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CHINA'S NUCLEAR AND MISSILE CAPABILITIES

AN OVERVIEW

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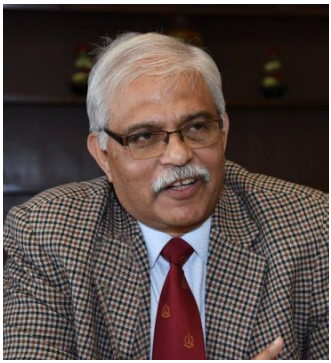


One of the foremost experts on Cyber, SIGINT and Electronic Warfare. Maj Gen PK Mallick, VSM (Retd) is a graduate of Defence Services Staff College and M Tech from IIT, Kharagpur. He has wide experience in command, staff and instructional appointments in Indian Army. He has also been a Senior Directing Staff (SDS) at National Defence College, New Delhi. Presently, he is a Consultant with the Vivekananda International Foundation, New Delhi.

Contents

Introduction

Since China first conducted a nuclear weapon test in 1964, its nuclear doctrine has remained unchanged and is underpinned by two principles: a minimum deterrent doctrine and a No First Use (NFU) policy. China's 2019 defence white paper states, "China is always committed to a nuclear policy of NFU of nuclear weapons at any time and under any circumstances, and not using or threatening to use nuclear weapons against non-nuclear-weapon states or nuclear-weapon-free zones unconditionally."

However, a recent U.S. Department of Defence (DoD) report claims that the scope of China's nuclear modernisation and its lack of transparency "raise concern that China is not only shifting its requirements for what constitutes a minimal deterrence, but that it could shift away from its longstanding minimalist force posture." The data available show that China is modernising and expanding virtually every element of its nuclear forces, including each aspect of its nuclear weapons and missile, sea, and air delivery systems. What is not clear are China's current and planned holdings of nuclear weapons, China's future plans for deploying additional delivery systems, its commitment to some form of NFU, first preemption, or launch on warning, and the extent to which it will accept what might be called a form of 'minimum assured destruction.'

China continues to improve its ground and submarine-based nuclear capability with a new generation of mobile missiles, with warheads consisting of multiple independently targetable reentry vehicles (MIRVs) and penetration aids. China is increasing peacetime readiness levels for these nuclear forces to ensure responsiveness. China maintains nuclear-capable delivery systems in its Rocket Force and Navy. The People's Liberation Army (PLA) Air Force has been assigned a nuclear mission of the development of strategic bomber. The bomber's deployment would provide China with its first credible nuclear triad of delivery systems dispersed across land, sea, and air—a posture considered since the Cold War to improve survivability and strategic deterrence.[1]

Now under Xi Jinping, China's Nuclear posture has become bolder. It seeks to provide Chinese leaders with a nuclear arsenal to underpin the country's global ambitions. Xi calls China's missiles the "core of strategic deterrence, a strategic buttress to the country's position as a major power and a cornerstone on which to build national security." Xi has also called for "a great rise in strategic capabilities".

Though no two nuclear weapon power states have fought a conventional war, there have been two occasions where two nuclear weapon power nations fought a war in a limited geographical location with a lot of restraint. The recent standoff between India and China in East Ladakh has opened up some intriguing questions. Both are powerful nations and their armies are face to face under intense tension. Both nations will like to keep the conflict localised. Both have NFU Policy on nuclear weapons.

The present situation demands thorough analysis and understanding of nuclear deterrence, its application in a limited war scenario, China's nuclear weapon policy and its nuclear and delivery mechanism arsenal and the role of non-nuclear strategic weapons.

Chapter I

Limited War

The traditional understanding of limited war is to remain short of general war to achieve specific political objectives using limited forces. It focuses on the military means used by the states which are lesser than what they are capable of. The political purposes here are not so important that a state would risk its survival to achieve them. Limited wars do not threaten the survival of the states. A nation may aim to seize and hold a fraction of the enemy's territory during limited wars. The limited aims usually guide the states to restrict to the geographical location, types of weapons used, casualties, resources used to fight and the pace of operations.[2]

A prominent example of a self-imposed limitation is the avoidance of nuclear weapons on the assumption that the adversary will also reject them, limiting the potential costs of war. As per Robert Osgood, limited war is "to be fought for ends far short of the complete subordination of one state's will to another's, using means that involve far less than the total military resources of the belligerents and leave the civilian life and the armed forces of the belligerents largely intact."[3] If the objectives are not achieved, as to how long a limited war should continue is an extremely crucial decision. War involves two sides. In a limited war, both sides need to know each other's intentions and overcome information asymmetry.

The first to develop the concept of limited war as an alternative to total war was Basil Liddell Hart at the beginning of the 1950s. Bernard Brodie adopted this view as soon as he learned that a thermonuclear weapon was about to be tested. Henry Kissinger brought a major contribution to thinking about the middle ground between total peace and total war. Kissinger was unconvinced by the military, and encapsulated the problem in 1957 to write: "We can hardly be said to possess the capability for limited war either conceptually or physically."[4] In his famous book 'On Escalation', Herman Kahn concludes that limited war is not an alternative to total war. With targets including industrial facilities, airbases and ports located in or near big cities, even a counter-force strike could amount to an all-out war. Limited war could get out of hand by degrees and lead to an all-out war.

Post Cold War, it can be said that limited wars have become the dominant type of war. Some examples are air wars by the U.S. in Iraq in 1998 and Syria in 2007, Western interventions in Kosovo in 1998-9 and Libya in 2011, invasion of Georgian territory in 2008 and Russia's annexation of Crimea in 2014.

Use of Nuclear Weapons as a Source of Strategic Leverage in a Limited War

While nuclear weapons have brought on caution, they have by no means prevented rivalry, competition and conflict. Nuclear-armed states have sought ways other than war to achieve their objectives and have adopted strategies for fighting limited wars without provoking their opponents to retaliate with large scale nuclear strikes. States engaging in limited wars against nuclear-armed powers require a theory for the use of military force to achieve their objectives while regulating the risk of uncontrolled, large scale nuclear escalation.[5] States cannot easily use their nuclear weapons as a strategic leverage source in a limited war, especially against nuclear-armed adversaries. But they still want to maximise their strategic leverage

to help them deter the outbreak of war or compel an end to a limited war using threats of violence.

Nuclear-armed states wanting to use their nuclear weapons as a source of strategic leverage face the following disadvantages, which are accentuated in limited wars:-

- Making nuclear threats credible is difficult. Nuclear weapons could cause damage to both the states that are completely out of proportion to the stakes of the conflict.
- Nuclear threats increase the risk of a total nuclear war.
- Nuclear-armed adversaries could realistically calculate that a state would be self-deterred from carrying out a nuclear strike and so ignore the threatening state's political demands. The adversary could either call the threatening state's bluff or trigger a nuclear exchange by ignoring the nuclear threat.

It is unlikely that any nuclear state would try to use nuclear weapons to achieve limited war aims, given the credibility and escalation challenges associated with nuclear coercion.

Chinese Thinking on Limited War

As per some Chinese military writings, regional wars will begin as limited conventional conflicts. Both sides are unlikely to seriously consider the use of nuclear weapons or nuclear threats too soon in the conflict. But as the war escalates, "the use of nuclear deterrence becomes a possibility." China developed a conventional missile posture. It also began to prepare for a limited war scenario. Beijing developed space, cyber and conventional missile postures to maximise its strategic leverage in a limited war without using nuclear weapons. These non-strategic nuclear weapons give Chinese leaders the tools to coerce the adversaries into a limited war.

PLA scholar Chu Shaofeng writes, "Nuclear weapons should not be a means of fighting limited wars." Arms control expert Gen. Pan Zhenqiang notes that, "the past decades of international security practice has shown that even when nuclear weapon states suffer setbacks in conventional conflicts, they still do not dare to use nuclear weapons to reverse a losing war situation." There is a high degree of uncertainty over how a state would react to being attacked with nuclear weapons first. This makes efforts to control nuclear escalation too risky. There are major problems to the control of nuclear escalation, including leaders' thinking, decisions and resolve, societal pressure on leaders not to back down, societal opposition to nuclear use, the country's circumstances and uncertainty about the opponent's anticipated reaction to a nuclear attack.[6] Many experts contend that, in the nuclear age, limited conventional wars offer the only way for states to attain their political goals through military force.[7] Chinese experts are of the view that no evidence exists to support theories suggesting that limited nuclear war is possible.

