts to turn airfield and support stations from those that provide steady and conventional support into those that provide rapid and highly efficient support. They have also made great efforts to tackle a number of long-standing problems that undermine support efficiency, including backward plane refueling technology, backward bomb loading technology, and so on, with the result that some airfields have built computerized automatic refueling systems and all major airfields have stopped using refueling trucks and commissioned pipeline refueling. For example, in 1997, an Air Force emergency mobile field pipeline team conducted a pipeline laying exercise in the Nanjing Military Region. The team used close to 5,000 steel pipes weighing over 100 kilograms each to connect an oil depot with an air station 30 kilometers away, crossing a hill of over 400 meters, a town, 27 railroads and highways, 12 caves and bridges, and over 800 meters of rivers and marshes. The exercise was held against the background of a forward airfield, whose oil depot had been bombed.²⁰

The Lanzhou MRAF Logistics Department and subordinate unit personnel tested some of these new concepts during two 1995 "joint high-tech ground and air attack exercises." During one exercise, Air Force logistics personnel supported more than 30 combat planes of four categories and seven types, which took off from an unidentified airfield within three minutes of each other. The other exercise involved three categories and six types of combat aircraft, including attack planes, large transport planes, armed helicopters, and transport helicopters.

During the exercises, Lanzhou MRAF aviation units made efforts to turn airfield and support stations from those that provided logistics support for only one category of combat planes in the past into those that provide support for all categories and all types of combat planes. Since different categories and different types of combat planes are to participate in future air battles in one air fleet, units have worked out different types of support plans, renovated and transformed existing combat planes' service equipment and facilities, and imported advanced foreign logistics support equipment and facilities, with the result that airfield and support stations can now

²⁰*Jiefangjun bao*, May 15, 1997.

provide logistics support for different categories and different types of combat planes.

During the mid-1990s, the Chengdu MRAF increased investment to speed up the modernization of the logistics support system of Air Force stations in Tibet: POL and ammunition reserve bases were built and their supportive warehouses and logistics support systems were built or improved; aviation control centers and modern logistics command systems were connected with the operational logistics command offices by system networks; construction of logistics support facilities for rear-area airports was stepped up; the conditions for logistics support for airports were improved; and aircraft parking areas were enlarged.²¹

In the late 1980s, they succeeded in developing air transport, forming a three-dimensional (air, land, and rail) multi-directional transport system equipped with various types of aircraft that increased the transport capacity more than sevenfold. To increase their capacity to provide logistics support for air warfare using advanced technology, they also built military medicine reserve bases for Army units stationed in Tibet and increased much-needed and conventional equipment, to form a complete system of combat-readiness logistics support.

As a result of these changes, during June 1996, a Tibet-based Chengdu MRAF station took only two hours to accomplish preparations for redeployment of a certain air unit, instead of the 20 days it took to accomplish the same task in the past. Li Maifu, director of the Chengdu MRAF Logistics Department, stated that was the result of strengthening the Tibet-based Air Force's comprehensive logistics support system. In the past, various Tibet-based Air Force stations lacked reserve bases, so when air units entered and were stationed or trained in Tibet, all supplies had to be shipped there from the hinterland by road, which took a long time and was subject to seasonal changes.

JOINT SERVICE AND CIVIL-MILITARY LOGISTICS REFORMS

According to a 1997 *Xinhua* report, the establishment of the socialist market economy has constituted an unprecedented challenge to PLA logistics, but it has also provided an opportunity for new developments. This has especially been the case for the fuel and transportation sectors. For example, in the Jinan theater of operations, the supply of fuel oil, which accounts for 60 percent of the total consumption of materials in a modern war, was less than 35 percent of the planned amount because of market constraints. Therefore, between 1987–1995, the Jinan MR reformed the supply of fuel oil by “joint supply of the three armed services” and the “army-civilian joint supply.” As a result, the reformed system now provides a fuel oil support mechanism among the three services, the local military logistics departments, and the local economy.

²¹Deng Guilin, “Air Force in Tibet Sets Up a Comprehensive Logistics Support System,” *Jiefangjun bao*, July 17, 1996.

