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The People's Liberation Army Rocket Force: reshaping China's approach to strategic deterrence

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ABSTRACT

The Chinese People's Liberation Army (PLA) is in the midst of a sweeping reform programme to significantly transform its organisation, force posture, command and control structures, and internal politics. Among the many important aspects of this effort is the establishment of the PLA Rocket Force (PLARF). Creation of the PLARF solidified China's missile forces as a critical element of China's evolving strategic deterrent posture, portends continued significant investment in PLARF modernisation, and points to a more concerted effort to integrate PLARF capabilities into more effective PLA-wide joint operations—all key developments in the fundamental reshaping of China's approach to strategic deterrence. These developments will affect U.S. strategic and extended deterrence postures, U.S.-China strategic stability, allied conventional force operations, information dominance and security, critical infrastructure, and other key aspects of national security. This study details the organisational, technological, and doctrinal changes afoot for the PLARF, and analyses how—if successful—they affect U.S. and U.S.-allied military strategy in the Indo-Pacific region.



KEYWORDS


China; strategic deterrence; People's Liberation Army Rocket Force; missiles; military reform; military modernisation

Introduction: shaking up the PLA

The Chinese People's Liberation Army (PLA) is in the midst of a sweeping reform programme formally initiated at the end of 2015. These reforms have significantly transformed the PLA's organisation, force posture, command and control structures, and internal politics. From the Chinese leadership's perspective, these reforms are critical to China's goal of transforming the PLA into a world-class military from a force that is unprofessional, untested and deeply corrupt. In their view, the rise of China as a global power must be underpinned by a military that is capable of conducting effective joint operations, fighting short, intensive and technologically-sophisticated conflicts, and doing so farther from Chinese shores.

In short, the reforms intend to make real the rhetoric of the PLA's official mandate as stated in the most recent Chinese defence white paper: 'winning informationized local wars, highlighting maritime military struggle and maritime PMS [preparation for

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military struggle]’ in which ‘[i]ntegrated combat forces will be employed to prevail in system-vs-system operations featuring information dominance, precision strikes and joint operations.’ (State Council 2015) While many obstacles remain ahead for Chinese military modernisation, these reforms will likely make a major contribution to building the PLA into a more powerful and effective military organisation. (Chase and Engstrom 2016; Cliff 2016; Secretary of Defense 2016).

Among the many important aspects of this reorganisation and reform effort was the establishment of the PLA Rocket Force (PLARF), which is the focus of this article. A number of studies have focused on the overall aims and prospects of the latest PLA reform drive (Allen, Blasko, and Corbett 2016; Finkelstein 2016; Wuthnow and Saunders 2017; Cooper 2018). In addition, some analyses have looked specifically at whether and how these reforms have affected particular branches of the Chinese armed forces, such as the PLA Strategic Support Force (Lin 2017; Pollpeter, Heginbotham, and Chase 2017; Costello 2018; Costello and McReynolds 2018) and PLA Army (Saunders and Chen 2016). Recent studies on the PLA Rocket Force (PLARF) have also considered the impact of the recent reforms on the organisation and evolving role of China’s nuclear and missile forces (Logan 2016; Heginbotham *et al.* 2017; Chase 2018; Ni and Gill 2018).

Building on these studies and drawing from Chinese (and other) sources, this article provides a comprehensive update regarding the ongoing reform and reorganisation of the PLARF. It focuses in particular on those developments which appear to be reshaping China’s approach to strategic deterrence (Johnston 1995–96; Gill, Mulvenon, and Stokes 2002; Fravel and Medeiros 2010; Chase 2013; Wu 2013; Cunningham and Fravel 2015) including development of the concept of ‘integrated strategic deterrence’ (Chase and Chan 2016). In doing so, the article highlights the doctrinal, technological, and operational building blocks which are in formation to support a more expansive and flexible approach to strategic deterrence on the part of the PLA and the PLARF in particular (Chase and Chan 2016; Cheng 2016; Blasko 2017).

While not entirely ‘new’, establishment of the PLARF has solidified China’s missile forces as a critical element of China’s evolving strategic deterrent posture, portends continued significant investment in PLARF modernisation, and points to a more concerted effort to integrate PLARF capabilities into more effective PLA-wide joint operations—all key developments in the fundamental reshaping of China’s approach to strategic deterrence. Importantly, such advances on the part of the PLARF pose significant new challenges to the United States, its allies and other security partners, including Australia. These challenges could affect U.S. strategic and extended deterrence postures, U.S.-China strategic stability, allied conventional force operations, information dominance and security, critical infrastructure, and other key aspects of national security. Given these developments, this study details the organisational, technological, and doctrinal changes afoot for the PLARF, and analyses how—if successful—they could affect U.S. and U.S.-allied military strategy in the Indo-Pacific region.

Background on the PLARF

On December 31, 2015, as part of a sweeping reorganisation and modernisation drive, China’s missile force, the Second Artillery Force (第二炮兵部队), was formally elevated to a full ‘service’ (军种), and renamed the Rocket Force (火箭军) (Xinhua 2016a). This move

recognised the increasing importance of China's conventional and nuclear missile forces for the country's military strategy and national security. In addition, it formalised the *de facto* status of China's missile forces within the PLA given that the Second Artillery Force has played a role similar to a full service for decades (Ministry of National Defence 2016).

In some respects, as the successor organisation of the Second Artillery Force (SAF), the PLARF represents more continuity than change. The SAF, first formed in July 1966 shortly before the PRC test-fired its first nuclear-capable ballistic missile, had always been responsible for China's land-based nuclear-armed missiles and their nuclear deterrence mission, and this responsibility will continue for the PLARF. Starting from the mid-1980s, the SAF was tasked to pursue 'dual deterrence and dual operations', meaning it was to maintain both nuclear and conventional missiles, a mandate under which the SAF dramatically expanded and diversified its conventional forces. The PLARF will maintain this dual role as well (Lewis and Xue 1991, 1994; Gill, Mulvenon, and Stokes 2002; Feigenbaum 2003).