Nuclear Posture in a Local Conventional War

After 1985, the PLA examined how China could fight and win 'local wars' on its periphery, especially over its territorial disputes. In December 1988, The Central Military Commission (CMC) made a minor change to China's national military strategy through its 'Strategic Guidelines'. It applied China's 1980 strategy of active defense to a new type of "local wars and armed conflicts," without specifying any primary adversary in those conflicts.[8] A change in Chinese thinking was observed during the mid-1990s, when a 'minimum deterrent' strategy was redefined by a 'limited deterrent strategy' to include limited warfighting capability. Taylor Fravel, Evan Medeiros and Fiona Cunningham advocate that China is pursuing a calculated 'assured retaliation' capability.[9]

PLA publications emphasise the view that today's local conflicts with a nuclear-armed state is likely to take the form of "local wars under nuclear

deterrence conditions." The *Chinese Strategic Missile Force Encyclopedia* defines such conflicts as "local conventional wars backed by nuclear force."[10] In such cases, nuclear weapon readiness is likely to be enhanced as armed forces will be "constantly under the threat of nuclear attack", and there could be a grave possibility that the conflict will escalate to the nuclear level.[11]

Chapter II

Chinese Views on Nuclear Issues and its Assets

Views

Chinese views on nuclear issues have evolved through the times. In 1961, Mao Zedong told British Field Marshal Bernard Montgomery, "If you want to fight, you still need to use conventional weapons to fight."[12] Two decades later, Deng Xiaoping, cautioned the Prime Minister of Denmark: "Do not ignore the conventional war. Because with nuclear weapons, if you have them, I will have them. If you have more, I will have more and perhaps no one will dare to use them. Conventional war is possible."[13]

China possesses nuclear weapons and ballistic missile capabilities. Nuclear weapons' program in China began in 1955 and culminated in successful nuclear tests in 1964. China carried out altogether 45 tests, including tests of thermonuclear weapons and a neutron bomb. The chain of nuclear tests in 1995-96 before China signed the Comprehensive Nuclear Test Ban Treaty (CTBT) made it possible to develop a smaller and lighter warhead for a new generation of intercontinental ballistic missiles (ICBMs). China joined the Nuclear Suppliers Group (NSG) In 2004.[14]

Chinese nuclear forces have undergone a considerable transformation over the past 30 years. China is expanding and modernising its nuclear arsenal. It has developed an assortment of ballistic missiles starting from short-range systems to ICBMs. China is now shifting from relatively inaccurate, liquid-fueled, silo/cave-based missiles to more accurate, solid-fueled, road-mobile missiles. To increase its force›s survivability, it has developed JL-2 submarine-launched ballistic missiles (SLBMs). It has changed from primary reliance on intermediate and medium-range missiles to a force of inter-continental and medium-range nuclear systems. The rate of change has also increased over the past decade. A key uncertainty is as to how the current military modernisation efforts will ultimately reshape China›s strategic nuclear capabilities.

According to the U.S. DoD, China is developing "decoys, chaff, jamming and thermal shielding" to break-in ballistic missile defence systems. China is making progress in boost-glide systems, railgun technology and other next-generation missile weaponry. In April 2016, China conducted the seventh test of its hypersonic strike vehicle, the DF-ZF, and announced a breakthrough in electro-magnetic missile launching technology.[15]

Evolvement of Nuclear Strategy

China's national military strategy, also titled the 'Strategic Guidelines' does not describe nuclear weapons' role in conventional conflicts. In the 1980 Strategic Guidelines, use of nuclear weapons was not incorporated. The plan was to fight a protracted conventional war on Chinese territory against the Soviets with forward defences to buy time for nationwide mobilisation and to protect key cities from being occupied.[16] China had adopted a retaliatory nuclear posture in 1964 and has maintained that posture ever since. The Second Artillery, now PLA Rocket Force (PLARF), China's strategic missile forces, has developed the capability to launch missiles independently of other PLA units.

The key features of China's retaliatory force posture are: its second use doctrine; a small arsenal of strategic weapons oriented towards surviving a disarming first strike; strict and centralised command and control arrangements, and; transparency about how it would use its nuclear weapons in a conflict in view of its declaratory nuclear NGU policy. The 1987 *Science of Military Strategy* states, "China's nuclear strategy is defensive in nature, but if an enemy is first to use nuclear weapons, China will resolutely implement a nuclear counterstrike and carry out nuclear retaliation."[17] The most authentic description of Beijing's nuclear strategy was given at the 2006 Defense White Paper, issued by China's State Council Information Office. It says that China follows a "self-defensive nuclear strategy." This strategy's primary objective is to deter nuclear attacks against China and stop other countries from coercing China through nuclear threats.

Latest addition of road-mobile ICBMs, improved nuclear powered ballistic missile submarines, MIRV-capable silo based ICBMs and the current development of hypersonic glide vehicles are making China a capable nuclear deterrent force. In its 2019 Defence White Paper, China insisted on its longstanding position, "…keeps its nuclear capabilities at the minimum level required for national security." [18] Chinese experts believe that "When the enemy employs high-tech conventional strikes or considers using nuclear weapons, they have to realise that the other side also has nuclear weapons and is capable of retaliating effectively". China's enemy has to take decisions very carefully, considering the risk of escalation and the possibility of nuclear retaliation.

Chapter III

China's Nuclear Policy

China's approach to nuclear policy has been remarkably consistent since its first nuclear test in 1964. It centres on deterrence through "assured retaliation". That is the ability to survive an initial attack and retaliate with nuclear strikes that inflict unacceptable damage on the attacker. China's nuclear policy's key elements are NFU of nuclear weapons and emphasis on maintaining a limited number of nuclear weapons, what China calls a "lean and effective" deterrent capability, to deter nuclear attack. China has put in considerable resources to maintain a limited but survivable nuclear force.[19]

The Chinese government has an old policy not to use nuclear weapons first and not to use nuclear weapons against non-nuclear countries or nuclear weapon-free zones. The Chinese State Council Information Office, in July 2019, repeated this policy in a national defense white paper[20]: "China is always committed to a nuclear policy of no first use of nuclear weapons at any time and under any circumstances, and not using or threatening to use nuclear weapons against non-nuclear-weapon states or nuclear-weapon-free zones unconditionally. China advocates the ultimate complete prohibition and thorough destruction of nuclear weapons. China does not engage in any nuclear arms race with any other country and keeps its

nuclear capabilities at the minimum level required for national security. China pursues a nuclear strategy of self-defense, the goal of which is to maintain national strategic security by deterring other countries from using or threatening to use nuclear weapons against China".

China does not intend to use its nuclear weapons first to gain strategic leverage over an adversary in a conventional war. A 1975 Combined Combat Campaign Regulation (Hecheng Zhandou Gaize) revealed that policy: "at any time, under any circumstances, we will absolutely not use nuclear weapons first, only when the enemy uses them first, will we, according to the order of the supreme command, then use this kind of weapon to resolutely counterattack." The goals of nuclear weapons within China's defence policy are to deter a nuclear attack and deter nuclear coercion.[21] The only campaign within the PLA's official doctrinal framework for using its nuclear weapons is a nuclear counter-attack campaign. China's 2015 National Defense White Paper summarised the key elements of China's approach to nuclear strategy and policy as keeping nuclear capabilities at the "minimum level required for maintaining national security" and remaining "firmly committed to the policy of no first use of nuclear weapons at any time and under any circumstances." The White Paper further indicated that "China will deter other countries from using or threatening to use nuclear weapons against China." In contrast to the 2006 Defence White Paper's advocacy of "complete prohibition and elimination of nuclear weapons," the 2015 White Paper promotes a more modest goal. No longer pledging to eliminate nuclear weapons, it stated that China will "never enter into a nuclear arms race with any other country."

One of the key features of China's nuclear posture is that it maintains a low alert level. The PLA stores its warheads separately from missiles until they are paired in preparation for a retaliatory strike, unlike U.S. and Russian forces, which keep many of their nuclear weapons on high alert. As China's nuclear capabilities grow, there is a conjecture that it will take up a more

offensive nuclear stance. The U.S DoD report of 2019 on China's military states that China may grow the capacity to "launch on warning" of an incoming nuclear attack. This requires advanced surveillance capabilities, heightened readiness and fast response. For the PLA, it would also mark a watershed moment. It would imply that Beijing may move toward a more offensive nuclear force posture and abandon its NFU policy.

The No First Use (NFU) Policy

To reiterate, on the day of China's first nuclear test on October 16, 1964, China announced, "China will not at any time or under any circumstances employ nuclear weapons first." Only China and India among the Nuclear weapon states have No First Use (NFU) Policy. China's long maintained NFU policy states that it would use nuclear forces only in response to a nuclear strike against China. This NFU pledge has two stated commitments: China will never use nuclear weapons first under any circumstances and will refrain from using or threatening to use nuclear weapons against any non-nuclear-weapon state or in nuclear-weapon-free zones unconditionally.

The *Science of Military Strategy, 2013*, reaffirms China's NFU policy and indicates that the main purpose of nuclear weapons is strategic deterrence, in which the nature of nuclear weapons means "the deterrence application is the principal method of the application of nuclear forces." China has maintained that a credible second-strike capability would be sufficient to deter any attack on China. While it discusses force modernisation and how its responses are intended to ensure deterrence effectiveness, it does not offer details about specific systems China is developing.[22]

In a hypothetical but probable conflict scenario, China has a strong case for using nuclear weapons as strategic leverage in a limited war scenario to compensate for its conventional military disadvantage compared to Taiwan and the United States. This is intriguing. Would China accept

defeat in a conventional war with Taiwan U.S. combine and not rattle the nuclear sabre?[23] Many analysts believe that despite the NFU, the Chinese military plans to use nuclear brinkmanship in a conflict by increasing force readiness, moving missile launch units to demonstrate preparations for combat, conducting test launches, or publicly clarifying or amending its policy to allow limited nuclear strikes.[24]

Chinese strategists are aware that foreign countries have doubts about the sincerity of China's NFU policy. Through 47 nuclear weapons tests between 1964 and 1996, flight tests of its missile capabilities and one paired missile and warhead test in 1966, China has demonstrated that it has the warheads and delivery systems to conduct a nuclear counter-attack on an adversary. China is not transparent about the features of its deployed weapons or capabilities under development such as precision, reliability, penetrability, numbers and locations of these. This lack of transparency is likely to avoid giving an adversary information that could enhance the effectiveness of a disarming first strike in a future conflict.

There is some ambiguity about the applicability of China's NFU policy. Some PLA officers feel that China's conditions which might need use nuclear weapons first need to be spelt out. One of the conditions could arise when an enemy's conventional attack threatens the survival of China's nuclear force or of the regime itself.