The *Xinhua* article also described how the Nanjing theater of operations took the lead in establishing a new military-civilian defense transportation network and joint supply structure for vehicles and equipment between 1987 and 1995. This system consolidated national defense, increased the capability of ensuring adequate military transportation support, facilitated local civil transportation, and promoted local economic construction. According to statistics, in the 8th Five-Year Plan period alone, the state and local governments invested a total of more than 2 billion yuan (USD240 million) in building and renovating more than 50 national defense highways and dozens of bridges and tunnels. In the construction of the Lanzhou-Xinjiang double-railway line and the Baoji-Zhongwei, Nanning-Kunming, Beijing-Kowloon, Guangzhou-Meixian-Shantou, and the Northern Xinjiang trunk railways, more than 200 national defense requirements were met. In civil aviation, national defense requirements were also met in the building and expanding of the Lhasa, Kunming, Guizhou, and other airports.²²

PLAAF STORAGE AND MAINTENANCE FOR OLD AIRCRAFT

According to a March 1997 Hong Kong report, U.S. reconnaissance satellites discovered in June 1993 that China had gathered over 1,000 combat aircraft at an airfield in central China, which turned out to be an exceptionally large aircraft depot to accommodate retired planes. The storage center has three purposes: taking over and storing retired aircraft from all Air Force units nationwide; routine maintenance for those planes still functioning well; and renovating old and broken aircraft.²³

It is not easy to store aircraft for a long time, since special conditions are usually required to achieve this. China can store aircraft only in a cave or in the open as it is doing now, making the job extremely difficult. When aircraft are stored in the open for a long time, the sheeting that seals the cabins will gradually age and break, leading to pools of water in the cabins on rainy days. Excessive humidity in a cave can erode aircraft components.

To overcome the above difficulties, the storage center has developed a set of new maintenance and management measures. For those aircraft stored in the open, new materials are used to mothball the whole aircraft, thus maintaining the critical temperature and humidity to keep the aircraft from rusting and harboring harmful bacteria. Personnel subject precision instruments to partial de-oxygenation treatment. The new techniques can protect aircraft stored in the open from damage

²²“Striding Toward Modern and Great Logistics—All Armed Services Implement Chairman Jiang Zemin’s Five General Guidelines: Guideline on Providing Effective Logistics Support,” *Xinhua*, August 2, 1997.

²³“Storage Center for Fighters, Transport Planes, Bombers of Air Force,” *Ta kung pao*, March 17, 1997. Of note, the U.S. Air Force hosted a small PLAAF delegation in the United States in 1988 to discuss maintenance and logistics. The delegation visited Hill Air Force Base, Davis-Monthan Air Base, and the Smithsonian’s aircraft refurbishment center in Washington, D.C. One of the leaders of the delegation returned to Beijing and became the head of the Air Force’s new aviation museum at Shahezhen airbase located just north of Beijing. During the visit, the delegation made known that they were planning to build a huge aircraft storage facility similar to Davis-Monthan, but were having problems finding a place with the proper climate and necessary space. The most likely place was going to be near the historic capital of Luoyang, in Henan Province.

for as long as six years. When the aircraft are unsealed, they will have preserved their original performance and function.

For aircraft stored in caves, the center has adopted another, totally different mothballing technique. Through experimentation, the center has attained the ability to control airframe humidity, temperature, and anti-rust oil molecule density, adjusting them at any time according to changes in the micro-climate of the caves. This method is called “meteorological mothballing.”

Apart from maintaining aircraft that function satisfactorily, another job of the center is to dismantle and reprocess old and useless aircraft. In a simple and crude aluminum metallurgical workshop in the center, workers have dismantled more than 100 aircraft and smelted more than 100 tons of aluminum ingots from abandoned parts. The useful parts and components are then delivered to the air-materiel maintenance plant for renovation. The plant currently can repair more than 300 items and annually recovers hundreds of aircraft engines, as well as 10,000-odd pieces of other equipment.

PLAAF’S SU-27 FIGHTERS: IMPLICATIONS FOR LOGISTICS AND MAINTENANCE

One of the most important events in the past 50 years was China’s 1990 agreement with Russia to purchase Sukhoi-27 fighters and then to produce up to 200 of the aircraft in China. The Su-27s produced in China will be known as the J-11. Although reports have differed about the exact number of Su-27s, the first batch of 26 aircraft arrived at the 3rd Air Division in Wuhu in 1992, followed by a second group of 24 more at Suixi airfield in 1996. Initial reporting indicated that China would acquire a total of 72 aircraft in three batches of 24 each, and would then begin to produce approximately 200 more at the Shenyang Aircraft Factory over the next 10–15 years at a cost of \$2 billion U.S.