In addition, official characterisations of the newly-established PLARF are closely similar to official descriptions of the former SAF. China's paramount leader Xi Jinping and China's Ministry of National Defence have described the PLARF as the 'core force' (核心力量) of China's strategic deterrence (战略威慑); a 'strategic support' (战略支撑) for China's major nation status; and a 'cornerstone' (基石) of national security (Ministry of National Defence 2016). Moreover, current high-level characterisations of the PLARF are similar in many respects to the way authoritative Chinese documents—such as the 2015 Chinese defence white paper—described the SAF in the past (State Council 2015).

However, beyond the similarities, official characterisations also point to a more expansive role and greater expectations for the new PLARF when compared to its predecessor, the SAF. At the inauguration ceremony for the PLARF in December 2015, Xi Jinping articulated a new formulation for the strategic requirements for China's missile forces. In his words the PLARF needs to 'possess both nuclear and conventional [capabilities]' (核常兼备) and be prepared to conduct 'comprehensive deterrence and warfighting' (全域慑战) operations (Xinhua 2016a). While the requirement to possess both nuclear and conventional capabilities is not new, the emphasis on 'comprehensive deterrence and warfighting' is significant. The Chinese term *quanyu* (全域) in this formulation can be best translated as 'comprehensive' or 'all-encompassing'. This comprehensiveness includes a geographic element that requires the PLARF to be able to fight and deter enemies across different regions and distances (Xiao 2015, 367–368). But it also includes a domain element that requires the PLARF to conduct operations with effects across land, sea, aerospace and electromagnetic spectrums (Xiao 2015, 367–368). The newly-emphasised requirement for the PLARF to prepare for 'comprehensive deterrence and warfighting' operations suggest that the force is expected to execute, either independently or as part of a joint effort, a diverse range of warfighting and deterrence operations. The idea of 'comprehensive deterrence and warfighting' may have been aspirational for the Second Artillery Force, but the rapid development of China's missile forces means that it has become a key requirement for PLARF going forward. The elevation of the Second Artillery Force to the PLARF, in the words of one PLA source, 'will certainly put forward higher requirements with respect to the construction of [China's] strategic missile forces.' (China Military Online 2016)

In addition to the elevated expectation on the PLARF to carry out conventional strike and strategic deterrence operations across geographic regions and domains, Xi also called

on the PLARF to enhance its ability for ‘strategic balancing’ (战略制衡) (Xinhua 2016a). While the term ‘strategic balancing’ was not explicitly defined, PLA sources have often advocated the use of asymmetric capabilities as means of balancing, defeating and deterring stronger foes (MSRD 2013, 150; Xiao 2015, 363). While Xi did not specify any target countries for this ‘strategic balancing’, there seems little doubt that this is aimed at China’s main strategic competitor, the United States, and to a lesser extent, Russia and India. This ‘strategic balancing’ language signals the increased expectation placed on the new force to contribute to China’s overall strategic position.

PLARF missions

The PLARF has two key missions: strategic deterrence and warfighting. As the successor of the SAF, the PLARF is the ‘core force of China for strategic deterrence’ with the responsibility for ‘deterring other countries from using nuclear weapons against China.’ (State Council 2013, section II). As part of its strategic deterrence mission, the PLARF conducts a diverse range of operations, including the display of combat readiness and missile capabilities through the media, military parades, military exercises, and force deployments. In addition, the PLARF is also responsible for nuclear counterattack ‘either independently or together with the nuclear forces of other [PLA] services’ (State Council 2009, section VII). Under China’s nuclear strategy, nuclear counterattack serves primarily a strategic purpose, such as to deter future nuclear aggression. However, authoritative PLA texts suggest that nuclear counterattacks may also serve secondary operational objectives (MSRD 2013, 169–176).

The PLARF has been explicitly called upon by the Chinese leadership to make a significant contribution to ‘strategic balance’ between China and its main strategic competitors (Xinhua 2016a). This suggests that China’s commitment to continuing the modernisation of its strategic missile forces remains unchanged. At the same time, it is worth noting that the PLA Navy and PLA Air Force are seeking a larger nuclear role through the development of sea and air platforms for the delivery of nuclear weapons. The PLARF will increasingly share its strategic deterrence role with these two services along with a corresponding need to coordinate strategic deterrence and nuclear counterattack missions.

The development of conventional missile capabilities has been a relatively recent phenomenon for a force that was traditionally focused on nuclear-armed weapons. However, China’s conventional missile forces and capabilities have grown rapidly over the last two decades. This resulted from a realisation on the part of China’s strategic leadership starting from the mid-1980s of the changing nature of warfare and the value of longer-range, offshore, precision-strike conventional weaponry for both deterrent and warfighting purposes. It was also the case that—owing to the decades-long investment in the country’s nuclear missile program—China’s missile technology capabilities were far more advanced than other potential long-range strike platforms such as aircraft. Hence, the SAF was tasked with the ‘dual deterrence and dual operations’ role to maintain both nuclear and conventional missile forces. Since the mid-1990s, these conventional forces and capabilities have become critically important for both deterrence and warfighting vis-à-vis Taiwan, the East China Sea, the South China Sea as well as in relation to deterring or defeating U.S. intervention around China’s periphery.