Contra View on NFU

Several Chinese experts have raised questions about the circumstances under which China should consider deviating from its NFU policy. Fudan University's Shen Dingli, in a 2005 article, argued that the U.S. military's development of precision guided weapons and their potential use against nuclear assets "begins to blur the boundary" between conventional and nuclear weapons.[25] Major General Peng Guangqian has contended that a conventional attack on a country's nuclear forces could be deemed

equivalent to nuclear weapons' first use.

Since 2013, some Chinese publications have suggested that China should adapt its NFU policy in a way that it should protect China's core national interests. Some feel that attacks such as attacks on the Three Gorges Dam might cause mass casualties to be constituted as "first use."[26] While China has pledged never to use nuclear weapons against a non-nuclear state, some Chinese analysts believe that if a country that is allied to a nuclear weapon country provides bases for China's nuclear adversary and houses its nuclear weapon, should not be seen as a non-nuclear country. They advocate a greater degree of ambiguity to achieve a broader deterrent effect.[27]

Earlier strategists from the then Second Artillery had identified three disadvantages of China's No First-Use policy:-

- China had no options to counter limited nuclear use by an opponent without escalating to the use of its strategic nuclear weapons.
- China's nuclear force could be compromised, or even eliminated, by an opponent equipped with conventional offensive and defensive capabilities without crossing the nuclear threshold by exploiting China's NFU policy.
- As the weaker party in a future limited conventional war, China could be forced to accept defeat in a war over Taiwanese independence with U.S. interference if it maintained its strict retaliatory nuclear posture.

Most of the articles quoted above are by academics or retired military officials. They represent the hawkish views within the strategic community and do not represent the Chinese government's official position.[28]

Present Status of China's Nuclear Deterrence Policy

China's evolving views of the security landscape, strategic ambitions, and concerns over survivability are responsible for driving major changes to its nuclear forces' size, capabilities, and readiness. China is improving its ground and submarine-based nuclear capability and is pursuing a viable nuclear 'triad' to develop a nuclear-capable air-launched ballistic missile. China emphasises that the new generation of mobile missiles, with warheads consisting of MIRVs and penetration aids, are meant for ensuring the capability of its nuclear forces in the face of advancement in U.S' strategic ISR, precision strike and missile defence capabilities. China is giving increasing emphasis on nuclear deterrence. It also seems to be moving away from a deterrence approach to a more calculated strategy of assured retaliation.

Beijing has not clarified how its strategic forces will evolve commensurate with its objective of having a "world-class" military. China's 2019 Defence White Paper reiterated that China's nuclear forces were increasing their readiness posture and enhance deterrence capabilities to "protect national strategic security and maintain international strategic stability." It seems that China's nuclear forces are on a trajectory to exceed the size of a "minimum deterrent". China's evolving nuclear posture is now between a minimum and maximum deterrence.

Chapter IV

China's Nuclear Arsenal

China is growing, modernising and diversifying its nuclear weapons and delivery systems. It has increased the readiness and improved the accuracy of its nuclear forces.[29] But far less attention is given to the the development of Chinese nuclear forces in comparison to modernisation of the PLA's conventional capabilities. China's nuclear modernisation has been slow compared to the modernisation of its conventional forces. However, the pace of change in Chinese nuclear forces and thinking is accelerating and could quicken further over the next 15 years. China aims to maintain a large enough arsenal to ensure that it can retaliate following a pre-emptive strike, but not so large as to waste its resources or trigger an arms race.

The U.S. Strategic Command thinks that China has doubled its number of warheads in the last decade. Lieutenant General Robert Ashley, Jr., director of Defense Intelligence Agency (DIA) and Rear Admiral Michael Brooks, head of intelligence U.S. Strategic Command assess that China is on track to double its stockpile again over the next decade. Lieutenant General Ashley further characterised this buildup as "the most rapid expansion and diversification of its nuclear arsenal in China's history." David Santoro, director and senior fellow for nuclear policy at the Pacific Forum, noted that China is now capable of hitting the U.S. homeland and

has been making significant enhancements in its capabilities.

Chinese nuclear testing program showed a wide array of warhead yields. Current and more accurate missiles carry warheads with yields possibly in the low hundreds of kilotons compared to older and less accurate missiles equipped with megaton yield warheads. Nuclear weapons are kept in central facilities under the control of the Central Military Commission. If China comes under nuclear threat, the weapons would be released to enable missile brigades to go on alert and prepare to retaliate. The table below counts nuclear versions DF-21A (CSS-5 Mod 2) and DF-21E (CSS-5 Mod 6), of which fewer than 50 launchers are deployed. DF-31AG TEL carries the same missile as the DF-31A but is an improved version. It is believed that additional warheads are being produced to arm the DF-41. In addition to the 186 warheads assigned to deployed forces, Warheads for the fifth and sixth nuclear-powered ballistic missile submarines (SSBN) will add to that total.[30]

Details of Chinese nuclear warheads and delivery systems are given below:-

Estimated Chinese Nuclear Forces 2020 And 2030*						
			2020 Estimate		2030 Projection	
Type	**Fielded**	**Loading**	**Launchers**	**Warheads**	**Launchers**	**Warheads**
Land-based ballistic missiles						
DF-4	1980	1 x 3.3 mt	6	6	0	0
DF-5A	2005	1 x 4-5 mt	10	10	10	10
DF-5B	2015	5 x 200-300 kt MIRV	10	50	10	50
DF-5C	?	5 x 200-300 kt MIRV	0	0	?	?
DF-21A	1996	1 x 200-300 kt	20	20	0	0
DF-21E	2016	1 x 200-300 kt	20	20	40	40
DF-26	2016	1 x 200-300 kt	200	20	300	20
DF-31	2006	1 x 200-300 kt	6	6	0	0
DF-31A	2007	1 x 200-300 kt	36	36	0	0
DF-31AG	2018	1 x 200-300 kt	36	36	72	72
DF-41	(2020)	3 x 200-300 kt MIRV	(16)	(48)	24	72
Subtotal			**344**	**204**	**456**	**264**

Sea-based ballistic missiles						
JL-2	(2015)	1 x 200-300 kt	48	48	72	72
JL-3	(2026)	3 x 200-300 kt			24	72
Subtotal			**48**	**48**	**96**	**144**
Subtotal ballistic missiles			**392**	**252**	**552**	**408**
Air-based weapons						
H-6K	(2015)	1 x bomb	20	20	0	0
H-6N	(2020)	1 x ALBM	(0)	0	10	10
H-20	(2025)	2 x ALCM?	0	0	10	20
Subtotal			**20**	**20**	**20**	**30**
Total			**412**	**272****	**572**	**438**

* *(Corrected table.)* This table builds on estimates published earlier this year but modified for new information included in the 2020 DOD report. The 2030 projection shows what the "more than doubling" of the Chinese stockpile that DOD anticipates over the next decade could potentially look like.
** The DOD report states that China currently maintains an "operational" nuclear warhead stockpile in the low-200s. The estimate probably does not include warheads produced for weapons that are not yet operational, including the DF-41 and JL-2 SLBMs on the two additional SSBNs, and probably does not count bombs for bombers.

Kristensen/Korda, FAS 2020

Weapons Grade Fissile Material

A few factors may hinder Beijing from substantially building up its nuclear arsenal. China has a relatively small reserve of weapons-grade fissile material, which is needed for nuclear detonations. Two kinds of fissile material are required for making nuclear warheads: highly enriched uranium (HEU) and plutonium. As per the International Panel's estimation on Fissile Materials, China's fissile material stockpile is 14 metric tons of highly enriched uranium and 2.9 metric tons of plutonium. This is enough to produce only a few hundred warheads. Although China's current reserves of fissile materials are relatively small, they are sufficiently large to meet the country's modernisation requirements in the near term. China has the technological capacity and resources to increase its supplies of HEU and weapons grade plutonium quickly.

China has supplied design information including warhead design and fissile material to develop Pakistan's nuclear weapons program. The same was later transferred to Libya's program[31]. China supplied Pakistan with 34 DF-11 short-range missiles in 1992.[32]

Nuclear Weapon Testing

China sustained a high level of activity at its Lop Nur nuclear weapons test site throughout 2019, as per the U.S. Department of State's April 2020 Executive Summary of Findings on Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments. It states, "China's possible preparation to operate its Lop Nur test site year round, its use of explosive containment chambers, extensive excavation activities at Lop Nur, and lack of transparency on its nuclear testing activities – which has included frequently blocking the flow of data from its International Monitoring System (IMS) stations to the International Data Center operated by the Preparatory Commission for the Comprehensive Nuclear Test-Ban Treaty Organization – raise concerns regarding its adherence to the 'zero yield' standard adhered to by the United States, United Kingdom, and France in their respective nuclear weapons testing moratoria."

Survivability

For assured retaliation survivability is the key. Earlier, China's leaders observed that their silo-based, liquid-fueled missiles were susceptible to a pre-emptive strike. China undertook significant efforts to secure and modernise its nuclear forces to address this concern. Historically, China's nuclear deterrent has centred on its land-based inter-continental ballistic missiles. In the early 2000s, China made significant advances by fielding road and rail-mobile ICBMs to complement its existing silo-based Dong Feng-5 (DF-5). The DF-31 was fielded in 2006 and featured a maximum range of 7,200 km. A better variant, the DF-31A, entered service in 2007 and has a range of up to 11,200 km. The mobility of these systems dramatically enhances their survivability. China is also in the process of fielding the new road-mobile ICBM, DF-41, that is capable of carrying multiple independently targetable reentry vehicles (MIRVs) like the old DF-5B.