According to ITAR-TASS reports from November 1997, Russia was completing transfer to China of technical documents for the licensed production of 200 Su-27CK fighters.²⁴ Following the handover of the documents, China will scrutinize them and coordinate all technical issues with the Sukhoi design bureau, which was to send a group of Russian specialists to China before the end of 1997. There is a special provision in the “Chinese contract” stipulating that any changes in the Su-27CK fighter produced in China can be made only with Russian consent. The provision is valid not only for the period of batch production of Su-27CK jets in China but also for the entire time of their use by China’s Air Force. The contract prohibits any exports of Su-27CK that have not been authorized by Russia. China has no opportunity to modernize and export Chinese-made Su-27CK without Russia’s participation. Russia supplies to China the AL-31F engines and the complete set of the on-board radio-electronic equipment.

²⁴Nikolay Novichkov, “China To Begin Licensed Production of Su-27CK Fighters,” ITAR-TASS in English, November 13, 1997.

The ITAR-TASS report specified that the first licensed Su-27CK jets should take off before 2000. In line with world practice in licensed production transfer, China will assemble its first Su-27CK from knockdown kits of units, assemblies, and systems beginning in 1998. The kits will be supplied by the Komsomolsk-on-Amur aircraft production association (KnAAPO), the head Russian manufacturer of SU-27CKs. The KnAAPO should hand over to China the necessary technological equipment and assembly fixtures worth \$150 million U.S. The company is also to deliver some 30 percent of all assembly units for China's 200 Su-27CKs. Under the contract, Russia is obliged to deliver AL-31F engines and the whole set of the on-board radio-electronic equipment for all the jets to be assembled. The maintenance service for AL-31F engines will be set up in China. The "Chinese contract" will require certain restructuring to expand the production of some parts in Russia. This is explained by the fact that a number of companies producing aircraft instruments were in former Soviet republics and many of them are unable to ensure supplies to Russia.

The latest reporting from *Jane's Defense Weekly* indicates that the first 50 Su-27s, worth \$450 million U.S., will be assembled from Russian components, with the first two projected to come off the assembly line by the end of 1998. The share of Chinese components will keep growing, finally reaching 70 percent. The AL-31F turbofan engine is not among the items that will be license-produced by China. According to sources who toured the Shenyang factory, manufacturing capabilities and procedures are generally poor and could take several years before successfully assimilating Russian manufacturing technologies. A clause in the Su-27 contract stipulates that if Shenyang fails to meet the annual production target of 10-15 aircraft, then Russia's facility at Komsomolsk will provide the substitute aircraft.²⁵

What does all of this mean for the PLAAF's capability to provide logistics and maintenance support for the Russian-built Su-27s and IL-76s? First of all, the PLAAF typically stores at least one year's worth of spare parts for each aircraft at the base housing the aircraft. This should not be that big of a problem for the IL-76s, which are concentrated at a single base in south central China. However, the Su-27s are a different story.

For now, the Su-27s are located at only two bases (Wuhu and Suixi), and reportedly have not been physically deployed to any other bases for exercise purposes. Therefore, the Air Force has been able to concentrate its spares at only two locations, with others possibly stored at the bases' supporting regional depots. However, if the Air Force follows through on its concept of predeploying spares at deployment bases, then it will have to purchase even more spares. In addition, the majority of these spare parts will have to come from Russia for several years to come, until China can begin producing some of the parts. Even then, some of the most critical parts, such as the engines, will still be made in Russia.

²⁵"Beijing Builds Su-27 fighters from Russian Kits," *Jane's Defense Weekly*, June 10, 1998, p. 12

Based on conversations with U.S. aviation company representatives, the PLAAF's philosophy for purchasing spare parts has not changed for over 20 years.²⁶ Basically, they always have at least one, and usually more, spares on hand for any given item. Ordering parts is initiated from the unit's purchasing department through a third party, such as the Aviation Ministry's import and export arm. The spares requested are compiled by the different departments (avionics, electrical, mechanical, etc.). The departments in general take the full recommended spares and add to them based on the number of airplanes in the fleet. The total amount of money needed to purchase the spares is then requested by the purchasing department. The entire process can take six months or more before the parts are received. Ordering of special items is difficult and at best might take 2-3 weeks to process the initial order. In general, foreign-acquired aircraft are operated seldom and the Air Force as a whole puts all of its emphasis on allowing no defects for these airplanes. From the outside, their operation is extremely safety-oriented with well-trained crews. However, the negative side is the lack of documentation, procedures, records for cost of operations, and the personal desire to achieve and improve these items.