In terms of conventional warfighting, the PLARF is responsible for 'conducting medium- and long-range precision strikes' with land-based conventional missiles against 'key strategic and operational targets of the enemy' (State Council 2009, section VII). The PLA's conventional missile strategy acknowledges that due to the limited number and high cost of the PLARF's conventional missiles, 'the types of targets suitable for conventional missile strike is limited.' As such, during joint operations, China's conventional missile force will be used against high-threat and high-value enemy targets, such as reconnaissance and early warning systems (侦察预警系统), electronic countermeasure systems (电子对抗系统), anti-air and anti-missile positions (防空反导阵地), and military bases. The goal of PLARF conventional missile operations is to 'degrade the enemy's combat system' and 'suppress its operational capabilities' in order to 'create the necessary conditions for follow up operations by other service branches of the PLA' (MSRD 2013, 236).

The strategic requirement for the PLARF to be ready for 'comprehensive deterrence and warfighting' operations signal the expectation on the force to develop a full spectrum of capabilities for a diverse range of scenarios. This was not expected of the Second Artillery Force because of inadequacies in weapons technology, operational doctrine, and critical support systems, such as the lack of effective and space-enabled command, control, communications, intelligence, surveillance, reconnaissance and targeting systems.

In addition, the PLARF has a clear counterspace role that involves the operation of anti-satellite missiles. While much of the PLA's military space mission was consolidated under the new PLA Strategic Support Force created at the same time as the PLARF, the PLA's anti-satellite missile capabilities remain under its missile forces. This is because the PLARF has existing expertise and missile logistics and supporting capabilities inherited from the SAF. Some PLA sources have argued for the continued involvement of China's missile forces in space warfare for the future. For example, one source asserts that China's missile forces will need to develop 'new operational means' (新型作战手段) in response to the changing nature of warfare, especially the intensification of military competition in non-traditional domains, such as outer space (MSRD 2013, 232–233). Therefore, for the PLARF, 'an important direction in its development' is to 'extend its operational capabilities to new areas, such as space' (233). In fact, according to current PLA missile strategy, under special circumstances, the PLARF's missiles can be used to strike key nodes in the enemy's space and information network, such as military satellites. It is envisaged that this would create wider effects on the enemy's operational systems, thereby creating the conditions for the PLA to 'seize strategic initiative' (236). It is also the case that the PLARF's missile forces could target and attack an adversary's space-related land-based infrastructure, such as telemetry, tracking and control sites and other space communications systems. These PLARF counterspace roles will in turn demand enhanced coordination and deconfliction with the PLA Strategic Support Force and its counterspace and cyber offense role, adding another layer of command and control challenges for the newly-reorganised strategic forces of the PLA.

Going forward, the PLARF's key missions are unlikely to change, but the scope of its strategic role and operational activities may evolve to allow it to undertake a wider range of strategic deterrence and warfighting activities, enabled by technological and organisational transformation. At the same time, the PLARF must adjust to increased involvement of other services and branches of the PLA in strategic deterrence operations, which

raises important questions about strategic coordination and communication as well as inter-service rivalry and competition over budgetary resources.

PLARF nuclear strategy

China's latest defence white paper, the 2015 *China's Military Strategy*, presents what has been a longstanding and largely consistent position with respect to nuclear weapons: 'China has always pursued the policy of no first use of nuclear weapons and adhered to a self-defensive nuclear strategy.' In addition, 'China will unconditionally not use or threaten to use nuclear weapons against non-nuclear-weapon states or in nuclear-weapon-free zones.' The White Paper also asserts that 'China has always kept its nuclear capabilities at the minimum level required for maintaining its national security,' and the reason for the modernisation of Chinese nuclear forces is only to 'deter other countries from using or threatening to use nuclear weapons against China' (State Council 2015, section IV).

The positions outlined above are consistent with both past official pronouncements and authoritative PLA publications. For example, in its chapter on nuclear strategy, the 2013 *Science of Military Strategy* stresses three key points. First, China's nuclear weapons are used for strategic deterrence and counter nuclear coercion purposes only, and 'the target of [China's] nuclear deterrence is limited to other nuclear-armed states.' Second, China pursues 'a policy of no first use of nuclear weapons,' and it will only use nuclear weapons in self-defence when it comes under nuclear attack. Third, China adopts a 'revenge' logic of nuclear deterrence and would seek to reinforce the credibility and efficiency of nuclear deterrence through improving capabilities for nuclear counterattack (MSRD 2013, 172).

While China's declared strategy in the white paper is a restatement of earlier positions, its evolving capabilities are opening up new strategic options. This can be illustrated, for example, in the case of nuclear counterattack. In the past, Chinese nuclear doctrine emphasised that nuclear retaliation would occur only after China had absorbed an enemy's nuclear attack (MSRD 2013, 174–176). However, the mobility, readiness and informatisation of PLARF units and the PLA's new space-based early warning system makes it increasingly feasible for China to adopt a 'launch on warning' posture that would have been impossible in the past. The PLA apparently considers this to be consistent with the no first use commitment that China espouses. In the words of the *Science of Military Strategy*:

Rapid launch of nuclear missiles for counterattack is consistent with [China's] no first use policy and could effectively prevent further loss of nuclear forces, and increase the survivability and counterattack capabilities of [China's] nuclear power. [This is appropriate] when the necessary conditions are met: it has been clearly determined that an enemy has launched nuclear missiles against us; [the enemy's missiles] have not yet reached the intended targets and effected explosions; and that actual nuclear damage has not been caused. (MSRD 2013, 175)

Another area of possible change concerns China's no first use commitment in the case of a non-nuclear attack (Pan 2016). The debates among Chinese strategists on the nuances and merits of adhering to the no first use commitment suggest that this is a lively issue within the China's nuclear establishment (Xia 2016). In particular, given the advances in strategic

conventional and non-traditional capabilities among the leading world's militaries, there are questions as to whether the strict form of no first use is tenable strategically.