PLA's Underground Facilities

Fig.1: A photo of China's Underground Great Wall

(The Chinese text on top of the photo reads: "CCTV-7 Military Records—Traveling together with the Motherland, the sharp sword toward heaven, PLA Second Artillery." Text at bottom reads: -the modern underground great wall.)

The PLA maintains a robust and technologically advanced underground facility (UGF) program to protect all aspects of its military forces, including Command and Control, missile systems and logistics against enemy missile strikes. China's NFU policy contributed to the construction of UGFs for the country's nuclear forces for surviving an initial nuclear first strike by a rival. During the mid-1980s, China expanded a series of underground facilities to house its nuclear and conventional weapons from enemy attack. After the U.S. military revealed significant precision strike capabilities during the 1991 Persian Gulf War, China hurried up work to reinforce and expand these underground facilities which was finally completed in 1995.[33]

These tunnels are in deep mountainous areas, hundreds of meters underground and are difficult to detect from space. These can survive nuclear and conventional attacks. The missiles, personnel and related

equipment can be moved by rails and vehicles within the network of tunnels to various locations. All the activities for launch preparation can be done in the tunnels without detection. Some of the tunnels could also be used for logistical support or as command and control facilities.

China's underground Great Wall is transforming its land-based ballistic missiles into tunnel-launched ballistic missiles. China has relocated its land-base missiles to underground-basing to ensure a limited and reliable second-strike nuclear force after absorbing a first nuclear strike.

Conventional Missiles as a Deterent

As part of modernising the People's Liberation Army (PLA), China has developed one of the globally most powerful land based conventional missile arsenals. Earlier, the emphasis of the PLA was to improve its retaliatory nuclear strikes launch capability. While deterring nuclear attacks continue to remain a top priority, China's leaders have attached increasing importance to the role of conventional land based missile capabilities for both deterrence and warfighting. China's pursuit of conventional precision strike capabilities dates back to around the end of the Cold War. 1998 defense white paper stated that with the end of the Cold War the risk of a nuclear world war decreased, but the threat of "local wars" remained.

During the 1990-1991 Gulf War, the Allied success showed the power of conventional precision strike capabilities to win local wars. The gap of missile capabilities between allied forces and China was starkly evident to the China's leaders. The first Gulf war experience is instrumental in Beijing's pursuit of anti-ship missiles, that could discourage adversary actions along its periphery. Collectively with air and sea defences, this capability is known as Anti Access and Area Denial (A2/AD).

Policy for the use of Conventional Missiles

China intends to use its conventional missiles to deter crises and outbreak of limited wars, and compel a favourable conclusion to limited war. The 'Guide to Campaign Theory' claims that conventional missile units can be used as a source of strategic leverage because they "can not only directly destroy and weaken an adversary's military power in a military sense, but can also shock the adversary psychologically in a political sense and cause its will to waver, to stop the process of a war escalating or increasing in tempo. "[34] Unlike nuclear missiles, which would "stop an adversary from possibly initiating a nuclear war against us," China's conventional missiles would be used as a source of strategic leverage to "prepare us to win future high-technology local wars." More recent texts described the conventional missile force as "a powerful deterrent role against a strong adversary."[35]

China's conventional missile campaign involves two missions: military deterrence in a crisis and an attack campaign at the outset of a conflict. The attack campaign involves using conventional missiles to quickly exert the maximum amount of strategic leverage over an adversary and compel it to capitulate to China's demands and end a limited war. The deterrence campaign also involves the first use of conventional missiles in a crisis, but in a limited and symbolic manner more similar to a calibrated escalation doctrine.[36] China is modernizing and diversifying its nuclear forces as part of a long-term programme to develop a more survivable and robust deterrence posture consistent with its nuclear strategy of assured retaliation.[37] Assured retaliation is the ability to survive an initial attack and retaliate with nuclear strikes that inflict unacceptable damage on the attacker.

Chinese Government's declared aim is to maintain its nuclear capabilities at the minimum level required for safeguarding national security. China has adopted a nuclear strategy of self-defence, the goal of which is 'deterring other countries from using or threatening to use nuclear weapons' against

it.[38] China established a conventional missile force to maximise strategic leverage in a limited conventional war. It feels that conventional missiles are more credible sources of strategic leverage than threatening to use nuclear weapons. They also offer a cheaper and faster way of compensating for the PLA's conventional military inferiority.

The 2004 *Science of Second Artillery Campaigns*, a classified campaign manual for China's missile force, described the campaign as follows: "according to the standpoint of our country's No First-Use principle, the Second Artillery can only carry out nuclear missile strikes against an adversary's important strategic targets after an adversary has carried out a nuclear strike against our country and according to the combat orders of the highest supreme command. The intensity of counterattack campaigns may vary from those involving only one missile base to all of the missile force's five bases." One recent text explained, "it is necessary to control the scope of the nuclear counterattack, do not conduct equivalent nuclear strikes to an adversary, do not let the nose lead oneself by an adversary, but play to one's strengths: you fight your way, I fight my way." The Second Artillery would use strategic nuclear weapons on strategic targets, which include civilian and soft military targets, not just the enemy nuclear forces.

An attack campaign would involve the use of conventional missiles as part of a joint firepower campaign to create favourable conditions at the outset of a conflict for an air force or naval attack. The campaign has a clear operational as well as a coercive objective. It involves pre-emptive, large-scale attacks to inflict maximum damage on an adversary. The campaign has two principles. "Subduing the enemy at the decisive moment" involves attacking the adversary when it is unprepared and attacking before one's own forces enter combat to reduce their losses. "Keypoint surprise attacks" involves "increasing the intensity of the first surprise attack," concentrating attacks, and striking key points.[39]

State of Conventional Missiles

China has stressed heavily on development of greater range and accuracy in its conventional missile forces. This enables the PLA an enhanced ability to conduct precision strikes farther from own territory. In particular, China has prioritised the fielding of intermediate-range ballistic missiles (IRBMs), with maximum ranges between 3,000-5,000 km. The number of IRBM launchers in China's arsenal increased from zero in 2015 to 72 in 2020. This is roughly 56 per cent of the growth in China's total arsenal over this period.

Dong Feng-26 (DF-26), is a dual-capable, mobile, IRBM with a maximum range of 4,000 km. It is the mainstay of China's arsenal of IRBMs. Apart from nuclear ICBMs and SLBMs, the DF-26 can fly farther than any other Chinese missile. It can conduct precision strikes in the Western Pacific, the Indian Ocean and the South China Sea from mainland China. It is the only land-based missile in China capable of conducting conventional strikes against the U.S. territory of Guam, which is home to an American Air Force base. There is another version of the DF-26 that can strike ships at sea. Every PLA Rocket Force brigade operating the DF-26 is capable of carrying out both conventional and nuclear missions. The DF-26 is launched from a six-axle road-mobile launcher. It was displayed during a parade in 2016 and the first brigade of DF-26 was raised in April 2018 outside Xinyang in Henan Province. The DF-26 was found operating in a new training area in Inner Mongolia in January 2019 and has been found with several other brigades. This missile is both dual-capable and more accurate, and provides China with its first precision nuclear strike capability. The dual-capable role of the DF-26 and the DF-21 raises some tricky issues about command and control and the possibility for misunderstandings in a crisis.

The PLARF has an increasing number of medium-range ballistic missiles (MRBMs) with ranges of 1,000-3,000 km. In 2013, China had an

estimated 42 MRBM launchers. By 2020, this number had more than doubled to 94 launchers. China's inventory of DF-21Ds grew from six to 30 between 2013 and 2020. The DF-21A (CSS-5 Mod 2) is a two-stage, road-mobile, solid-fuel, MRBM with a range of about 2,150 km. A conventionally armed variant of the older, nuclear-armed DF-21, the DF-21D is equipped with a manoeuvrable re-entry vehicle, which considerably improves the accurecy of the missile. The DF-21D is supposed to be the world's first operational anti ship ballistic missile and is often referred to as a "carrier killer" for its suspected ability to strike aircraft carriers. China has been showcasing a new version, the CSS-5 Mod 6, known as DF-21E since 2016. It is estimated that China has approximately 40 launchers for the nuclear DF- 21A/E. It has also deployed two conventional versions: the DF-21C (CSS-4 Mod 4) land-attack missile and the DF-21D (CSS-5 Mod 5) anti-ship missile.

Over the past few years, the predominance of the DF-21 among China's regional nuclear forces has been overtaken by the DF-26 IRBM in considerable numbers. In its annual reports, the Pentagon states that over the past three years, the DF-26 force has grown from 16 to 30 launchers in 2018, to 80 launchers in 2019, to 200 launchers in 2020 with "more than 200 missiles." It is felt that the actual number of launchers is closer to 100. The majority of the dual-capable DF-26s have a conventional mission, including an anti-ship role. About 20 launchers may serve a regional nuclear role alongside the DF-21. It is estimated that four or five DF-26 brigades have become operational and several more are in the process of raising.

China's short-range ballistic missile (SRBM) forces have not grown. The number of SRBM launchers fell from 252 in 2013 to 189 in 2020. As a part of China's full conventional arsenal, SRBM launchers declined from about 72 per cent of the total to just 45 per cent over the same period.

