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CHINA AEROSPACE STUDIES INSTITUTE

# The Regenerating Road

## China's Rapid Runway Repair Capabilities and Other Recovery Methods


**A BluePath Labs report by**

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# Acronyms

| | |
|---|---|
| ACE | Agile Combat Employment |
| AVIC | Aviation Industry Corporation of China |
| CMC | Central Military Commission |
| C4ISR | Command, Control, Computers, Communications and Intelligence, Surveillance and Reconnaissance |
| EOD | Explosive Ordnance Disposal |
| FARP | Forward Arming and Refueling Point |
| FOD | Foreign Object Debris |
| ISR | Intelligence, Surveillance, and Reconnaissance |
| JLSF | Joint Logistics Support Force |
| MCF | Military-Civil Fusion |
| NDMD | National Defense Mobilization Department |
| PLA | People's Liberation Army |
| PLAAF | People's Liberation Army Air Force |
| PLAN | People's Liberation Army Navy |
| PRC | People's Republic of China |
| TCAF | Theater Command Air Force |
| UAV | Unmanned Aerial Vehicle |
| USAAF | United States Army Air Force |
| USAF | United States Air Force |

# Key Findings

## 1: The PLA expects initial assaults against its airfields in a conflict and integrates this expectation into its strategic planning

U.S. actions in Operation Desert Storm and Iraqi Freedom prompted close scrutiny from People's Liberation Army (PLA) observers and strategists. They noted that in the initial phases of the conflict the first targets for U.S. air strikes were Iraqi airfields and communications facilities. In their assessment, Iraq missed multiple opportunities for pre-emptive strikes to blunt the U.S. assault and failed to restore air operations after the initial damage. Since the early 1990s the PLA has been developing capabilities to mitigate U.S. air power, including improved early warning systems, hardened facilities, and rapid runway repair capabilities.

## 2: The PLA Air Force maintains dedicated training time allotted to runway repair

The PLA Air Force (PLAAF) holds numerous emergency support training exercises with a focus on restoring functionality to an airfield after an enemy air strike. These exercises consist of disposing of ordnance, firefighting, cutting out damaged sections of the runway, refilling and refinishing the damaged portions, and occasionally laying steel plates over the affected location. The ability to quickly repair a runway is considered to be an important capability due to an airfield's vulnerability and importance in the event of a conflict.

## 3: PLA Army Aviation appears to focus more on remote and temporary basing rather than runway repair

PLA Army Aviation appears to be pursuing remote and temporary basing options to address vulnerabilities. Temporary helicopter support bases are relatively easy to construct compared to the runway requirements for an aircraft. Temporary bases feature constructed helipads and supplies brought from support vehicles. This divergent course of training offers better flexibility for PLA Army Aviation, as they are less reliant on fixed bases which are easy to target and damage. It is possible the PLAAF is also working to establish temporary runways at civilian airports, but concrete evidence is limited at time of writing and the PLAAF appears to still be exploring this option.

## 4: China's Runway Repair planning involves extensive civilian participation

PLA runway repair training exercises will commonly feature extensive support from local militia organizations located close to the airfield. Militia personnel responsibilities typically align with their civilian professions: construction crews will resurface runways, ambulances will find and rescue the wounded, professional firefighters will work to put out flames. This aspect of military-civil fusion (MCF) allows the PLA to reduce costs associated with maintaining large numbers of professional support staff and reduces costs of training new personnel for these roles.

## 5: China's highway landing and take-off capabilities appear to be rudimentary at present

At present, China's highway system does not appear to have many sections with high enough build quality nor sufficient clearance to support military aircraft operations. PLA authors have been advocating for improving China's highway landing capabilities for some time, however as of 2012 there were reportedly only nine lengths of highway deemed appropriate for aircraft use. While there was a high-publicity highway landing in 2014 in Henan Province, this does not appear to be a common occurrence, although this may be a result of less reporting after the 2014 landing. Practicality is a concern as well, as a length of highway in 2018 had to have guardrails and traffic signs removed before a landing was feasible. In an emergency situation this would be a hindrance.

# Introduction

This report addresses China's rapid runway repair capabilities and other methods of restoring air operations when faced with enemy assaults. If functionality is hindered, this will restrict the PLA's ability to launch air operations and respond to attacks from outside forces. Fixed and obvious runways present a clear area of vulnerability to a country's air power. Given the centrality of air superiority in modern conflicts in general and to U.S. military doctrine specifically, it is important for a country to be able to weather an assault on an airfield and maintain rapid response capabilities.

Observing U.S. actions during Operation Desert Storm, the PLA deduced that the initial stages of a conflict would most likely involve attacks against its airfields to dampen its ability to respond to U.S. air power. Given the proximity of multiple United States Air Force (USAF) airfields in Japan and South Korea, it is critical for China to be able to quickly respond and contest the airspace over a potential area of conflict. If the PLA can repair damage done to its runways or develop other methods of mitigating damage to airfields, this would both hinder U.S. operations, which rely on air superiority, and draw important U.S. resources away from other areas of a conflict. Thus, denying air superiority through resilient air facilities and rapid repair capabilities is a potentially potent tool in the PLA's arsenal.

With this in mind, the PLA is exploring numerous methods and techniques. Traditional runway repair methods such as detecting and removing unexploded ordnance, cutting out and refilling damaged sections, and rapidly disposing of foreign object debris are common training subjects. The PLA often includes local militia organizations as a manner of reducing costs, fulfilling military-civil fusion obligations, and bringing in qualified personnel for relatively simple tasks. Other more innovative methods under development include remote temporary basing and shipboard landings at sea for PLA Army Aviation helicopters, and highway landings for PLA fixed-wing aircraft.

To explore these topics, this report draws upon previous work by scholars to examine PLA air power. This includes work by Sean O'Connor and Carlo Kopp in understanding PLA air basing for Air Power Australia Analysis, as well as previous reports by the RAND Corporation examining the effectiveness of U.S. air power in a theoretical conflict with China. Primary sources from the PLA were also consulted when examining training activities, techniques, and equipment. This report seeks to fill knowledge gaps about how the PLA views its airspace environment, and what steps it might take to maintain continuous air capabilities in the event of a conflict.

The contents of this report are separated into roughly three sections. The first section discusses China's historical experience with airfield survivability, as well as lessons learned on likely scenarios involving a conflict with the United States. The second section looks at China's runway repair capabilities by examining training performances, techniques and equipment used by the PLA and its supporting militias, and how their chosen practice methods may translate into real-world applications. The third section examines other methods for restoring air operations, including remote basing options, highway landing activities, and other military-civil fusion activities. Specific areas explored include capabilities and techniques for restoring function to airstrips, cooperation mechanisms between the PLA and local militias, agreements and practices for using civilian airfields and highways, and training of militia forces for runway assistance.

Ultimately, this report found that the PLA's training for rapid runway repairs suffers from a low degree of realism or surprise elements, with equipment and personnel often pre-positioned next to the runway and reports featuring highly variable times for completion. Perhaps as a means to ameliorate this deficiency, the PLA is also exploring alternative methods for establishing remote and temporary airfields, including using highways as emergency landing strips. However it appears that highways with the proper specifications needed for landings are few and exercises to practice these landings are not common. The PLA has also signed joint agreements with civilian construction companies with the proper equipment and experience needed to reestablish an airfield's operability. This fact, coupled with the sheer variety of options being pursued, points towards a degree of resilience for PLA airpower that should not be underestimated.