Under the traditional interpretation of China's no first use commitment, conventional and cyber attacks against Chinese strategic targets, such as military command and control systems, space platforms, and key infrastructure, would not rise to the threshold of warranting a nuclear response. However, these attacks may have the effect of substantially degrading China's nuclear deterrence and warfighting capabilities. There is evidence that China's current approach to the above challenge is based on the concept of 'ambiguity' (模糊). *Science of Military Strategy*, for example, states that China must maintain an 'appropriate degree of ambiguity' in its nuclear deterrence posture so as to increase uncertainty for its enemy, thus 'enhancing the deterrent effectiveness of China's limited nuclear forces' (MSRD 2013, 173). This approach suggests that even if there are internal deliberations on the conditions attached to the no first use commitment, China's public pronouncements are unlikely to change in the near future in order to maintain a degree of strategic ambiguity.

In addition to nuances of the no first use commitment, Chinese nuclear thinking could also evolve towards a new limited nuclear warfighting posture in the years ahead. The strategic requirement for the PLARF to be prepared for 'comprehensive deterrence and warfighting' operations may suggest a more integrated and flexible approach that blurs the traditional conventional-nuclear distinction. While a formal shift to a nuclear warfighting posture has been consistently ruled out by official Chinese pronouncements, the technological, operational, and doctrinal limitations which have constrained a more forward-leaning, nuclear warfighting posture are being rapidly eroded. This is made possible by advances in missile and warhead technologies as well as development of key enabling capabilities, such as reconnaissance, surveillance, communications, tracking and sensory platforms.

The trajectory of China's military modernisation with the development of new joint operations, nuclear and cross-domain capabilities have implications for China's nuclear warfighting capabilities that goes beyond the current official Chinese strategy and policy pronouncements. As China aspires to an integrated deterrence and warfighting posture, this will increasingly include a *de facto* nuclear warfighting element which allows for a more expansive interpretation of the no first use pledge and could encompass greater counterforce options against critical land-based military infrastructure such as naval and air bases.

Developments in China's nuclear capabilities

China's nuclear arsenal is estimated to have grown from around 145 warheads in 2006 to 270 in 2017 (Kristensen, Norris, and McKinzie 2016, 42, 43, 145; SIPRI 2017). However, despite the near-doubling of nuclear warheads, China's nuclear arsenal is still relatively small compared to the nuclear stockpiles of United States and Russia, consisting of 6,800 and 7,000 warheads, respectively (ACA 2018). Some estimates suggest the number of Chinese ICBM nuclear warheads that could reach continental U.S. will exceed 100 within the next five years (NASIC 2017, 3).

The steady growth in the size of China's nuclear arsenal is accompanied by rapid and impressive modernisation of its nuclear delivery capabilities, which are becoming

increasingly diversified, mobile, resilient and effective. China's nuclear deterrent today is more credible than any time in history with the deployment of new or upgraded missile capabilities and platforms, including intermediate-range ballistic missiles (IRBM), inter-continental ballistic missiles (ICBMs), nuclear ballistic missile submarines (SSBNs), strategic bombers, and a variety of missile-related technologies. Table S1 (below) shows estimates of China's nuclear forces as of January 2017.

Land-based nuclear missile force

According to the U.S. Department of Defense, the PLARF has 'advanced long-term modernization plans to enhance its "strategic deterrence capability"' (Secretary of Defense 2018, 36) and is 'developing and testing several new variants of missiles, forming additional missile units, retiring or upgrading older missile systems; and developing methods to counter ballistic missile defenses' (Secretary of Defense 2017, 31). Indeed, in recent years, the PLARF has focused heavily on developing and deploying mobile, solid-fuelled missile systems in order to increase the survivability of its nuclear missile forces. The most notable additions to the China's land-based nuclear force include the dual-capable DF-26 IRBMs and the DF-31AG ICBMs. The DF-41 ICBM is in the pipeline and could be deployed from 2018.

The road-mobile DF-26 IRBMs was publicly unveiled by China during the Victory Day Parade in September 2015 (People's Daily 2015), and began to be fielded by the PLARF in 2016 (Secretary of Defense 2018, 36). According to China's Ministry of National Defence, the DF-26 could perform both nuclear and conventional precision strike missions against land and sea targets, including large ships (Ministry of National Defence 2018). Its deployment highlights China's improving regional nuclear deterrent capabilities, and the diversification of its suite of conventional and nuclear precision strike options. Whether intended or not, the ambiguity arising from the dual-capability of the DF-26 could further increase its deterrence effect by introducing additional risks of nuclear escalation for enemies planning to target PLARF units armed with conventional DF-26s.

The DF-31AG is the modified and upgraded version of DF-31A road-mobile ICBM with improved mobility and range. The presence of six DF-31AGs at the PLA's 90th anniversary military parade in June 2017 indicates that the missile system has already been deployed by the PLARF. While China has not made any official statements about the capabilities of the DF-31AG, it is clear from the Chinese designation of the missile system (by adding the letter 'G') that it makes incremental changes to DF-31A instead of the significant upgrades that would warrant the designation of 'DF-31B.' The solid-fuelled missile has an improved transporter erector launcher vehicle allowing it to move through rugged terrain (Fisher 2017), which makes it more flexible, mobile and survivable than either the silo-based DF-5 or the DF-31A (with its dependence on road networks). Some Chinese analysts claim that the DF-31AG can be equipped with both nuclear and conventional warheads. Even if true, it seems highly unlikely that the DF-31AGs would be armed with conventional warheads owing to the highly confusing message it would send for nuclear deterrence purposes (not to mention the economic inefficiency of delivering a conventional payload on an ICBM) (East Pendulum 2018). Chinese media has reported the missile could be armed with up to five or six multiple independently targetable re-entry vehicles (MIRVs) (Sina 2017b).