Nuclear Capable Missiles

Most of China's nuclear-capable missiles do not have a strategic range. This includes the DF-21 MRBM and the DF-26 IRBM. A U.S. Department of Defense fact sheet published with the 2018 Nuclear Posture Review describe the DF-21 and DF-26 as non-strategic weapons.[40]

In 2006, China debuted its first solid-fueled ICBMs with the DF-31. It is a three-stage, road-mobile missile which is transported in a 15-meter canister on a six axle transporter-erector-launcher (TEL). The DF-31 has a range of about 7,200 km but cannot reach the continental U.S. from its deployment areas in China. It is assumed to take over much of the regional targeting of Russia, India and Guam by the soon to be phased out DF-4. At present, China has only one DF-31 brigade deployed, with fewer than 10 launchers that might soon be improved to the new DF-31AG. The DF-31A (CSS-10 Mod 2) is an extended-range version of the DF-31 with an identical launcher. With a range of 11,200 km, the DF-31As have the capability to reach about half of the continental U.S. Each DF-31A brigade was operating with six but have now been upgraded to 12 launchers. It is estimated that China deploys about 36 DF-31As in three brigades. The DF-31A brigades are being upgraded to the DF-31AG.

Since 2017, China has focused on replacing the DF-31s and DF-31As with the DF-31AG. This is a new launcher that carries the same missile as the DF-31A but has improved off-road capability. A 2018 Defense Department report described the DF-31AG as "an enhanced version of the DF-31A ICBM that also uses a transporter-erector-launcher to increase its mobility and survivability."

The long-awaited DF-41 ICBM (CSS-20), eighteen of them, were mobilised for China's 70th National Day Parade in October 2019. The 16 that were displayed came from two brigades. The DF-41s are not yet operational but are being integrated into the first few brigades. Pentagon

believes that this missile is capable of carrying MIRV. Some media reports state that the DF-41 can carry six to 10 warheads. These reports are inflated. The number of warheads that the DF-41 can carry may be three and the additional payload capability may be reserved for decoys and penetration aids to overcome the U.S. ballistic missile defense system. The DF-41 is expected to eventually replace the aging DF-5 and could potentially be launched from silos and railcars, in addition to mobile TELs. The possibility of a silo-launched DF-41 would be consistent with recent discovery of construction of several new types of silos in the Jilantai training area in Inner Mongolia. There are also reports of possible silo construction in the 662 Brigade area in Henan province.

Introduction of road and rail-mobile ICBM DF-41 can generate considerable increase in China's nuclear arsenal. The DF-41 jointed service in 2019. It has an estimated operational range of 12,000 – 15,000 km. As per the DIA estimate, the PLARF is likely to double its arsenal by 2029 and may field as many as 24 DF-41 launchers with 144 warheads by 2029. China has erected an ICBM silo at one of the PLARF's Western training ranges. It is smaller than the existing CSS-4 (DF-5) silos. The DF-41 ICBM can be launched from silos. This location may be used to develop a concept of operations for silo basing system. China may be building new CSS-4 (DF-5) ICBM silos.

Submarines and Sea-Based Ballistic Missiles

The JL-2, a modified version of the DF-31, is equipped with a single warhead and penetration aids. It has a range of about 7,200 km. This range is sufficient to target Alaska, Guam, Hawaii, Russia and India from waters near China. However, unless the submarine carrying the missile sailed deep into the Pacific Ocean, it could not target the continental U.S. The SLBM JL-3, could considerably increase China's nuclear capabilities. The JL-3 would have a range of more than 9,000 km and be MIRV-capable. When available operationally, the JL-3 will be installed on China's next-generation Type-096 SSBN. China has launched six Jin-class (Type 094) SSBNs, which are centered at the Longposan naval base near Yulin on Hainan Island. Four of these are currently operational. The two latest SSBNs, handed over to the PLA Navy in April 2020, are variations of the original Type 094 design. These boats include a more prominent hump which has activated some speculation whether they could move up to 16 JL-2 (CSS-N-14) SLBMs instead of the usual 12. However, satellite images confirm that the new submarines are equipped with 12 launch tubes each.[41]

The PLA Navy's SSBNs could launch strikes from closer to China's shores with the increased range of the JL-3. The SSBN will be better protected from enemy anti-submarine warfare forces. Also this will improve the reliability of China's sea-based nuclear deterrent. It is estimated that by 2029, China could have as many as 24 MIRVed JL-3 launchers carrying a total of 72 warheads.

China will start developing the quieter third-generation (Type 096) SSBN in the early 2020s. The completion of a new construction hall at Huludao, where the PLA Navy's submarines are built, indicates that work may soon begin on the Type 096. It is expected to be larger and heavier than the Type 094. Given that China's SSBNs are assumed to have approximately a 40-year service life, the US Defense Department expects that the Type

094 and Type 096 boats will operate concurrently. This would potentially result in a future fleet of eight to 10 SSBNs.

To develop a survivable sea-based nuclear deterrent, the SSBN fleet will face several doctrinal, operational and technical limitations. Though Chinese missile forces regularly practice the techniques to load warheads onto missiles, China's CMC has long resisted handing out nuclear warheads to the armed services to deploy on missiles under normal circumstances. Giving custody of nuclear warheads to deployed submarines during peacetime would constitute a significant change of Chinese policy. Moreover, before doing so, the CMC and China's navy would first have to build up experience operating an SSBN force during realistic military operations, which would require development of reliable command-and-control technologies and procedures.

In 2019,China launched more ballistic missiles for testing and training than the rest of the world combined. China has given more importance on developiment of hypersonic glide vehicles. China successfully tested the XINGKONG-2 (Starry Sky-2) in August 2018, which it publicly described as a hypersonic waverider vehicle.

Cruise Missile

Estimated Number of Launchers in China's Land-based Missile Forces

Missile Type	Range (km)	DoD 2010 Estimate	IISS 2010 Estimate	DoD 2020 Estimate	IISS 2020 Estimate
IRBM	3,000-5,500	0	0	200	72
MRBM*	1,000-3,000	75-85	36	150	94
SRBM	300-1,000	210-250	204	250	189
GLCM	>1,500	40-55	54	100	70

Source: US Department of Defense (DoD); International Institute for Strategic Studies (IISS)

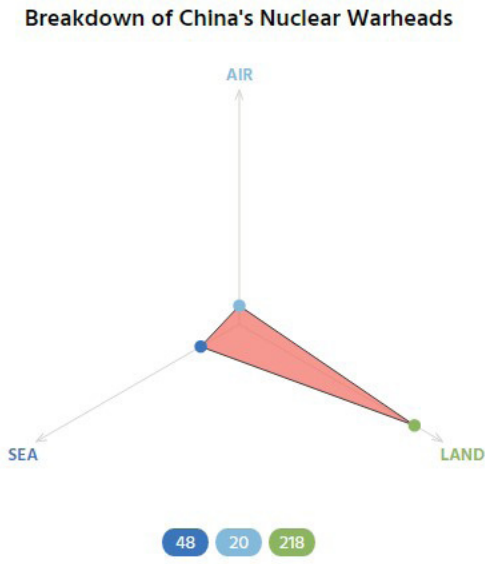
*IISS estimates for MRBMs are lower because we have disaggregated them to exclude the nuclear DF-21A/E. DoD estimates are not disaggregated.

The PLA currently deploys several types of ground, sea and air-launched cruise missiles. The Rocket Force is fielding more ground-launched cruise missiles (GLCMs). China's inventory of GLCM launchers increased from 54 to 70 between 2013, and 2020.[42] The CJ-100 is expected to have a range of up to 2,000 km, but few details have been publicly revealed. There is uncertainty whether these may have nuclear delivery roles. In its 2017 assessment of ballistic missile and cruise missile threats, the US Air Force National Air and Space Intelligence Center (NASIC) did not list any Chinese cruise missile as being nuclear capable[43].

China's conventional missile arsenal is different from other countries. The U.S. and Russia do not possess substantial land-based conventional missile forces. From 1987, the Intermediate-range Nuclear Forces (INF) Treaty prohibited these two countries from developing or deploying land-based missiles with ranges of 500-5,500 km. In August 2019, The U.S. withdrew from the INF Treaty in reaction to Russia's fielding of the SSC-8 (9M729) ground-launched intermediate-range cruise missile, which was not compliant with the treaty. The U.S. withdrawal was also provoked by concerns that the treaty left U.S. missile capabilities restricted as China rapidly built up its arsenal.

A day after the US withdrew from the INF Treaty, Mark Esper, U.S. Defense Secretary, stated the US desire to place ground-launched intermediate-range missiles in Asia. Till date allies like Australia and South Korea have indicated that they have no plan to host any U.S. land-based missiles. After withdrawing from the INF Treaty, in August and December 2019, the U.S. carried out two tests.[44,45]

Nuclear Triad



Countries with a nuclear force structure that consists of land based ICBMs, SLBMs and strategic bombers are known to have a nuclear 'triad'. The capability to attack from ground, sea and air improves the survivability of a country's nuclear forces. It also increases its ability to make a retaliatory strike. Today only the U.S. and Russia have complete and credible nuclear triads. India and China are close to attaining the triad status.

Till recently, the air-based component of China's strategic deterrent had a low priority. The PLA Air Force is now developing a nuclear-capable subsonic strategic stealth bomber, the Xian H-20. The H-20 has a range of up to 8,500 km. The DoD and the DIA think that fielding these systems would give China a credible nuclear triad.