## Background on Airfield Attacks and China's Lessons Learned

Air superiority, claiming control over the aerospace components of a battlefield, has become a critical component of strategic planning. While it is possible to win air superiority through direct elimination of opposition aircraft in the air, this is a risky and costly endeavor. Alternatively, preventing the opposition air force from leaving the ground achieves air superiority without the need to engage in more high-risk air-to-air contests. Given the advantage of grounding an opponent's air power, it is assumed that airfields and their supporting components will be a primary target during the initial stages of a conflict. According to a report from the RAND Corporation, the purpose of attacks on airfields is typically to destroy aircraft and equipment, as well as to harass defenders and deny the use of the facility.[1] If successful, the effects of these attacks could have potentially large payoffs, as they not only damage enemy materiel, but also allow the use of friendly air power without fear of interdiction. For example, the RAND report found that British raids against German airfields in North Africa during the Second World War led to out-sized impacts in the theater as the effects of denied air power cascaded into other domains.[2] Conversely, China had extensive experience employing rapid runway repair techniques to address Japanese bombing raids during the second World War, involving a corps of Chinese early warning spotters and groups of laborers who quickly performed repairs, filled craters, and re-leveled landing strips.[3]

Much of China's recent strategic thinking around air power can be traced back to lessoned learned from observing the 1991 Gulf War.[4] According to Huang Dong [黄东], a Chinese military analyst, watching the U.S. forces during the Gulf War was like "a psychological atomic bomb to the PLA, who believed in the Soviet-style tactics of the 1960s and 1970s."[5] By observing U.S. actions in Iraq, Chinese defense planners learned multiple important lessons. Primarily, they stressed the importance of information and early warning systems, the need to deny air superiority to the enemy, and the likelihood of rapid attacks against airfields in the initial stages of conflict.[6]

Currently, China's rapid response capabilities revolve around identifying U.S. military activities in the Western Pacific and mitigating the threat. Much like how the Chinese network of spotters mitigated Japanese air raids in the Second World War, China has been focusing on its command, control, computers, communications and intelligence, surveillance, and reconnaissance (C4ISR) network of sensors to track U.S. military movements.[7] If an incoming threat cannot be eliminated by interception and air defense capabilities, then focus will shift to survivability. For example, the PLA developed a number of protective structures and underground hangers throughout China for its aircraft to survive an initial assault. Meanwhile, the PLAAF's unprotected runways rely on the PLA's ability to quickly refill craters, patch holes, redeploy supporting elements, and restore airfield operability as quickly as possible.

## China's Rapid Runway Repair Capabilities and Other Recovery Methods

In general, the PLAAF and PLA Naval Aviation appear to utilize similar runway repair training and techniques. Activities typically consist of suppressing fires started by enemy ordnance, removing unexploded ordnance, performing emergency surface repairs on runways, and removing foreign object debris on the airfield to prevent further damage to aircraft.[8] Following repairs on the airfield, mobile fuel trucks will likely be used to create temporary refueling stations in the event that fixed fuel supplies were damaged.[9] Often, these activities employ a large number of local militia personnel as both part of MCF and as a cost-saving measure. This will often be determined by the location of the airfield and its proximity to civilian resources. If a runway were to be damaged beyond repair, the PLA is also exploring temporary basing options including using civilian highways and airports as runways. Further, PLA Army Aviation is pursuing temporary remote basing revolving around deployable helipads and shipborne landing options.

Given the PLA's limited experience in modern warfare, it is difficult to assess the true extent of their capabilities. It appears that success in exercises is frequently judged by how quickly a task can be performed. For example, one training ground's media team triumphantly reported detecting and detonating ordnance in 23 minutes, while another reported ten repair tasks completed within two and a half hours, and another reported putting out fires and reestablishing communication links in only ten minutes.[10] Yet, it seems that in these exercises, and in many listed below, equipment and personnel were prepositioned. During one PLA Naval Aviation exercise, the report explicitly mentions that the specialist vehicles were brought onto the runway while PLA Naval Aviation personnel were lined up awaiting the starting signal.[11] Time to completion is reported based on when the exercise began but does not include time taken to move personnel and equipment into position. Thus, these reported times and accomplishments may not reflect an accurate understanding of the PLA's capabilities.


*A photo demonstrating prepositioned vehicles, equipment, and personnel.*[12]

A more accurate picture of how quickly a runway can be repaired and brought back to working condition may be better estimated on surprise drill performance. However, given the documents at hand, sudden or unannounced drills and exercises do not appear to be a common method of training for rapid runway repair in the PLA.

Given this limitation, the following section focuses on methods used for training and probable actions taken during a conflict. All times reported are taken directly from the sources but should not be considered a full or accurate picture of the PLA's ability to recover from an airfield attack.

## Explosive Ordnance Disposal

Typically, the PLA's runway repair capabilities begin with explosive ordnance disposal (EOD) operations. If any bombs or missiles remain undetonated on the airstrip after an enemy attack, they may be triggered by later repair activities, causing further loss of life and undoing any previous efforts towards re-establishing flight capabilities. Thus, ensuring that all ordnance is removed prior to repair efforts is essential. In the words of a PLAAF Logistics Department member, "ordnance removal is a key method for reestablishing airfields that have been attacked."[13]

Ordnance detection and removal is carried out by engineering technical service groups [工兵技术勤务大队], which are frequently featured in drills and exercises alongside other essential runway repair activities, and typically act as a precursor to filling craters.[i][14] For example, in October of 2018, a Northern Theater Command Air Force airfield organized a large joint civil-military training exercise to improve coordination between the two forces in the event of an attack.[15] EOD was the first task in a larger 2.5 hour repair support exercise. During the exercise, the repair unit of an engineering platoon was tasked with searching the training ground for unexploded ordnance to detonate, which took 23 minutes.

Typically, training exercises occur at PLAAF airfields. However it is not uncommon for training sites to be established at remote locations.[16] As stated previously, while sudden, unannounced drills can occur, it appears that the majority of training exercises are held at predetermined times and locations. In a training exercise in October 2019, holes were dug to simulate craters with ordnance at the bottom, however winds kicked up sand and buried the targets, forcing the disposal team to use their detection equipment. [17][ii] This suggests that while they had the equipment on-hand before, it was originally not needed to complete the activity.


*Ordnance disposal team*[18]

i The subordination of these teams is unclear. While it seems likely that they belong to the individual airfields as part of their support elements, it is also possible that the teams fall under the TCAF Support Department as mobile teams to be deployed where needed.

ii The PLA frequently uses simulated hardship in their training exercises. Although this particular article made no mention of simulated elements being introduced, it is possible that the wind burying the targets was an introduced element, not a random occurrence.


*Ordnance disposal equipment*[19]


*Ordnance disposal training activity*[20]

In 2014, the PLAAF developed an unexploded ordnance simulation system, which can randomly simulate both location and depth of unexploded ordnance and monitor performance by personnel.[21] The reason this system of simulated ordnance detection and disposal was developed for PLAAF training and what deficiency of traditional methods it seeks to address was not mentioned.