The solid-fuelled DF-41 is China's most advanced ICBM, with capabilities rivalling the American LGM-30 Minuteman and the Russian Topol-M ICBMs. Chinese state media reported in November 2017 that the DF-41 is close to operational and would be deployed in 2018 (Sun 2017; Secretary of Defense 2018, 37). The DF-41 has an estimated range of 12,000 kilometres and can carry up to 10 MIRVs. In addition to silo-based launchers, the DF-41 is also road- and rail-mobile. Once deployed, the DF-41 will be a powerful addition to Chinese nuclear strike capabilities.

PLARF divisional-size elements (designated as Bases) with their subordinate missile brigades and possible missile systems are listed in Table 1 below.¹

Missile-related technology

Beyond the introduction of new and upgraded land-based missile systems with greater mobility and survivability, China is developing penetrative aids and MIRVing existing missile models. For example, media reports have claimed that China has tested and developed a new variant of the DF-5C missile with 10 inert warheads (China Military 2017; Gertz 2017). The MIRVing of existing DF-5C missiles may have as much to do with developing MIRV technology as for current operational needs. According to one Chinese expert, '[through MIRVing the DF-5C] China is verifying the MIRV technology for mobile land-based nuclear missile and next-generation submarine-launched nuclear missile. China has made substantial progress in this key technology' (China Military 2017).

China is also actively pursuing hypersonic glide vehicle (HGV) technology, which are manoeuvrable, extremely fast, and capable of penetrating existing missile defence systems. China has conducted at least seven successful test flights of its HGV, designated WU-14 (also known as DF-ZF) (Chen 2017). Media reports indicate that China has also conducted two tests of a new kind of HGV-capable ballistic missile (dubbed DF-17) in November 2017 (Panda 2017). Moreover, China is investing heavily in infrastructure for research into hypersonic weapons, including by building the world's most advanced hypersonic wind tunnel (Chen 2017). To be sure, China is not the only major power developing hypersonic weapons: the U.S. and Russia are both pursuing the development of these platforms (Speier *et al.* 2017). In addition, it is too early to know whether China's HGV testing program will ultimately result in operational deployments. That said, these developments bear watching as hypersonic missiles would pose a serious challenge to strategic relations between nuclear powers because of their ability to defeat existing missile defence systems as well as of the compressed timeframe for decision-making by the side under attack.

China's emerging nuclear triad

In addition to the modernisation of China's land-based nuclear forces, the PLA Navy is also developing China's first credible sea-based nuclear deterrent capability in the form of four Jin-class (Type 094) SSBNs, each capable of carrying 12 JL-2 submarine-launched ballistic missiles (SLBMs). The JL-2 missiles are MIRV-capable and have an estimated range of about 7,200 kilometres. China's next generation SSBN, the Type 096, would likely be armed with China's third-generation sea-based strategic missile, the JL-3

Table 1. PLARF bases and brigades.

Base number	Headquarters	Brigades/missile types
Base 61	Huangshan, Anhui Province	611 DF-21 MRBMs 612 DF-21 MRBMs 613 DF-15 SRBMs 614 DF-11 SRBMs 615 DF-11 SRBMs 616 DF-15 SRBMs 617 DF-11 SRBMs
Base 62	Kunming, Yunnan Province	621 DF-21 MRBMs 622 DF-21 MRBMs; possibly DF-31 ICBMs 623 D-10 LACM variants 624 DF-21 MRBMs 625 DF-21 MRBMs 626 DF-21 MRBMs; possibly DF-26 IRBMs
Base 63	Huaihua, Hunan Province	631 DF-5A ICBMs 632 DF-4 ICBMs; transitioning to DF-31 ICBMs 633 DF-5A ICBMs 635 DH-10 LACMs
Base 64	Lanzhou, Gansu Province	641 DF-31 ICBMs 642 DF-31 ICBMs 643 DF-31 ICBMs 646 DF-21 MRBM variants
Base 65	Shenyang, Liaoning Province	651 DF-21 MRBM variants 652 DF-21 MRBM variants 653 DF-21 MRBM variants 654 Possibly DF-21 MRBM variants
Base 66	Luoyang, Henan Province	661 DF-5 ICBMs 662 DF-5 ICBMs; possibly some DF-4 ICBMs 663 DF-31 ICBMs 666 DF-26 IRBMs
Base 67	Baoji, Shaanxi Province	Responsible for management, storage and handling of nuclear warheads

Source: Stokes 2018.

(based on the DF-41), and is currently being developed with construction set to begin in the early-2020s (Secretary of Defense 2018, 29). Media reports indicate that China will arm the Type 096 with JL-3 SLBMs which are currently under development (Dempsey and Boyd 2017). It is important to note that the recent developments in China's sea-based nuclear deterrent underscore the incremental nature of China's SLBM capability. As one researcher points out:

[t]he first Type 094 SSBN entered into service by 2014, roughly 60 years after the initiation of China's SLBM program, 35 years after China's first successful test launch of a ballistic missile from a submerged submarine, and about 30 years after the initiation of the Type 094 SSBN program. (Babiarz 2017)

China faces multiple constraints in the deployment of a credible and effective sea-based nuclear deterrent. Geographical constraints mean that Chinese SSBNs have limited channels for accessing the Pacific Ocean from their base on Hainan Island. The United States and its allies are likely to deploy a strong network of submarine surveillance and anti-submarine systems to track any SSBN deterrent patrols conducted by the Chinese navy. Another limitation is the noisiness of the Type 094, making it difficult to evade U.S. and allied surveillance systems (Kristensen 2009). Moreover, there are serious command and control challenges for China's nascent sea-based nuclear force (see below).