China now has only a small number of air-based platforms capable of delivering nuclear weapons. China is likely to field a new strategic bomber and air-launched ballistic missiles (ALBM) in the coming years. The U.S. DIA states that China will not possess a "credible" nuclear triad

until the PLAAF Force has a strategic bomber fleet. In 2016, the DIA reported that China was developing two ALBMs for the H-6 bomber, "one of which might include a nuclear payload." The missile, designated by the U.S. as CH-AS-X-13, will be carried by yet another modification of the H-6 bomber known as the H-6N BADGER. It first appeared at the October 2019 Parade and appears to be entering service with the PLAAF. This H-6N's appearance is distinct from that of the H-6K dual-use bomber. It is equipped with a nose-mounted in-flight refueling probe and includes a modified fuselage that the U.S. Defense Department believes can accommodate the nuclear-capable ALBM, or possibly a drone. One of the first bomber units to get an operational nuclear capability might be the 106 Brigade at Neixiang air base in the south-western part of the Henan province.

China has a small number of ballistic missiles housed on four SSBNs, providing it with a credible sea-based nuclear deterrent. In 2015, China's nuclear forces' sea-based leg was confirmed when the PLAN introduced the Julang-2 (JL-2) SLBM. The JL-2 has a range of about 8,000-9,000 km. Its four Jin-class (Type-094) SSBNs each carry 12 JL-2s, giving the PLAN about 48 nuclear warheads.

The Rocket Force may bid for operational control of China's emergent fleet of Jin-class SSBNs. The PLAN has minimal experience in controlling nuclear weapons. Conversely, the Rocket Force has no experience of operating naval vessels. Operating and protecting the SSBN force is a complex operation. Whatever the future command and control structures would be, Chinese SSBNs would be staffed and operated by navy crews and serviced in navy ports. It is assumed that China's future SSBN force could fall under the command of the Rocket Force.

Chapter V

Recent Developments in PLA Missiles

Recent Versions

On October 1, 2019, China celebrated the seventieth anniversary of its founding. In a military parade, the PLA performed a highly orchestrated show of strength, exhibiting many of its strategic weapon systems.[46] China displayed several new or upgraded nuclear delivery systems. These mobile ICBMs and SLBMs are intended to enhance China's nuclear forces' survivability and penetration capacity. The display highlighted China's strategic missile force's technical sophistication and modernity, a central consideration in Chinese nuclear decisionmaking.

Details of some of the recent versions of missiles which were displayed in the parade are given below.

YJ-12B

The ground-launched variant of ramjet propelled supersonic anti-ship missile YJ-12 with an estimated range of 500 km made its first public appearance. As per some media reports the YJ-12B has already entered Chinese service.

YJ-18 /-18A

YJ-18, is a subsonic anti ship missile with an estimated range between 220 and 540 km. The YJ-18 after cruising to the target under turbojet propulsion, releases a rocket propelled warhead which accelerates to supersonic velocities. The YJ-18 was not publicly showcased prior to the parade.

CJ-100/DF-100

CJ-100 is a long-range, vertically launched supersonic cruise missile. The missile uses ramjet propulsion. Little else is publicly known about the missile.

DF-17

The DF-17 is a short to medium-range ballistic missile. It combines a DF-15-like rocket booster with a hypersonic boost-glide vehicle. The missile was not displayed until the October 1 Parade. Hypersonic glide

vehicles create uncertainty over where to commit defensive interceptors by modifying their trajectory through most of their flight. This makes boost-glide vehicles vulnerable to point defences. Hypersonic glide vehicles travelling at slower velocities than their ballistic counterparts retain less energy to spend on evasive manoeuvres in terminal flight.

DF-26

DF-26 is an IRBM with a 4,000 km range. The missile can carry nuclear and conventional payloads and is typically seen with a manoeuvring warhead. Such a payload can penetrate terminal missile defences or strike mobile targets. To hit a moving target like a ship with a ballistic missile would require an ISR asset providing near real-time targeting information, most likely an unmanned aerial system.

DF-5B

DF-5B is an upgraded variant of the DF-5, China's oldest ICBM. The DF-5B is silo-based and takes a substantial time to move or fire.

DF-31AG

An upgraded variant of DF-31, the DF-31A, has a range of 11,700 km and is fitted with a 1-3 megaton nuclear warhead. The latest upgrade of the DF-31A, the DF-31AG, is equipped with a ruggedised launch vehicle for traversing unpaved terrain. No longer limited to China's roads, the DF-31AG could disperse to more remote areas, making it difficult to target.

JL-2

JL-2 is a submarine-launched ballistic missile that made its first appearance. It reflects Beijing's growing confidence in its sea-based deterrent. The JL-2 reportedly possesses a maximum range of over 8,000 km and maybe MIRV-capable.

DF-41

The ICBM DF-41 is the future 'mainstay' of China's nuclear forces. The road mobile missile reportedly possesses an operational range of 15,000 km and is MIRV-capable. The missile will likely share critical technologies with the JL-3, China's next-generation SLBM. No complete images of

the system were available until two missile brigades—armed with eight missiles each, appeared at the National Day parade.

Future Trends

China's nuclear forces will evolve considerably over the next decade as it modernises, diversifies and increases the number of its land, sea and air-based nuclear delivery platforms. China wants to increase the peacetime readiness of its nuclear forces by moving to a launch-on-warning (LOW) posture with an expanded silo-based force

China justifies its development of a range of technologies for its nuclear forces including MARV, MIRVs, decoys, chaff, jamming, thermal shielding and hypersonic glide vehicles as essential to counter U.S. and other countries' ballistic missile defence (BMD), ISR and precision strike systems.

Readiness

China keeps the majority of its nuclear force on a peacetime status—with separated launchers, missiles, and warheads. However, nuclear and conventional PLARF brigades conduct 'combat readiness duty' and 'high alert duty' which includes assigning a missile battalion to be ready to launch and rotating to standby positions. Authoritative PLA textbooks on strategy state 'high alert duty' is valuable for the defender in a nuclear war. Such a stance is compatible with the People's Republic of China's (PRC) 'active defence' concept, NFU policy and post-strike response approach.

There are reports that China might have mated warheads with some of its missiles to increase their readiness, there has been no official confirmation. A recent Pentagon report clearly states that "China almost certainly keeps the majority of its nuclear force on a peacetime status—with separated launchers, missiles, and warheads". However, some Chinese military

officials have advocated to increase the readiness of China's nuclear missiles. A recent report states that PLA Rocket Force brigades carry out combat readiness duty and high alert duty drills, which includes making a missile battalion responsible to be ready to launch. The units are rotated to standby positions as much as in monthly basis for unspecified periods of time.

Targeting

As per China's 2008 defense white paper the country's conventional missile forces are charged with conducting precision strikes against "key strategic and operational targets of the enemy." PLARF aims to establish the conditions necessary for China's naval, air and other forces to conduct their own operations by neutralising these enemy capabilities early in a conflict,

No authoritative written sources are indicating what kinds of targets the PLA would strike, if any, in a deterrence operation. The 2015 *Science of Military Strategy* recommends that any military warning strike should "use a small amount of force and a small-scale attack" on a "military, political target that is suitable for an isolated attack and does not hurt civilians." It describes the deterrence action of "limited military manoeuvres," which involves military exercises, tests or creating no-fly or no-ship exclusion zones to "control and isolate local seas and airspace."

Missile attacks would take aim at "the targets with the greatest influence on the adversary, that have a clear status, are easy to have effects on, and hard to recover." Those initial targets include command and control centres and strategic warning and reconnaissance systems, anti-air and anti-missile systems, adversary communications and electronic warfare facilities, aircraft, airfields and hangars, information centres and concentrated reserve forces, economic targets that directly and indirectly support an adversary military, transport targets, energy facilities, repair facilities and

munitions storage.[47] The target set listed in the 2013 *Science of Military Strategy* is narrower and specific: reconnaissance and warning systems, electronic warfare systems, anti-air and anti-missile bases and air bases.

More recent descriptions of conventional missile targets have focused on adversary military assets, reflecting China's gradual shift towards a calibrated escalation posture since 2013. The 2013 *Science of Military Strategy* notes that when conventional missiles are used in joint operations they are used to attack targets out of range of other conventional capabilities, "targets that pose a great threat to our military, have an important influence on the process of combat, and have a sustaining role on the entire war situation."

Command and Control of CMC

China's nuclear weapons are under strict command and control arrangements whose use could be authorised only by the CMC. The CMC is chaired by the Communist Party General Secretary in his capacity as Commander-in-Chief. To ensure that Chinese leaders exercise strict command and control over China's nuclear forces, its nuclear missile units are not integrated into the same chain of command as its conventional army, navy and air force units. A direct line of authority from the CMC to its nuclear missile units was established in 1967.

The first set of regulations for nuclear missile units, the 'Temporary Regulations on the Second Artillery's Basic Tasks and Command Relationships', were promulgated by the CMC on July 12, 1967 ('1967 Regulations'). The regulations state that the Second Artillery's "force development, deployments, manoeuvres, and especially its combat operations, must all be under the collective leadership of the CMC; extremely strictly, extremely precisely, obeying and carrying out the orders of the CMC."

The CMC's direct command over Chinese missile units has not changed since 1967. To implement CMC command and control of China's nuclear missiles, the 1967 Regulation established a three-tier chain of command. Command authority flows from the CMC to the Second Artillery, the missile combat base, and then to the missile regiment "in order to make the leadership and organisation of command easy." The CMC could also skip echelons, "at the necessary time the Second Artillery could bypass the immediate leadership to command the regiment directly." In 2004, the chain of command was the same as described in the 1967 Regulations, including the ability to skip echelons, except that the launch company was added as a fourth echelon at the bottom of the command and control hierarchy.