Another U.S. aviation-related company representative discussed possible limitations of supplying petroleum, oil and lubricants (POL) for foreign aircraft. Whereas the PLAAF can purchase and store sufficient nonperishable hardware, the situation is different for various perishable POL supplies. For example, many of the specialized lubricants have a shelf life of only 90 days from the time they are produced. By the time the supplies are actually delivered in China, the shelf life has been reduced to about 60 days. Therefore, the PLAAF will have to maintain a good supply line for its POL products. This problem will be compounded if the PLAAF intends to preposition logistics and maintenance supplies at auxiliary and forward bases.²⁷

Finally, the PLAAF has 21 factories, which produce spare parts for older aircraft such as the F-6, A-5, and F-7, and overhaul and repair all of the Air Force's engines and aircraft, except the F-8, which has to be sent back to the Shenyang Aircraft Factory for any modifications or overhaul. Therefore, until the Shenyang Aircraft Factory or the PLAAF is capable of overhauling the Su-27s, all of the PLAAF's Su-27, as well as the IL-76s, will have to be sent back to Russia to be overhauled. Although there is no information available on the time-between-overhauls for China's Su-27s, the PLAAF completely overhauls its B-6 bombers after 800 hours of flight operations. Overhaul of the PLAAF's current fighters and bombers can take anywhere from 6 to 12 months in the repair facility.²⁸

²⁶The U.S. representatives asked not to be identified by name or company, but their responses to specific questions were virtually the same.

²⁷The representative asked not to be identified by name or company.

²⁸This information is based on the author's visit to several PLAAF bases and repair/overhaul facilities between 1987 and 1989.

CONCLUSIONS

Taken at face value, the above description of the PLAAF's improvements, which were taken primarily from a limited number of PLA publications, is quite impressive. It is obvious that the Air Force has not only identified its weaknesses to fight in a high-tech, or any other, war, but that it is moving in positive directions to modernize its combat tactics and logistics and maintenance support to meet those challenges.

On the positive side, the PLAAF has slowly begun to automate its command posts and to network the various functional organizations from command and control to logistics and maintenance. It has established a tactical training base to develop new tactics and train pilots, and has established and expanded exercises using a "Blue Army" to simulate hostile forces against the "Red Army" both offensively and defensively. Furthermore, PLAAF pilots have intensified their training under different weather conditions, at lower altitudes, and, especially, over water. They have also practiced rapid deployment to fixed and auxiliary airfields, using transports to support the deployment by carrying equipment and support personnel. The pilots have also received flight safety gear for all combat environments. Finally, the Air Force is beginning to study the concepts and work more with the Army and Navy on joint operations and logistics and maintenance support. There are also efforts to enhance civil-military logistics support capabilities.

On the negative side, the Air Force still has many airfields and support stations that provide service to only one type of aircraft and are not equipped to support deployed aircraft for any length of time. In addition, many aviation units still have a number of long-standing problems that undermine support efficiency, including backward plane refueling technology, backward bomb loading technology, and so on. The Air Force, and PLA as a whole, is still a long way from being able to conduct joint logistics and maintenance support. The Su-27s, IL-76s, and any Chinese-made aircraft with extensive foreign parts will continue to provide a logistics and maintenance challenge for the Air Force.

This paper raises many more questions than it answers. For example, more information is needed about the "Blue Army" before its impact can be assessed. Are the pilots under strict ground-controlled intercept (GCI), as is the rest of the PLAAF? When will Su-27s be introduced into the unit? What types of electronic warfare will the aircraft use? Are the exercises set piece, or does the aggressor unit show up without warning?

Other questions raised include how often do PLAAF units deploy and practice from deployed airfields? How many aircraft usually constitute a deployment—division (72 aircraft), regiment (24 aircraft), group (8 aircraft), or a squadron (2–3 aircraft)? What types of logistics and maintenance packages (personnel and equipment) are deployed to support the aircraft? Do most deployments take place within the same military region or between military regions? What type of sortie generation and rapid turnaround capabilities do these aircraft have when they deploy? How proficient are PLAAF pilots in firing their air-to-air missiles? Is most of their night flying done on clear, moonlit nights or when it is pitch black? Do PLAAF units have a direct communications link with ground and naval forces that they are supporting, so that

the pilots do not get shot down by friendly fire? What is the current identification friend or foe (IFF) capability on PLAAF aircraft?

In conclusion, it is clear that the PLAAF is slowly moving toward modernizing its fighting force, as well as its support systems. The question is how well it will be able to carry out these reforms, especially in a joint force arena, and how well will it be able to support its weapons systems acquired in full or in part from foreign sources.