There are also indications that China is making progress in acquiring an air-based nuclear deterrent in the form of an effective strategic bomber coupled with nuclear-

capable air-launched ballistic missiles (ALBM). In September 2016, the PLAAF confirmed that it is working on the next generation long-range stealth bomber, designated as the H-20, when the then-commander of the PLA Air Force, Ma Xiaotian, stated that: 'China's current long-range strike capabilities have increased significantly compared to the past. In the future it will be even greater ... we are currently developing a new-generation long range bomber' (Wings of a Great Power 2016). Some analysis estimates that the first H-20 prototype could fly as early as 2020 (Rupprecht 2017). The U.S. Department of Defense assesses that both China's older H-6 bomber and the new stealth bomber could both be nuclear capable and that the deployment and integration these systems 'would provide China with its first credible nuclear 'triad' of delivery systems dispersed across land, sea and air' (Secretary of Defense 2018, 34). That source also notes that the 'PLA is also upgrading its aircraft with two new air-launched ballistic missiles, one of which may include a nuclear payload' (34). Pictures circulated on Chinese social media in August 2017 show a new H-6 variant (dubbed H-6N), which may have been modified to carry out ALBM delivery missions (Rogoway 2017). Recent reports suggest that China may have conducted up to five tests of a new ALBM that is possibly a variant of the DF-21 MRBM (Panda 2018). China's nuclear ALBM capability was highlighted by the Director of the U.S. Defense Intelligence Agency in the 2018 World Threat Assessment: '[the PLARF's precision strike capabilities] are being augmented with two new air-launched ballistic missiles, one of which may include a nuclear payload' (DIA 2018).

As with the newly-developed capability to deploy at-sea nuclear forces, the Chinese supreme command authority will also face new command and control challenges if and as the PLAAF takes on a nuclear role. In addition, as the Chinese military moves toward a viable nuclear-weapons triad, we should expect some greater inter-service rivalry and competition for budgetary resources as the PLARF, the PLAN, and the PLAAF vie for operational and doctrinal pre-eminence across various scenarios for nuclear-weapons deployment and use.

PLARF leadership

An analysis of the background of PLARF's top leadership provides a number of interesting insights as to the organisation's improving status within the Chinese military hierarchy, the technological and warfighting experience of PLARF leaders, and the ongoing and growing importance of the PLARF's conventional missile force. To begin, the PLARF's leadership have by and large risen through the ranks of former SAF, with decades of experience in commanding missile operations. Recent analysis of promotion patterns within the Second Artillery Force and the PLARF indicates that those officers with experience predominantly serving in conventionally-oriented bases—and especially those who have served at Base 61 (formerly Base 52)—appear more likely to be promoted and have a stronger representation at the upper reaches of the PLARF. According to this study, this 'suggests a current and future strengthening of the Rocket Force's conventional units and missions, potentially at the expense of its nuclear ones' (Logan 2018). At a minimum, it is reflective of the growing importance of the PLARF's conventional role over the past two decades.

The first commander of the PLARF was Wei Fenghe (魏凤和), who was appointed to the position in December 2015 upon the establishment of the PLARF (The Paper 2016a).

Wei has more than 40 years of experience in China's missile forces, with nearly all his career associated with Base 54 (now Base 62), Brigade 813 (which operates nuclear-armed ICBMs) (Ni 2018; Xinhua 2018a). In the same year that he became the first PLARF commander, Wei was also promoted to full General and made a junior (last, 11th-ranking) member of the Central Military Commission (CMC), China's supreme military body. Currently, he is the fourth-ranking member on the (smaller) seven-member CMC, behind the Chairman (Xi Jinping) and the two vice-chairs (Qu Qiliang (许其亮) and Zhang Youxia (张又侠)). In addition to CMC membership, he is also China's current Defence Minister (Hou 2018).

Wei is the highest-ranked missile force officer in PLA's history by virtue of his senior position on the CMC. In addition, he is the first non-Army general to take on the Defence Minister role. This fits the broader effort by China's top leaders to change the PLA's Army-centric culture and may suggest the increasing prestige and importance of the missile forces within the PLA.

The current PLARF commander is Zhou Yaning (周亚宁), who took over command from Wei in September 2017 (Phoenix Net 2017). Born in 1957 in Hebei province, Zhou has over 40 years of experience as an officer in the missile forces (Baidu Encyclopedia 2018). His previous appointments include, the deputy commander of the Second Artillery Force and later Rocket Force (2015-2017) (The Paper 2015), the commander of former Base 52 (now Base 61) (2011-2015), the commander of former Base 53 (now Base 62) (2008-2011), and other leadership positions within the former Base 52, including the head of logistics and chief of staff. His career path closely fits the trend identified above which favours PLARF officers associated with conventional forces. Zhou is also a member of the military delegation to the 13th National People's Congress (2018-2023) (Xinhua 2018b). Zhou was promoted to Major General in July 2009 and Lieutenant General in August 2016 (The Paper 2016b; Sina 2017a).

Zhou has made very few public statements. However, he appears highly focused on the importance of technological development for missile operations and overall warfighting. In a 2011 *PLA Daily* article on the future of warfare, Zhou asserted that in modern warfare technology and tactics are 'highly infused' (163.com 2017). In his view, the shape of future wars would be principally determined by the level of technology and weaponry at the disposal of combatants, and in these wars the role of strategy is 'merely to perfect and complement' the operations of technology.