According to a 2004 Second Artillery Campaign Manual, command of nuclear brigades would bypass the command and control posts set up in wartime for each of the PLA's geographic Military Regions. By contrast, its conventional missile brigades could be commanded by Military Region wartime command and control posts, or directly by the CMC. These command and control arrangements are likely to endure after the 2015 PLA reforms, which elevated the Second Artillery to a full service and re-named it the PLA Rocket Force.

China focused on hardening and ensuring redundancy in its command and control infrastructure to ensure that launch orders can always be executed. In the event that communications are disrupted, special teams may be dispatched from the central command to the bases, brigades or launch companies to deliver launch orders personally.

China's mobile nuclear missiles remain in garrison in peacetime and their warheads stored separately in a central storage facility. If China anticipates a crisis involving a risk of nuclear attack, the Second Artillery equipment inspection units would transport the warheads from the warhead storage facility in central China and mate them with missiles operated by a launch

brigade. Road mobile missiles would then be dispatched on deterrent patrols.[48]

China's small nuclear arsenal relies on mobility and diversity to ensure its survival following an enemy disarming strike. One text describes how on receipt of warning of an incoming attack, missile brigades would take up concealed positions and implement emissions control of electronic signals to prevent them from being identified and destroyed by an enemy first strike[49].

Impact of the 2016 Reforms

China is going through sweeping military reforms that have affected force structure, organisation and command and control mechanisms of the PLA. Tightening political control and improving the military's capability to conduct joint operations are the dual goals of the reforms. China elevated the Second Artillery to full-service status and renamed it the PLA Rocket Force (PLARF). In spite of much attention paid to its new name and higher organisational status, the PLARF seems to be the least affected service by the reforms.

While the reforms include exciting changes in the other services' command and control arrangements, the Rocket Force appears largely untouched. Initial reports emphasised continuity in both China's nuclear policies and Rocket Force command and control arrangements. There is progress toward integrating China's missile forces with the newly established theatre commands' joint operations command centres.

The centralised command continues to extend to not only nuclear units but also conventional ones. Some theatre commanders claimed to control conventional missile forces within their theatres. Media reports noted that the new theatre commands would have dedicated forces from the army, navy, and air force but did not include the newly formed Rocket

Force forces. This suggests that its units will remain with their home bases. The theatre commands were reported to have two deputy commanders from "each of the three service branches", not including the Rocket Force. One report noted that 100 Rocket Force personnel had been assigned to Theater Command headquarters as staff officers, suggesting that some mechanisms exist for integrating the Rocket Force into theatre planning.

Conventional Missile Command and Control

The level of authority required to order China's conventional missiles varies depending on when they are used in a conflict. In stand-alone deterrence missions during a crisis, the conventional missile force would be "under the direction of the CMC". However, when taking part in joint firepower operations, conventional missile strikes may be ordered by theatre commanders.

In peacetime, conventional missile units are under the CMC's exclusive authority through the direct command and control arrangements for PLARF missile bases. These command arrangements ensured that "it takes a short time to transform from peace to war; it is favourable for stability and development." The CMC may maintain some authority over conventional missile units once they are assigned to joint campaigns under theatre commanders in wartime[50].

Chapter VI

China's Missile Force

People's Liberation Army Rocket Force (PLARF)

In December 2015, China's largest nuclear weapons stakeholder, the Second Artillery Force, was renamed the Rocket Force and elevated from a military branch to military service. The PLA Rocket Force maintains and operates China's land-based conventional and nuclear missiles.

Xi Jinping, President of the People's Republic of China, has emphasised the importance of possessing a robust nuclear capability. He stated that the PLARF needs to be prepared to conduct "comprehensive deterrence and warfighting," which could imply that the force, including its nuclear component, will not be limited to strict deterrence functions and could instead take on a more active posture. Xi has said the PLA Rocket Force will be "a strategic pillar for our country's great power status, and an important cornerstone in protecting our national security."

Due to the improvement in Beijing's nuclear capabilities, including more precision strike capable systems, development of a nuclear triad and growth in the number of warheads, the Chinese Commuist Party (CCP) "will have more options in the nuclear realm" in the future.[51] PLARF is

responsible for the China's strategic land-based nuclear and conventional missile forces. It develops and fields a wide variety of conventional mobile ground-launched ballistic missiles and cruise missiles. Some of them are capable of carrying both conventional and nuclear payloads.

Nuclear Deterrence

China has preserved a doctrine of minimum deterrence since its first nuclear test in 1964. Chinese leaders felt that a credible second-strike capability would be enough to deter an attack on China. It placed the bulk of their efforts to ensure the survivability of their nuclear arsenal. The PLA has kept a low alert level for its nuclear forces. It keeps most of its warheads at a central storage facility in the Qinling Mountain Range. Some are also kept at smaller regional storage facilities.

Chinese publications, including the 'Intimidation Warfare and Science of Second Artillery Campaigns' (SSAC), highlight the role of the missile force as an instrument of deterrence, and they emphasise that any future conventional conflict involving nuclear powers will take place "under nuclear deterrence conditions." Rocket Force campaign deterrence operations take place in peacetime, crisis and wartime. Books on military campaigns frequently open with a discussion of nuclear and conventional "dual deterrence" operations to compelling the adversary to accept certain conditions. Rocket Force campaign deterrence activities' objective is to compel the enemy to accept the conditions put forward by China through intimidation.

This process begins with lower intensity deterrence actions, such as warnings and demonstrations of strength and gradually progresses to higher intensity deterrence actions, such as launch exercises or even test launches close to enemy targets. Conducting launch exercises is an essential method for achieving campaign deterrence objectives. This involves launching missiles at the pre-determined ground or sea targets to place psychological

pressure on enemy decision-makers. SSAC characterises launch exercises as "mid-trength" or "high-strength" deterrence activities that come close to actual combat. In addition to creating psychological pressure or fear on the enemy side and producing the desired deterrence effects, they have the added benefit of testing missile force units' operational capabilities. The test launch option could land missiles near enemy territory or ships for added effect.

PLARF Organisation

PLARF organises, mans, trains and equips the PRC's strategic land-based nuclear and conventional missile forces and associated support forces and missile bases. According to the PRC's 2019 Defence White Paper, the PLARF is working towards "enhancing its credible and reliable capabilities of nuclear deterrence and counterattack, strengthening intermediate and long-range precision strike forces, and enhancing strategic counter-balance capability, so as to build a strong and modernised rocket force." In 2019, the PLARF's participation in the PRC's 70th-anniversary military parade was designed to show its progress to "achieve a great rise in strategic capabilities" and accelerating the PLARF's pace of development and making enhanced "breakthroughs…in strategic deterrence capability."[52]

In 2019, the PLARF advanced long-term modernisation plans to enhance its strategic deterrence. The number of warheads capable of threatening the U.S. is expected to grow to roughly 200 in the next five years.

Details of missiles held by PLARF and its ranges are given below:-

Missile	Class	Range	News
YJ-18	Cruise Missile	220-540 km	Operational
DF-17	HGV	1,800-2,500 km	Operational
DF-12	SRBM	420 km	Operational

DF-11	SRBM	280-300 km	Operational
DF-26	IRBM	3,000-4,000 km	Operational
DF-16	SRBM	800-1,000 km	Operational
DF-4	IRBM/ICBM	4,500-5,500 km	Operational
DF-15	SRBM	600 km	Operational
HN 3	Cruise Missile	3,000 km	Operational
HN 2	Cruise Missile	1,400-1,800 km	Operational
JL-2	SLBM	8,000-9,000 km	Operational
DF-5	ICBM	13,000 km	Operational
HN 1	Cruise Missile	50-650 km	Operational
DF-31	ICBM	8,000-11,700 km	Operational
DF-41	ICBM	12,000-15,000 km	Operational
DF-21	MRBM	2,150 km	Operational

(https://missilethreat.csis.org/country/china/)

Location

China's nuclear forces take advantage of the country's vast size to improve the ability of the force to survive an enemy's first strike, according to a principle of "caves, dispersal, mountains (tong, san, shan)." Its nuclear missile units are commanded by five missile bases located in Shenyang in China's north, Anhui to the east, Yunnan to the south, and Hunan, Henan's interior province Gansu. Most of China's inter-continental ballistic missile brigades are located in these three interior bases to make it more difficult for an adversary to find and destroy them. All bases have both conventional and nuclear subordinate launch brigades.

The PLARF is divided into five or six regional bases, each of which has between four and ten subordinate nuclear and conventional missile brigades. The *Science of Second Artillery Campaigns* explained that while conventional missiles were dispersed throughout the country in peacetime, "in wartime, many conventional missile forces can be through inter-combat theatre manoeuvres concentrated on the main direction. It is not realistic to depend on a single missile base to implement an operational command for all conventional missile units participating in the war." The 2006 *Science of Service Strategy* also indicated that in wartime, the CMC would divide units from different bases into nuclear counter-attack combat groups and conventional missile combat groups, in which they would "carry out combat according to their combat formation." All DF-21 conventional missile brigades were made up of two battalions of six missile launchers each until about 2017, when conventional missile battalions were re-structured to include five missile launchers only. Unlike nuclear units, conventional missile launchers "have the same structure in wartime as peacetime." Nuclear missile units have equipment inspection support units that are responsible for handling nuclear warheads in wartime once they are distributed by the PLA's central nuclear warhead base. China's central nuclear warhead storage facility is tunnelled into a mountain in Shaanxi province.