For these capabilities, specialized ordnance detection and detonation equipment is often employed. It appears the adoption of this equipment is relatively new, as a source from 2014 describes detection and detonation equipment as "practical new equipment and new technology," while a later article from 2019 implies that the equipment had been used frequently as part of runway repair operations.[22] This specialized equipment includes a long magnetic rod for detonations, engineering vehicles equipped with ordnance detection components, aerial surveillance and digital detectors (presumably through the use of small reconnaissance drones), as well as portable explosion-proof walls.[23] Due to the technical nature of this specialized equipment, it appears that ordnance removal is often conducted by PLA personnel, and not given over to militia during joint training exercises.[24] While this display of specialized technology shows the PLA takes the task seriously, reports detailing the exercises often fail to account for the efficiency of this equipment in an emergency situation.


*Specialized EOD equipment*[25]

## Filling Craters and Resealing Runways

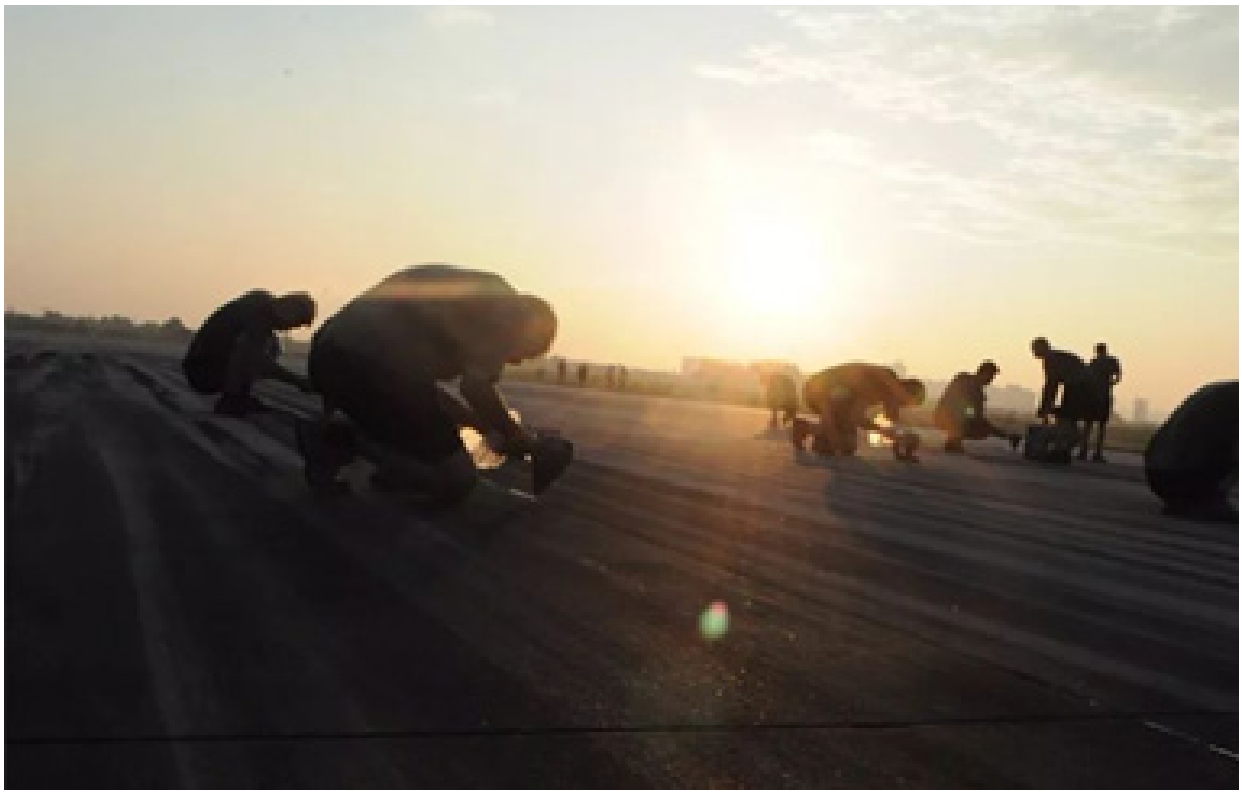
Following detonation and disposal of ordnance at an airfield, the next task is to fill the craters caused by the attack in order to resume operations. Typically, this is accomplished by Airfield Services Companies [场务连],[iii] which begin by first marking off the affected area, using a circular saw to cut out the edges, using a pneumatic drill to break apart larger sections, removing the broken pieces, and refilling the hole with concrete.[26] According to one Airfield Services Company, the adoption of a new type of quick-drying concrete in 2013 doubled the speed at which a crater could be filled.[27] That same company reported that the fastest time for the process was 25 minutes and 3 seconds during a competition.

After disposing of remaining ordnance and cutting out and refilling craters, the next process is typically resurfacing the area to keep out the elements, ensure cracks or other weaknesses do not develop, and to guarantee the surface is level. As with the other steps in runway repair, speed is emphasized, as the faster a runway has recovered from a strike, the sooner the PLA can launch their aircraft. As part of the repair process, it is not uncommon for resurfacing to be included in joint PLAAF-militia training exercises. For example, during a 2018 exercise, local militia units from a bureau of the China Railway Group [中铁某局] used their forklift and road roller to level the surface and compact the area.[28] Resurfacing is also a routine part of PLAAF airfield maintenance, especially as its runways see increased use and thus increased need for maintenance. One Central TCAF airfield awarded a member of its Airfield Services Company for his diligence in refilling cracks and gaps that constantly started appearing on the runway as the airfield saw its flight missions increase.[29] Reportedly, the sealant used to fill in hairline cracks easily wore away due to the frequent flights.

*Airfield Services Company breaking up a damaged runway section*[30]

iii These companies are directly subordinate to the airfield station which oversees the airfield and its facilities, and are responsible for a range of support and maintenance activities, including runway repair and upkeep, firefighting, snow removal, electrical power, and preventing bird strikes.

*Airfield Services Company resealing runway after repairs*[31]



*Airfield Services Company resealing runway after repairs*[32]

Other airfields located in more challenging locations frequently engage in runway resurfacing as weather conditions deteriorate, with one Northern TCAF airfield requiring six hours to complete their repair tasks (under non-emergency conditions).[33] This does not appear to be unusual however, as the machinery used to resurface runways operates at a very slow rate. One study from 2017 estimated a top speed of 4 meters per minute, which reportedly requires eight hours to complete resurfacing a runway.[34] Sometimes, if the need for flights is urgent (e.g., during a military conflict), fiber glass and steel plates will be set on top of the repaired section, presumably to be removed once the section has fully dried.[35]


*Militia laying steel plates over a damaged runway section*[36]

According to one source, the entire process of runway cutting, drilling, concrete mixing and filling, and resurfacing of two 81 cm x 39 cm x 59 cm holes during a PLAAF competition went as follows: "The runway cutting was completed in 10 minutes, the pneumatic drilling took 30 minutes, mixing the concrete was completed in 8 minutes, filling was completed in 2 minutes, and the surface was completed in 1 minute, after 25 minutes the repair material was initially set, and after another 2 hours the concrete finally solidified completely to meet the requirements of airfield use."[37] In another runway repair drill, a PLAAF Airfield Services Companies required ten minutes to cut apart a broken runway section about 1 meter long by .5 meters wide, thirty minutes to break the remaining pieces up, another ten minutes for stirring and filling with new concrete, and a further two hours for the concrete to solidify. Other airfields have reported times of thirty minutes for concrete to solidify when working with the quick drying concrete.