Command and control: changes and challenges

Two months after the establishment of the PLARF a new operational command structure was announced for the PLA (Xinhua 2016b). Under the new command arrangement, the four service branches are responsible for force development, and the five new joint theatres are charged with conducting operations. Under the previous system, the commanders of China's seven former military regions did not have peacetime command and control over non-army units. In wartime, these commanders would be assigned naval and air forces (Gill, Mulvenon, and Stokes 2002, 521). Unlike the three traditional services, the command and control of the Second Artillery Force was highly centralised CMC control, in both peacetime and wartime.

Despite changes to the PLA's command structure, there is no open-source evidence that the command and control arrangements for the PLARF's nuclear forces have changed. Chinese experts strongly assert that the creation of the PLARF and the broader PLA reforms in recent years have not affected command and control over nuclear forces: command authority remains highly centralised under the CMC (Beijing interviews 2018). Under this 'skip echelon' system, the country's supreme command authority skips over intermediate commanders and directly gives orders to commanders of missile brigades in the field. Arguably, with the streamlining of the PLA command hierarchy and overall strengthening of the CMC's authority under the latest reforms, that centralised command authority over nuclear weapons may be further reinforced.

Nevertheless, the diversification of China's nuclear force as well as the increasing role for PLARF conventional missiles strongly suggest important changes ahead for the command and control of China's strategic forces. For example, the introduction of new missile systems (such as the DF-26 and DF-41), the increasing dispersal of land-mobile missiles, as well as the steady increase in the number of deployable nuclear weapons will all add new complications to the command and control system of China's land-based nuclear delivery systems.

Even more challenging, China's intention to develop a bona fide nuclear triad adds new—and for China, unprecedented—layers of complexity to its nuclear command and control system. Authoritative Chinese-language literature is silent on how or whether the PLARF will be involved with the PLA Navy and PLA Air Force as those services take up nuclear missions. At a minimum, these services will need to develop capacities to manage, store, and transfer nuclear weapons, introduce appropriate communications systems, and train nuclear weapons systems technicians and operators. For nuclear-armed submarine patrols, it is possible the Chinese leadership and the PLA would introduce pre-delegation authority, which would be a major change in China's traditional command, control, and readiness posture. It seems likely that the PLARF would play some role in advising and providing direct support to the PLA Navy and Air Force as they take on their nuclear missions, but it is unknown what that role might be.

With the emergence of these new nuclear roles for the PLA Navy and Air Force, Chinese interlocutors insist the command and control structure would be similar, with the supreme command authority having direct command over navy and air force nuclear weapons. While that may be true, China's nuclear command and control system is entering a vastly more complex era, especially with the nascent deployment of nuclear weapons at sea (Zhao 2016).

In addition to these challenges in the nuclear realm, command and control changes are afoot for the PLARF's conventional missile forces. At the PLARF missile base (divisional) level, there are early efforts underway to integrate the missile base command and control system with theatre commands. One PLA article describes how a PLARF missile base has entered the 'joint operational command information system' (战区联合作战指挥信息) and has been integrating into the 'joint operations command structure' (战区联合作战指挥体系) of a theatre command. According to a staff officer from the Training Office of a missile base, '[the missile base] will participate in multiple joint exercises at the theatre level in 2018.' The article notes this would serve as a 'theatre-level pilot to assist other forces entering into the command information system', solve issues of joint operations, and improve 'joint effects' (联合效能) through 'leading the setup of operational

clusters (作战集群) in [joint] command exercises.’ This effort seems to have begun in late 2017 when, for the first time, this missile base set up an operational cluster command post under the theatre joint command structure, and commanded multiple missile brigades in an joint attack exercise (Zhang and Song 2018).

In another example, the Commander of the Eastern Theatre Command, General Liu Yuejun, in an interview shortly after the establishment of the joint theatre command system, stated that ‘[the Eastern Theatre Command] is responsible for commanding theatre Army, Navy, Air Force, PLARF and other armed forces in joint operations and military operations other than war.’ While he did not differentiate between the PLARF’s nuclear and conventional forces, it is highly likely that he only meant command over the latter (Dai, Wang, and Luo 2016).

Looking ahead, one practical obstacle to theatre-level command and control over conventional missile bases is that some missile bases have geographic boundaries which overlap more than one theatre command. The logical next step would be to reorganise the missile bases to match geographic boundaries of proximate command theatres. This step has not yet been taken, but bears watching.

Looking ahead: implications for the United States and its allies

The organisation, mission, capabilities, and stated ambitions of the PLARF add up to present new threats and challenges to the United States and its allies, especially those in the Indo-Pacific region. These threats and challenges concern deterrence, extended deterrence, cross-domain deterrence, strategic stability, allied conventional force operations, information dominance and security, critical infrastructure, and other key aspects of national security.

Deterrence challenges

Advances in the modernisation of the PLARF’s nuclear arsenal present new complexities and challenges to the U.S.-China strategic nuclear dynamic (and by extension to China’s deterrent relationship with U.S. allies). The PLARF will continue to make progress in improving the mobility, resilience, readiness, accuracy, and penetrability of its nuclear forces. Over the next one to two decades, China’s array of nuclear launch platforms will diversify beyond traditional reliance on land-based ballistic missiles to include submarines, stealth aircraft, cruise missiles, and possibly hypersonic vehicles.

On the one hand, this may reinforce the strategic stability of U.S.-China relations as Beijing is increasingly assured of a nuclear retaliation capability. On the other hand, it boosts Beijing’s ability to deter the United States and its allies across a wider spectrum of the escalation ladder, up to and including nuclear use, thus possibly limiting American and allied options in an escalating crisis. In this context, the PLA’s ability to advance down the path of ‘integrated strategic deterrence’—in essence, coordinating and tailoring capabilities across conventional, nuclear, space and cyber domains to gain deterrent effect—will further complicate U.S. and allied military planning and operations.

Under these circumstances, and with a growing array of conventional capabilities, the Chinese political and military leadership may feel more confident it can dominate the

escalation ladder beneath the nuclear threshold, wielding or using conventional capabilities which could have strategic effect by limiting American and allied operational choices.

China's burgeoning range of both nuclear and conventional capabilities could increasingly have the effect of undermining U.S. extended deterrence guarantees to U.S. allies. On the one hand, China is developing more sophisticated and diverse medium- and intermediate-range nuclear launch platforms which—in the expectation that the United States would be deterred at the strategic level—could be wielded against regional targets such as U.S. bases on foreign soil. Or, as China gains in its ability to deliver conventional attacks with strategic effect below the nuclear threshold, it may do so against U.S. regional allies in the expectation that the United States would not escalate to the nuclear level.

Challenges to strategic stability

While stability at the strategic nuclear level may be theoretically enhanced as China develops a secure second-strike capability, ambiguities in China's nuclear posture could lead to dangerous instabilities in the future. These ambiguities include the future interpretation of the no first use commitment; the proximate co-location of conventional and nuclear ballistic missiles; the existence of dual-capable ballistic missiles such as the DF-21 and DF-26; the nascent deployment of *Jin*-class nuclear-capable ballistic missile submarines; and the command-and-control challenges inherent in China's diversifying nuclear arsenal. These ambiguities could lead to misperceptions and escalatory actions on the part China and the United States (and its allies) in times of crisis and/or conflict.

As China invests more heavily in its space-related infrastructure to enhance its strategic capabilities, especially in support of PLARF operations, kinetic and non-kinetic attacks on China's land- and space-based reconnaissance and targeting assets could be interpreted as attempts to undermine the country's nuclear capability, prompting an escalation towards the use of nuclear weapons.

A more capable PLA at the conventional level

The future development of the PLARF will be central to the PLA's aim of becoming a more effective fighting force. A key motivation for the ongoing PLA reforms, including the establishment of the PLARF, is to develop the capacity to defy, deter and/or, if necessary, defeat the United States and its allies in what is envisioned will be a relatively short, localised conflict. In such a conflict, the PLA would seek to prevail in a system-vs-system confrontation featuring information warfare, precision strikes and joint operations.

The conventional forces of the PLARF will likely be employed offensively at the very outset of a campaign, while PLARF strategic deterrent capabilities would be readied with the aim to manage escalation risks and deter and/or defeat large-scale regional intervention. For example, the conventional side of the PLARF is being configured to deter and attack with precision strike capabilities: missile systems such as the DF-21 and DF-26 are designed with U.S. and allied land- and sea-based assets in mind. With further testing and development of more sophisticated reconnaissance and targeting assets, these weapons, in combination with other offensive (including other anti-ship) capabilities will increasingly complicate U.S. and allied military options, especially around China's maritime periphery.

Possible U.S and allied responses

These likely developments for the PLARF prompt several key recommendations for the United States and its allies. First, given China's diversifying array of nuclear and strategic conventional capabilities, the United States must articulate reliable extended deterrence guarantees to allied partners and develop and extend assurances to partners to deter non-nuclear Chinese threats and attacks which could have strategic effect as in the space- and cyber-domains.

Second, with China's growing array of advanced conventional capabilities, especially in the advanced aerospace (missiles), outer space, and cyber domains, the U.S. government, in cooperation where possible with allies, must enhance defensive and offensive countermeasures in these realms to ensure maximum operational manoeuvrability. These investments must include the ability to pre-empt, suppress and defend against Chinese conventional missile and counterspace attack. To the greatest extent possible, such defensive and offensive countermeasures should extend to protect key allies and security partners such as Australia, Japan, South Korea, and Taiwan which would likely to be targets of Chinese offensive operations.

Third, as the PLA becomes more reliant on space- and cyber-based systems to achieve its strategic aims and improve operational outcomes, including those of the PLARF, the United States and its allies should in turn increase focus on China's space- and cyber-related assets to assess the PLA's progress toward more effective joint operations and to identify potential targets for pre-emption and disruption.

Fourth and finally, relevant U.S. and allied agencies should invest further resources toward understanding China's evolving strategic deterrent posture, especially in the nuclear, space, cyber, and aerospace domains. Attention should be given to three important aspects of China's evolving strategic deterrent posture. The first is the PLA's effort, including through the PLARF, to explore and develop a 'strategic integrated deterrent' against strategic competitors. The second concerns the operational meaning and likely outcome of Beijing's expectation that the PLARF will enhance and achieve 'strategic balance' vis-à-vis the United States. Third, a sharper focus is needed to fully understand how the PLA's advancing strategic capabilities are affecting nuclear doctrine and use, including a broadening interpretation of the no first use pledge.

Conclusion

The sweeping reform of the PLA, including the establishment of the PLARF and the wholesale restructuring of the military command and control system, have major implications for China's growing military power. While many obstacles remain, the PLA is moving towards becoming a more professional force increasingly capable of joint operations across a wider spectrum of deterrence and warfighting scenarios.

The creation of the PLARF along with the continued rapid modernisation of China's nuclear forces pose new and formidable challenges to the U.S. and its allies, especially with respect to strategic stability, deterrence and extended deterrence, and allied conventional force operations. These challenges will become more pronounced in the years ahead as the organisational reform, technological developments, and doctrinal debates continue to shape China's evolving strategic forces. This lays the conditions for China to reconsider

its approach to the use of nuclear weapons and its strategic deterrence posture in the years ahead.

Note

1. PLARF missile base and brigade numbers were changed as part of the reorganisation implemented in early 2017 that consolidated the operational units of the PLA into 84 corps-level units (Xinhua 2017; Stokes 2018).

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