However, training practices across different branches appears to lack standardization. For example, photos from the "Joint Logistics Force-2018B [联勤力量-2018B]" and the "Jingwu Joint Logistics-2020 [精武联勤-2020]" reveal that the crater refilling activities featured at the Joint Logistics Support Force (JLSF) exercise take place on the ground, not on a runway tarmac.[38] These conditions are quite different than those the JLSF could expect to face in the event of a runway attack.


*JLSF practicing refilling craters with concrete*[39]

## Foreign Object Debris

The final key process in reestablishing runway functionality is checking for and clearing foreign object debris (FOD). Aircraft engines produce a large amount of intake as they pull in air around them. If there is nearby debris, including rocks, loose screws and bolts, or other small items, they can be pulled into the engine and cause massive damage. Reportedly, PLA practice until the early 2010s was to check for FOD and clean the runway manually. Airfield personnel were required to walk the length of the runway methodically, visually inspecting for FOD and removing it where found. According to one Northern TCAF airfield, this process involved ten personnel and took upwards of thirty minutes to complete.[40] It appears that as early as 2008 the PLA began to invest in specialized equipment to reduce manpower and time associated with FOD removal. Early equipment seems to have relied on sweeping FOD aside and away from the aircraft.[41] Presumably this was not an ideal solution as wind and foot movement could easily cause the debris to return to the cleared area and damage the aircraft. By at least 2016, the PLAAF appears to have introduced the airfield pavement individual rapid inspection device [机场道面单兵快速巡查器], not dissimilar to a Segway with a mounted vacuum cleaner, which relies on suction to remove FOD from the runway.[42]

*A group of airfield pavement individual rapid inspection devices*[43]

*An airfield pavement individual rapid inspection device*[44]

Such vehicles can move at speeds of 20 kph (12.4 mph) and operate for 25 minutes per charge. Reportedly, this equipment reduces manpower by half and cleaning time by two thirds as compared with before its introduction. Assuming the Northern TCAF airfield mentioned earlier is representative of the PLAAF in general, it can be assumed it currently takes five personnel approximately ten minutes to adequately check for and remove FOD.

The equipment can miss fine particles though, and for this purpose the PLAAF is also developing FOD monitoring systems to digitally identify FOD and act as a primary warning system. In 2012, the PLAAF had four competing FOD monitoring systems under development.[45] Three primarily used radar and digital imaging, while the other relied solely on video imaging. However, the systems cannot detect debris smaller than 20 millimeters, which the PLA deemed insufficient. The PLA is also working on a "big data" FOD detection system [跑道异物大数据信息分析系统] to record FOD-related information and help predict where FOD is most likely to appear.[46]

## Reestablishing Support Elements

Occurring in parallel to the repairs on the surface of the runway itself, many other emergency response activities are carried out at the airfield in order to restore flight function. Typically, the first activity to begin an emergency response is firefighting. Firefighting efforts are high priority since fires can easily spread, block off access to certain locations, and risk setting off further explosions from magazines and fuel depots. For example, as a regular part of their training, one Northern TCAF airfield simulated both aircraft fires and loss of communications following an enemy attack.[47] Wanting to focus on rapid mobile support, another airfield organized a drill to conduct runway repairs, fight fires, and reestablish fuel lines as part of their "actual combat environment" training.[48] Repairing fuel lines and utilizing support trucks to bring in fuel for aircraft is another essential support function.[49]

Similarly, entirely new fuel pipelines can be established by laying pipes in rapid succession using support trucks and teams to attach them.[50] Fuel bladders can also be brought by helicopters if road conditions do not permit vehicles or a remote basing option is too far removed from support elements.[51] These bladders arrive by helicopter, are set down near the aircraft (or other vehicle), and their contents are connected to the disabled aircraft. Similar to how a damaged runway can ground an entire airfield, lack of fuel, either through fire or destroyed infrastructure, can be equally crippling for air operations.[iv]


*Helicopter delivering a fuel bladder during a 2019 training exercise*[52]

iv For video footage of a fuel training exercise, see: "What "cards" are still in the hands of the field fuel support detachment after personnel "battle damage"?" [人员"战损"后 野战油料保障分队手里还有哪些"牌"？], People's Liberation Army News and Communication Center [解放军新闻传播中心], 20 August 2021, https://www.js7tv.cn/video/202107_252944.html

In this way, the JLSF contributes to runway and airfield repair activities. The JLSF was created to provide timely logistical support to the various branches of the PLA. This can include support ranging from food to fuel, as well as maintenance and other technical services.[53] The JLSF's support bases tend to be located near major transportation hubs so they can both rapidly deploy resources and requisition civilian support.[54] At the time of its inception, the JLSF had five support bases located in Wuxi, Guilin, Xining, Shenyang, and Zhengzhou.[55]

Exercises reveal a force geared toward rapid emergency deployment, requiring frequent long-range transportation and rapid response capabilities. For example, the Jingwu Joint Logistics – 2020 [精武联勤-2020] competition in December of 2020 focused on driving over surfaces cratered by opposing air power in order to deliver supplies such as emergency fuel and repair components to restore airfield functionality.[56] Similarly, during the North-2016B [北部-2016B] exercises, the JLSF operated out of fixed locations and practiced deployments to locations in need of support.[57] This often took the form of battlefield information relayed to the JLSF bases from the field, with the bases then deploying the necessary support through a combination of JLSF and civilian delivery methods. In the subsequent Joint Logistics Force 2018B [联勤力量2018B] exercises, the civilian integration aspects were crucial. These exercises featured combined military training for civilian and PLA personnel and stressed finding ways to better integrate these two sources of battlefield support.[58]

*JLSF engaged in firefight during the Jingwu Joint Logistics – 2020 competition*[59]

Exercises such as the "Joint Logistics Force-2018B [联勤力量-2018B]" and the "Jingwu Joint Logistics-2020 [精武联勤-2020]" operate in a similar manner to more routine exercises, albeit larger in scale and featuring more competitions than a typical training exercise.[60] JLSF personnel are brought to pre-prepared training grounds to practice skills such as driving around craters or rapidly refueling vehicles and aircraft.


*JLSF simulating an attack on fuel supplies during the Joint Logistics Force-2018B exercises*[61]


*JLSF practicing firefighting during the Joint Logistics Force-2018B exercises* [62]


*JLSF practicing refueling aircraft during the Joint Logistics Force-2018B exercises*[63]

## Temporary and Remote Basing

PLA Army Aviation is believed to have 15 aviation brigades consisting of helicopters, unmanned aerial vehicles (UAVs), and logistical support aircraft.[64] Their primary purpose is to provide support to the ground force, including air support, rapid transportation, and reconnaissance. Because of this, PLA Army Aviation faces very different challenges, requirements, and solutions than the PLAAF and PLA Naval Aviation. In terms of rapid runway repair, it appears that PLA Army Aviation is more focused on establishing remote landing locations, temporary helipads, and training their pilots to land in a variety of conditions.

As an example of PLA Army Aviation training, in May of 2014, a Nanjing-based PLA Army Aviation helicopter brigade undertook an exercise intended to demonstrate the practicality of establishing numerous ad-hoc aviation support points.[65] Dozens of helicopters left their training base in Eastern Anhui Province to carry out battlefield exercises that included joint strikes, targeted clearance, and coordinated assaults on determined locations. After the exercise, the brigade broke with previously established behavior and did not return to the base it launched from. Instead, the brigade worked with civilian sources to establish remote and dispersed helipads with refueling and refitting capabilities. According to the brigade's chief of staff, this new method was established because brigades previously had to make multiple trips to and from their training bases for their supply needs, slowing the exercises and lowering overall efficiency.[66] Reportedly, the remote points can sustain up to ten helicopters at a time, with PLA Army Aviation expecting even the smallest points to continuously support three helicopters per location. By July of 2015, the brigade reportedly expanded these capabilities to include emergency field repairs, with a goal of each point being able to provide self-sufficient battlefield support.[67] It appears that exercises involving improvised airfields is a common component of PLA Army Aviation training.

*PLA Army Aviation helicopter refueling at a remote location*[68]

Another avenue for PLA Army Aviation appears to be the use of temporary emergency landing pads for helicopters. For example, in September of 2013 a major PLA Army Aviation exercise in Hebei Province featured extensive use of temporary helipads to establish ad hoc support facilities.[69] Nearly one hundred flight commanders and logistics support personnel were organized by the General Staff Department to observe the exercise. Many support vehicles participated in establishing the temporary base, including command and control vehicles, navigation support vehicles, and numerous logistics support vehicles such as construction support and refueling vehicles. Some of these came from civilian organizations (including fire trucks, repair trucks, and private security personnel). Twenty emergency helipads were constructed, which appear to have been selected based on their ability to be rapidly deployed and dismantled.

*A temporary PLA Army Aviation flight support command post*
*[飞行保障指挥所][70]*

In keeping with the MCF strategy, Chinese companies such as Hubei Huazhou Heavy Industry Emergency Equipment Company Ltd. [湖北华舟重工应急装备股份有限公司] (which appears to be related to the China Shipbuilding Industry Corporation) have entered the sector, providing emergency-use helipads and other military engineering products.[71] Their emergency helipads were designed for both wartime needs and disaster relief, take thirty minutes and six people to set-up, and can support PLA Army Aviation's common helicopters with a take-off weight of up to 13,000 kilograms (28,600 pounds).[v] These helipad options have already seen use in civilian training exercises in both Hubei and Chongqing.[72]

v The Z-10 attack helicopter is estimated to have a take-off weight of 16,000 pounds, while the Z-20 utility helicopter has an estimated take-of weight of 22,000 pounds. See https://eurasiantimes.com/chinas-wz-10-attack-helicopters-provide-cover-fire-during-pla-air-landing-operations-watch/#:~:text=The%20helicopter%20has%20a%20four,a%20five%2Dbladed%20main%20rotor.&text=At%20the%20rear%20of%20the,off%20weight%20is%208%20tonnes ; https://www.globalsecurity.org/military/world/china/z-20-specs.htm


*Huazhou emergency helipad*[73]

*Huazhou emergency helipad in use*[74]

As mentioned in previous sections, training appears to focus on quickly establishing temporary bases with fuel and rearmament supplies so that helicopters are not reliant on returning to fixed PLA Army Aviation bases. Further, teams appear to be modular, with each team containing the necessary elements to establish a base independently. However, it is difficult to gauge how efficient this training is. In one training exercise it was mentioned that 20 helipads were established at a remote location during the timed phase of the exercise but did not mention how much time was required to establish them.[75] Further, another exercise in 2020 mentioned that a PLA Army Aviation helicopter brigade had conducted these exercises without incident ten times between 2017 and 2020, implying that either there were incidents in previous years, or that this type of training was only added in 2017.[76]

Regarding recovery from an enemy strike on landing bases, PLA Army Aviation is also training pilots for difficult landings in unconventional or emergency locations. For example, after Xi Jinping issued a training and mobilization order for the beginning of 2021, one PLA Army Aviation brigade in the Eastern Theater Command organized a training operation in which nearly a dozen helicopters practiced flying to an island and landing in a field without ground support.[77] Presumably this is to practice situations in which the helicopter cannot return

to base for various reasons. Similarly, PLA Army Aviation has also been training to use a 50,000-metric ton semi-submersible vessel developed by Shanghai Zhenhua Heavy Industries Company Ltd. [上海振华重工] for emergency landings at sea.[78] The ship has three helipads in the mid-section and has been advertised as useful for both civilian emergencies and military cross-regional exercises.[79]


*PLA Army Aviation helicopter attempting an emergency landing at sea*[80]

There is also some evidence that the PLAAF is attempting to introduce aircraft landings at "unfamiliar" airfields, indicating a willingness to use civilian airports when circumstances dictate. Such exercises were carried out in June and July of 2021 by the Western TCAF and featured supporting elements pre-deploying to an "unfamiliar" airfield, a number of aircraft (including a Y-20 transport and two J-16 fighters) landing, a simulated attack followed by EOD and rapid repair exercises, and participation from a local civilian construction company.[81] This may be a Chinese attempt to emulate the USAF Agile Combat Employment (ACE) concept and improve its ability to quickly pivot to other basing options should an airfield prove to be too damaged for continuing operations.

## Highway Landings

In case of emergencies where neither military nor civilian airfields are useable, the PLA is also exploring use of public highways as emergency airstrips for fixed-wing aircraft, although its capabilities here appear to still be rudimentary. In May of 2014, the PLAAF successfully landed a fourth-generation (third-generation in Chinese convention) fighter on the Zhengmin Expressway [郑民高速公路] in Henan for the first time.[82] In this attempt the fighter was accompanied by a transport craft and a PLA Army Aviation helicopter, both of which also successfully landed on the length of highway.


*PLA fighter landing on the Zhengmin Expressway in 2014*[83]


*PLA cargo plane landing on the Zhengmin Expressway in 2014*[84]

Following this, in October of 2018, a Northern TCAF airfield organized a joint support exercise with local civilian organizations.[85] After conducting rapid runway repairs on the PLAAF airfield, the joint forces of the PLAAF and civilian personnel moved the exercise to a local highway to practice fighter landing and take-off. The PLAAF airfield had an emergency support agreement with the provincial traffic readiness office, which arranged local civilian support to prepare the highway. The local police evacuated the highway and redirected traffic, while a local construction company used its equipment to remove the guardrails, posts, and road signs along the pre-planned landing zone. After the highway was cleared, two fighters landed, refueled and refitted, and then took off again from the highway. When discussing the landing, the Northern TCAF Support Department commented that most sections of highway were unusable for aircraft landings due to poor surface quality and inadequate clearance, but the exercise took place at a pre-selected length of the highway with adequate construction methods for aircraft landing.[86]

The Zhengmin Expressway was reportedly built to "Class A Standards" [一级甲类标准] which denotes extensive support facilities, proper surface standards, and appropriate clearance for aircraft.[vi][87] However, it seems that these specifications and abilities are not common among China's extensive highway system, and while the PLA first landed fighters on a highway in September 1989, construction of highways which meet the qualifications for these types of landings have lagged significantly.[88] According to Zhu Hongda, the Director of the PLAAF Logistics Department in 2012, while the PLA had successfully built highway airstrips for emergency landing use, they have been generally insufficient in quantity, layout, and practical application.[89] Further, because of their usefulness in emergency preparation, he believed that the PLA needed to regularly organize exercises to ensure that the highways which were suitable for aviation use did not fall into disrepair. Reportedly, during the Eleventh Five-Year Plan more than 350 lengths of highway were rebuilt with military requirements.[90] What those requirements specified were not mentioned. Likewise, in 2012 it was reported that nine highways had been constructed with full capabilities for emergency airfield use.[91]

It appears that these projects are mainly carried out as joint ventures between the Theater Commands of the PLA (formerly organized as Military Regions) and various provincial organizations. For example, the Hainan Provincial State Mobilization Committee [海南省国动委] worked closely with the Guangzhou Military Region Combat Office [广州军区交战办] in 2012 to improve its national defense system, which includes implementing aircraft landing capabilities in sections of the Wenchang East – Longlou highway [文昌东郊至龙楼公路].[92] The two organizations further created a consultation mechanism to continue such projects in the future. Similarly, the Hunan Province Department of Transportation [湖南省交通运输厅] organized a large meeting featuring delegates from the Southern Theater Command, People's Armed Police, and numerous local infrastructure and transportation departments for the purpose of identifying which national defense needs could be integrated into its transportation infrastructure.[93]

Beyond logistical needs, surveys specifically looked for sections of highway where the construction could be improved for emergency airfield use. This type of proactive behavior from civilian provincial governments regarding national defense requirements is not unusual. In the case of the 2014 fighter landing at the Zhengmin Expressway in Henan, the Henan Provincial Party Committee [河南省委] invested funds directly in order to ensure the runway was completed on time.[94] Similarly, following the successful landing, the Henan Provincial National Defense Mobilization Committee [河南省国防动员委员会] and the Henan Provincial Traffic Readiness Office [河南省交通战备办公室] jointly constructed the Henan National Defense Transportation Education Base [河南国防交通教育基地].[95] The Base is located next to the location where the fighter touched down and serves as a type of combination rest stop and museum dedicated to the fighter landing and national defense infrastructure in general. Reportedly, the local government hopes that the Transportation Education Base will inspire Chinese defense planners to implement more highway sections like the Zhengmin Expressway and further consider China's national defense transportation system.

vi While the general meaning of Class A Standards is understood, the actual numbers for these requirements are not specified in open-source literature.

Thus, Chinese highway emergency landing capabilities seem limited at present. The 2014 Zhengmin Expressway fighter landing led to considerable attention and praise in Chinese media, implying that it was a relatively difficult, remarkable, and uncommon feat for China at the time. Even if these types of landings and exercises become more commonplace, they may still be limited in terms of practicality in an emergency situation. When describing the 2018 landing exercise conducted by the Northern TCAF, the source did not mention how long it took to prepare the highway for use. In an emergency where an airfield was significantly damaged, the PLA may not have the time nor capability to systematically remove guardrails and traffic signs to allow for a highway landing. Likewise, even if a section of highway is long enough and straight enough for an aircraft to land, the construction materials may not be of high enough quality to survive sustained use.

## Militia Support

Local civilian militias are used extensively by the PLAAF, PLA Naval Aviation, and PLA Army Aviation for multiple airfield support functions. The PLA considers civilian resources a viable tool for wartime support, with one PLAAF division leader stating that local transportation facilities, civilian airport terminals, and local fuel supplies could be used in conjunction with coordination mechanisms to solve "difficult support problems [保障难题]."[96] Under the new civilian mobilization indexing system introduced in 2021, militia performing runway repairs likely fall under the "National Economy Class" engineering and construction resource subclass, though they may fall under the airstrike aftermath removal subdivision, while fuel support groups may fall under the logistic support subdivision.[97]

Typically, these are organized through formal joint-cooperation agreements and reinforced through combined training exercises. This may be a way to reduce costs of maintaining in-house support capabilities by outsourcing specific responsibilities. For example, one PLA Army Aviation regiment signed a cooperation agreement with local emergency vehicle crews in order to bolster its own response capabilities.[98] The cooperation agreement also allowed the regiment to draw from local air traffic control personnel, meteorological specialists, and oil and gasoline crews. Reportedly, this close cooperation allowed the regiment to reduce its own support force by more than 200 vehicles and half its previous personnel numbers during exercises.

Joint-cooperation agreements are a common method for formally establishing responsibilities and expectations between the PLA and various civilian organizations. Beginning in 2016 as part of the 13th Five-Year Plan, the Central Military Commission (CMC) established the National Defense Mobilization Department (NDMD) [军委国防动员部], whose responsibility is to promote national mobilization measures, propose long-term national defense mobilization tasks, and set core mobilization capability indicators for 2025.[99] As part of these responsibilities, the NDMD dispatches personnel to various localities to inspect their capabilities and propose methods for improving rapid response capabilities during a national crisis. One of its commonly recommended methods to improve mobilization is to utilize joint-cooperation agreements to more deeply integrate civilian and military personnel in construction and maintenance projects. For example, in 2017 the NDMD worked with the Fujian, Guangdong, Jiangsu, and Hunan provincial governments to promote an "integration platform" [融合平台] to bring civilian and military departments together. Reportedly, since the creation of this "platform" nearly 30,000 kilometers of frontier and coastal defense roads have been constructed, along with other projects including helipads.[100]

Beyond runway-related construction projects, these integration plans can stipulate which militia work units will be activated in the event of an attack on an airfield. Because of this, many civilian personnel are chosen for their work-related skillsets. Often, militia units can include civilian vehicles and personnel with repair duties related to their regular jobs. For example, one PLA Army Aviation regiment's civil-military joint cooperation agreement stipulated local civilian air traffic control support, as well as meteorological and oil resources.[101] Similarly, a Western TCAF airfield organized its militia by profession into chemical defense, medical rescue, and engineering repair units responsible for clearing the runway of smoke, injured personnel, and damaged sections respectively.[102] Following training in this manner, the PLAAF airfield and the local Civil Aviation Department signed an agreement specifically stipulating expected response times, militia responsibilities, and expressly shifting the militia's duty from "pre-combat support" to emergency response. In another example, one PLAAF airfield's emergency response militia was made up of employees from a local construction company who reportedly brought in their transport vehicles, excavators, and road rollers from their work to resurface a take-off strip during an emergency response drill.[103]


*Civilian construction equipment used for runway repair*[104]

It may be assumed that airfields closer to large urban centers have greater access to civilian resources. For example, given their proximity to a large urban center, one PLA Naval Aviation airfield near Shanghai added seventeen specialized militia coaches to help integrate civilians into military duty.[105] The Baoshan District[vii] militia engineering unit has already been used for runway repair tasks and exercises by the airfield, with Baoshan District bringing on more than 50 new teams of militia for various support tasks.[106]

In order to improve emergency response, local militia training is often organized by the PLA base with which it has signed support agreements and conducted jointly with the PLA personnel at the base. For example, a PLAAF airfield near Xuzhou, Jiangsu Province formally linked militia and PLAAF training in 2009, and by 2019 this joint training had become a regular event as part of the airfield's formal annual training plan.[107] In one exercise, the militia was given the duty of repairing a one square-meter crater, and due to the close cooperation and oversight of their PLA counterparts were able to accomplish the task in twenty minutes (which appears to be fairly standard when compared with other reports). Overall, militia tasks at the Xuzhou airfield included air defense, communications, engineering, and chemical defense response. Reportedly, the PLAAF airfield was following the 2018 "Militia Military Training Guideline" [民兵军事训练大纲]. Another PLAAF airfield relies on militia for meteorological and hydrological tasks, surveying, mapping and navigation, emergency repair engineering, and high-tech equipment maintenance.[108] Other airfields have given further specialized support training to their militias on setting-up and deconstructing anti-aircraft platforms and constructing field communication facilities.[109]

Other branches beyond the PLAAF also frequently employ militia teams. In October 2018, the Southern Theater Command organized a combat exercise in cooperation with the JLSF, PLAAF, and PLA Naval Aviation, which, for the first time, assigned six branches of local civilian support forces [6支地方支援力量] to organize and directly train with professional PLA forces in field operations.[110] Regarding runway repair, the civilian forces' training consisted of practicing deployment to areas where transportation may be difficult and establishing prepositioned support camps to provide emergency fuel and maintenance services in support of the PLA's aircraft and runways.[111]

vii A District of Shanghai

*Civilians assisting in aircraft field repairs*[112]


*Militia running a refueling pipeline for PLA aircraft*[113]

As mentioned above, the most common form of training appears to consist of local militia organizations arriving at PLA airfields for either direct training by PLA personnel, or to participate in support exercises in promotion of "jointness." This focus on using militia to supplement the PLA in a support capacity has been pushed by the NDMD since 2016 when it called for supporting joint operations, complementary national defense construction, more precise mobilization activities, and an integrated emergency and wartime response.[114] Commonly, PLA airfields activate joint training agreement mechanisms to establish a training exercise. The supporting militia are then brought to train with PLA personnel to perform a number of support roles relating to runway repair operations. For example, in 2019, the Xuzhou militia reported that militia training which began in 2004 had been rapidly expanding to include more diversified tasks with more frequent training as well.[115] This necessitated the militia going to a PLAAF airfield to receive guidance on various topics including emergency runway repairs as part of their annual training. These training activities can last multiple days, with one Eastern TCAF airfield organizing a three-day support evaluation which assessed subjects such as airfield protection and defense, runway repair, forced landings, and the coordination abilities between the PLA and local organizations.[116] A Western TCAF airfield went a step further and conducted a 15-day support training event, which featured over 150 militiamen organized into 10 units.[117] During the event, the militia was used for emergency response activities, including medical treatment and repairing damaged portions of the runway.

However, militia training does not always occur at PLA airfields. Due to PLA Army Aviation's focus on remote support bases, its supporting militia may also be required to travel for training exercises. For example, in one 2013 PLA Army Aviation training activity, field helipad stations were established by PLA Army Aviation personnel.[118] After this, local militia units and their civilian emergency support vehicles (these included fire trucks and road repair/construction vehicles) arrived and assisted in the training exercise. In a similar move, the Support Department of the Southern TCAF organized a training event in 2018 where PLA Air Force personnel guided local militia to perform support operations for both the PLAAF, JLSF, and PLA Naval Aviation.[119] Preceding this exercise, it appears that the PLAAF established an emergency response mechanism engaging local resources such as transportation facilities, airport terminals, fuel supplies, storage facilities, and maintenance facilities, which could be activated for military use at any time. During the training exercise, militia forces were gathered together into field support camps where teams were established, equipment and responsibilities were distributed, and supplementary training was provided. The teams were then dispersed to provide support to either PLAAF, JLSF, or PLA Naval Aviation units. This exercise was unique in Southern TCAF history in that nearly half of the forces involved were local militia.[120]

Likewise, during training for PLAAF highway landings, local support organizations are also used extensively to both prepare a section of highway for aircraft landings, and to support the aircraft after it has landed. For example, during a 2018 Northern TCAF highway landing exercise, initial local support came in the form of highway police closing off the section of the highway and diverting traffic.[121] Following this, local construction companies arrived to prepare the highway by removing traffic signs and guardrails. Finally, after two fighters touched down on the highway, civilian support staff were used to reinflate tires and refuel the aircraft. In this case, the civilian support came from local government and businesses who were contacted by the PLAAF prior to the landing. It was not reported how much prior warning the support elements had before the landing, and it remains unclear how long it took the support elements to arrive at the location after being notified.

## Military-Civil Fusion Activities

Beyond bringing militia to PLA airfields for training and integration, the PLA frequently extends into civilian spaces as well. This includes military use of civilian airports. In the event that an airfield is damaged in an attack, civilian airports present a viable alternative for PLA aircraft to use in an emergency.[viii] Reportedly, as of 2014 the PLA Air Force had specifically constructed nearly 70 airports to be used for either civilian or military purposes, presumably fulfilling either function depending on the state of conflict and the most pressing needs at the time.[122] In China's mountainous Western provinces, for example, the PLAAF Ninth Engineering Corps has built at least 110 airports, with their construction projects accounting for 90% of the high-altitude projects in the area.[123] While not all were built with set plans for dual civil-military use, given their construction history it would not be unexpected. In an interesting inversion of the typical MCF relationship between the PLAAF and militia personnel, one such joint military-civil use airport in the Northern Theater Command appears to be maintained by military personnel instead of local civilians.[124] The joint airport features twice-daily inspections of the landing strips by military personnel, numerous support vehicles used for assisting in repairs, and PLAAF monitoring and maintenance.

Civilian organizations also have a hand in supplying the PLA with materials and equipment related to rapid runway repair. As mentioned previously, the Hubei Huazhou Heavy Industry Emergency Equipment Company Ltd. [湖北华舟重工应急装备股份有限公司] manufactures many types of equipment for emergency uses, including portable, rapid deployment helipads for temporary use.[125] These are specifically marketed for military use during wartime as well as for disaster relief efforts. These helipads were recently demonstrated at the Hubei Flood Prevention and Rescue Exercise [湖北省防汛抢险综合演练] where they allowed medical evacuation helicopters to safety land in fields and other remote locations.[126] Civil-military dual-use equipment also extends to foreign object debris (FOD) detection, which is useful for both PLA and civilian airfields. The company Ao'pu Optoelectrics [奥普光电] worked jointly with the PLAAF to develop a system for monitoring FOD on airstrips which the company hopes to expand to China's burgeoning civilian airports as well.[127] Another company, Zhongxiang Aviation Industry LTD. [中祥航业科技股份有限公司] (which has partnerships with AVIC), signed an agreement with the Israeli company Xsight Systems to further implement FOD systems through China.[128] Likewise, the above mentioned semi-submersible ship designed by Shanghai Zhenhua Heavy Industry [上海振华重工] for PLA Army Aviation helicopter landings at sea is also frequently reported as supporting various civil and military activities, such as marine emergency repair, emergency evacuation, cargo transportation, earthquake relief support, and cross-regional military exercises.[129]

Civilian businesses have also used their equipment to participate in PLA repair exercises and can be assumed to be active in the event of conflict. For example, the PLAAF held a support exercise in October of 2018, which featured both PLA personnel and extensive civilian participation.[130] During the exercise, the repair unit of an engineering platoon was augmented by fifteen workers from the local branch of the China Railway Group, who used their civilian vehicles and equipment to perform emergency repairs on the runway.[131] However, the practicality of these situations in combat is not clear. In an actual combat environment, the militia personnel and their equipment would need to be brought to the airfield from their civilian workplace, an endeavor which could cost a precious amount of time. Unless the equipment was pre-deployed, this type of civilian participation only seems practical as a last resort. Further, it is unclear how frequently civilian construction companies drill for tasks such as EOD and FOD removal, and it is possible that they receive only occasional and rudimentary training in these tasks, limiting their speed and effectiveness in a conflict.

viii For more information on PLAAF use of "unfamiliar" civilian airports see: Derek Solen, "The PLA Air Force's Efforts Toward Agile Combat Employment," China Brief, Vol 21, no 17, 10 September 2021, https://jamestown.org/program/the-pla-air-forces-efforts-toward-agile-combat-employment/

## Conclusion

Anticipating U.S. strikes against landing strips, the PLA has taken numerous steps towards ensuring its airfields are resilient to enemy airstrikes. This includes traditional methods such as detecting and removing unexploded ordnance, cutting out and refilling damaged sections, and rapidly disposing of foreign object debris as common training subjects. These approaches are not confined to the PLAAF or PLA Naval Aviation, as local militia organizations are often included in training and preparations as a way of reducing costs. The exact extent and responsibilities of militia organizations are often established in joint-cooperation agreements between PLA bases and the local civilian government.

Beyond runway repair, the PLA also appears to be exploring alternate methods of ensuring its air power can respond in a conflict. Civilian airports and remote temporary basing, as well as shipborne landing options, are an active part of training and may be an alternative avenue for the PLA to explore. While highway takeoff and landing may also be an option in an emergency, it does not appear that the PLA capabilities are yet highly developed in this area. The fact that standards for highway suitability exist, but do not appear to be commonly applied or maintained, points towards either a lack of interest, or more likely a lack of capabilities.

Ultimately, it is difficult to assess the efficacy of China's rapid runway repair capabilities using only open sources. Although it has had ample time to prepare for a conflict with the United States, the PLA has not seen a protracted war since the 1950s. It has taken demonstrable steps by gearing training in multiple branches toward addressing inoperable runways, yet the exact parameters of the training are not often discussed, nor is the degree of realism. From public reporting it seems that situations and personnel are often prepositioned with a low degree of realism or surprise. Regardless, from temporary basing to highway landings, there is value in the variety of takeoff options being pursued by the PLA. Although they are large, noticeable facilities, runways are also slender and simple to construct and rebuild. Thus, even when considering the often low quality of PLA training, given the nature of airfield resilience it is likely that U.S. attempts to ground PLA air elements will face a daunting challenge from the PLA's rapid runway repair capabilities.

# Appendix 1: U.S. Basing, Capabilities, and Rapid Runway Repair Techniques

It is most likely that a potential conflict involving the People's Republic of China (PRC) and the United States would occur in East Asia and the Western Pacific. Given the proximity of the Chinese mainland in the event of a conflict in Taiwan, the South China Sea, or the Korean Peninsula, China has both an advantage in terms of initial force positioning and a disadvantage when considering the potential damage the Chinese mainland would face under threat of attack. Conversely, the United States faces disadvantages in terms of the distance between the potential theater of combat and the U.S. mainland, with supplies and forces requiring transportation and positioning to be effective. When considering the key initial stages of the conflict, forces already located in East Asia will most likely play a dominant role.

The United States maintains in its 2022 National Defense Strategy Fact Sheet that its top three priorities are defending the U.S. homeland in pace with the growing multi-domain threat posed by the PRC, deterring strategic attacks against the United States and its allies and partners, and deterring aggression with priority on the PRC challenge in the Indo-Pacific.[132] In a similar manner, previous National Defense Strategies have emphasized allied deterrence in the conventional, nuclear, and advanced technology realms.[133] This deterrence comes primarily from the significant U.S. presence in East Asia along China's eastern flank.

U.S. bases positioned in Japan act as a regional hub in the Western Pacific, hosting major combat components from the United States. U.S. military forces are located in 85 facilities throughout various Japanese islands, and Japan is home to the USAF 5th Air Force.[134] Of these facilities, the USAF has three main bases in Kadena, Yokota, and Misawa. Together, these three bases represent an estimated 27,000 servicemembers.[135] In addition to the many installations in Japan, the U.S. military also maintains a significant presence in the Republic of Korea. The USAF operates two major airfields at Kunsan and Osan with a combined estimate of 8,700 personnel.[136] Although these forces are postured to respond to a conflict involving North Korea, it is possible they would be involved in a Chinese conflict as well. Beyond these two major neighbors of China, the U.S. military also has numerous facilities and partners spread around China, neighboring its important shipping lanes, and in the Pacific in general. One of the most important of them is Andersen Air Force Base located in Guam, which houses the USAF 36th Wing (along with Diego Garcia and Singapore). This base represents an estimated 5,200 personnel and a forward edge for the USAF to project power into the Western Pacific.[137] Importantly, it is also located on U.S. territory, not supported by a host country.

Beyond these bases, The USAF Agile Combat Employment (ACE) concept calls for using Forward Arming and Refueling Points (FARP) and any suitable existing airfield across the globe, including civilian fields and other austere airstrips in the event of an emergency.[138] A C-17 would forward deploy maintenance personnel, munitions, and fuel in order to rearm, repair, and refuel F-22s for continued operations. This concept would enable up to 258 civilian airfields in the Pacific to be used for fighter operations and would significantly increase survivability of USAF operations in the event of an airfield being rendered inoperable due to enemy attack. However, this concept also seriously increases the risk of escalation in an otherwise limited engagement, as civilian airports in partner countries may come to be regarded as legitimate military targets.

With prominent USAF airfields in nearby countries, Chinese defense planners can expect stealth bombers, GPS-guided munitions, and long-range standoff missile strikes. A RAND Corporation report from 2015 predicted that in a direct confrontation, the United States would most likely be able to fly 24 bombers against Chinese airfields in the initial phases of a conflict but would probably need to compete with fighters and other aircraft for limited positions at forward U.S. airfields.[139] Likewise, initial assaults against Chinese airfields would most likely come from standoff missiles, including JASSMs and JASSM-ERs launched from B-52 or B-1B bombers.

In response to likely U.S. air strikes, the RAND report found that PLAAF airfields had built hangers, hardened shelters, and underground facilities, and improved their integrated air defense systems around important targets.[140] It further identified 33 PLAAF and six PLAN airfields within 800 kilometers of Taiwan that would likely be the first hit in a conflict. The report found that on average, the Chinese airfields required twice as many strikes to disable when compared to the USAF airfield in Kadena, and would require between four and eight hours to complete repairs.[141] Critically, it also noted that although U.S. standoff missiles had improved between 2010 and 2017, so too did the PLA's abilities to thwart legacy aircraft from penetrating Chinese airspace.

Thus, the threat posed to China in general and PLAAF airfields in particular is significant, but also being actively ameliorated by the PLA. Traditionally, the PLA has relied on a large standing army and the strategic depth of the Chinese mainland to absorb an invasion. However, the U.S. strategies displayed during Operation Desert Storm reinforced the importance of pre-emptive strikes and rapid responses in a conflict with the United States.[142] Regarding pre-emptive strikes, these tend to be justified by China's "active defense" concept, which considers threats against Chinese sovereignty or territorial integrity (such as supporting a Taiwanese independence movement) as warranting a military response.[143]

When facing threats from Chinese pre-emptive attacks, the United States can also deploy a number of similar rapid runway repair techniques. When performing repairs on a runway the U.S. Air Force's process involves a minimal operating strip marking team, EOD teams, a crater team, a mat team, an airfield lighting team, and a mobile aircraft arresting system team.[144] Typically, cutting and refilling a crater takes around 2 hours, and is conducted by civil engineers attached to airfields.[145] Similar to the Chinese system, the runway is inspected for defects, cracks, and FOD as both a part of routine maintenance and after a crater is repaired.[146] Fiberglass FOD covers can also be employed to newly filled craters to ensure FOD is not introduced during repair activities. Generally, these repair activities are organized at the Emergency Operations Center attached to the airfield.[147]

# Endnotes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