A command organisation chart in the *Science of Second Artillery Campaigns* also indicates that missile bases command both nuclear launch brigades and equipment inspection support units. Those inspection units coordinate with China's central warhead base command. Conventional units do not have equipment inspection units or a command relationship with the warhead base, suggesting that conventional missile warheads are stored on missile bases or brigade garrisons or mated to their launchers peacetime.

Organisation Structure

The organisational structure of the PLARF is complicated. The Rocket Force is commanded by a full General, who from 2004 to 2017 was also a member of the CMC. The Rocket Force political commissar is a theatre leader grade officer and chairs the Rocket Force Party Committee. The commander serves as vice chairman of the Party Committee. The force is divided into six bases (sometimes called armies) numbered 61–66, each led by an army officer. Bases 61–66 oversee subordinate launch brigades and support regiments.[53]

The Rocket Force also oversees a separate base, Base 67, which is responsible for maintaining China's stockpile of nuclear warheads. The Rocket Force leadership also runs three training bases and an engineering base headquartered in Luoyang. The engineering base in Hanzhong, Shaanxi is primarily responsible for tunneling. An 'engineering technology general group' located in Luoyang, Henan, is responsible for facility installation, and a specialised engineer brigade for disaster response is garrisoned north of Beijing.

Each missile base has between three and five subordinate missile brigades, with most bases operating a mix of conventional and nuclear brigades. The exception is Base 61 (formerly Base 51), which operates only conventional missiles and may have up to eight missile brigades. Within this organisational structure, command authority is exerted from the base,

down through brigades, battalions, companies and platoons. The Rocket Force's nuclear units are believed to report directly to the CMC, while the conventional units may now be under the theatre commands' operational command.

Each brigade has launch battalions and/or launch companies that operate a limited number of launchers. A launch platform in this context can be a silo as in the case of the DF-5, a cave rollout to launch site such as the DF-4, or for mobile missiles, a transporter-erector-launcher. Missiles and launchers also require effective communications, intelligence and maintenance support. The structure of brigades differs for fixed-site missiles and mobile missiles and conventional and nuclear missiles. The number of missiles per brigade may vary significantly between conventional missile brigades (up to 36 launchers with as many as six missiles per launcher), mobile nuclear-armed missile brigades (between 6 and 12 missile launchers per brigade), and fixed-site nuclear-armed missiles (6 or fewer silos or cave rollout sites.)

This reflects differences in the number of battalions, companies and launchers assigned to each unit. As per unclassified U.S. Government estimates, it is estimated that each nuclear-armed mobile missile brigade has approximately eight launchers. For example, the U.S. National Air and Space Intelligence Center assesses that China has 5 to 10 DF-31 missiles and "more than 15" DF-31A missiles. Using an average of eight, China probably has one DF-31 brigade and two DF-31A brigades. Using the structure of bases, brigades, and launch units, a rough order of battle for the Rocket Force is presented in the Table below:-

Table 2: PLARF Missile Force Structure 2020[1]

Base Number (Provinces)	Unit	Location[2]	Weapon Type[3]	Nuclear	Notes
PLARF HQ		Beijing (40.0352, 116.3197)			
Base 61 (Anhui, Fujian, Guangdong, Jiangxi, Zhejiang)	HQ	Huangshan (29.6957, 118.3025)			
	611 Brigade	Qingyang (30.6903, 117.9011)	DF-21A	Yes	Former DF-3A brigade.
	612 Brigade	Leping (28.9797, 117.1205)	DF-21(A)[4]	(Yes)	Nuclear status unclear.
	613 Brigade	Shangrao (28.4745, 117.8954)	DF-15B	No	First conventional SRBM unit
	614 Brigade	Yongan (26.0596, 117.3151)	DF-11A	No	First DF-11A brigade.
	615 Brigade	Meizhou (24.2828, 115.9708)	DF-11A (DF-17?)	No	Second DF-11A brigade.
	616 Brigade	Ganzhou (25.7823, 114.8805)	DF-15	No	Second DF-15 brigade.
	617 Brigade	Jinhua (29.1508, 119.6153)	DF-16[5]	No	Second DF-16 brigade.
	618 Brigade	?[6]	?	?	Rumored new brigade base.

Base 62 (Guangxi, Guangdong, Hainan, Sichuan, Yunnan)	HQ	Kunming (24.9888, 102.8346)			
	621 Brigade	Yibin (28.7607, 104.7914)	DF-21(A)	(Yes)	
	622 Brigade	Yuxi (24.3601, 102.4942)	DF-31A	Yes	Former DF-21A brigade.
	623 Brigade	Liuzhou (24.3856, 109.5726)	DF-10A	No	First DF-10A brigade.
	624 Brigade	Danzhou (19.4721, 109.4570)	DF-21C/D	No	New base under construction.
	625 Brigade	Jianshui (23.7354, 102.8713)	DF-26	Yes	Possibly third DF-26 brigade.
	626 Brigade	Qingyuan (23.6845, 113.1768)	DF-26	Yes	Possible second DF-26 brigade.
	627 Brigade	Puning (23.4122, 116.1816)?	? (SRBM, DF-17?)	(No)	Rumored new brigade base area.
Base 63 (Huaihua, Hunan)	HQ	Huaihua (27.5747, 110.0250)			
	631 Brigade	Jingzhou (26.5577, 109.6648)[7]	DF-5B	Yes	HQ base.[8]
	632 Brigade	Shaoyang (27.2532, 111.3859)	DF-31AG	Yes	Upgraded from DF-31.
	633 Brigade	Huitong (26.8935, 109.7388)	DF-5A	Yes	HQ base.[9]
	634 Brigade	Tongdao (26.1459, 109.7723)?[10]	? (DF-41?)	?	Rumored new brigade base area.[11]
	635 Brigade	Yichun (27.8869, 114.3862)	DF-10	No	Second DF-10 brigade.
	636 Brigade	Shaoguan (24.7579, 113.6797)	DF-16	No	First DF-16 brigade.
Base 64 (Gansu, Inner Mongolia, Ningxia, Qinghai, Shaanxi, Xinjiang)	HQ	Lanzhou (35.9387, 104.0159)			
	641 Brigade	Hancheng (35.4754, 110.4468)	DF-31A	Yes	Second DF-31 brigade.
	642 Brigade	Datong (36.9495, 101.6663)	DF-31 (DF-31AG?)[12]	Yes	DF-31AG seen in 2019.
	643 Brigade	Tianshui (34.5315, 105.9103)	DF-31AG	Yes	First DF-31AG brigade.
	644 Brigade	Hanzhong (33.1321, 106.9361)	(DF-41)	(Yes)	Rumored DF-41 integration base.[13]
	645 Brigade	Yinchuan (38.5938, 106.2269)?	?	?	Rumored new brigade base.
	646 Brigade	Korla (41.6946, 86.1734)	DF-21C (DF-26?)	(Yes)	DF-26s seen in 2019 and 2020.[14]
	647 Brigade	Xining (36.6168, 101.7782)?	?	?	Rumored new brigade base area.
Base 65 (Jilin, Liaoning, Shandong)	HQ	Shenyang (41.8586, 123.4514)			
	651 Brigade	Dengshahe (39.3028, 122.0654)	DF-21A	Yes	DF-26s seen in 2019.[15]
	652 Brigade	Tonghua (41.6681, 125.9548)?[16]	DF-21C	No	DF-31As seen training in area.
	653 Brigade	Laiwu (36.2332, 117.7154)	DF-21C/D	No	DF-21D seen recently.
	654 Brigade	Dengshahe (39.2353, 122.0440)	(DF-26)	(Yes)	Base under construction.
	655 Brigade	Tonghua (41.7649, 125.9857)?	?	?	Rumored new brigade base area.
	656 Brigade	Laiwu/Taian (36.2164, 117.2069)[17]	(DF-31AG?)	?	Rumored new brigade base area.
Base 66 (Henan)	HQ	Luoyang (34.6405, 112.3823)			
	661 Brigade	Lushi (34.0504, 111.0342)[18]	DF-5B	Yes	HQ base.[19]
	662 Brigade	Luanchuan (33.7883, 111.5925)[20]	DF-4, DF-5A/B	Yes	Potentially upgrading to DF-41.
	663 Brigade	Nanyang (33.0117, 112.4145)	DF-31A	Yes	First DF-31A brigade.
	664 Brigade	Yiyang (34.5435, 112.1470)?[21]	(DF-31AG?)	(Yes)	Possibly upgrading to DF-31AG.
	665 Brigade	Xinxiang (35.3999, 114.1263)?[22]	?	?	Rumored new brigade base area.
	666 Brigade	Xinyang (32.1675, 114.1257)	DF-26	Yes	First DF-26 brigade base.
Total:	**40 Brigades**			**~21**	
Base 67 (Shaanxi)	Central nuclear weapons storage complex. Headquartered in Baoji city. Responsible for storing and handling nuclear warheads at nearby underground storage facility as well as smaller regional storage sites located in each regional base area.				

[1] This table is based on: Mark Stokes, *PLA Rocket Force Leadership and Unit Reference*, Project 2049 Institute, April 9, 2018; P.W. Singer and Ma Xiu, "China's missile force is growing at an unprecedented rate," *Popular Science*, February 25, 2020; Decker Eveleth, "Mapping the People's Liberation Army Rocket Force," *aboyandhis.blog*, April 9, 2020; individual researchers such as Vinayak Bhat and others who prefer to remain autonomous; and the authors' observations and estimates. The table is a work in progress.

It is estimated that the PLA Rocket Force currently has up to 40 brigades with ballistic or cruise missile launchers. Of those brigades, approximately half operate ballistic missile launchers with nuclear capability, a number that is likely to grow further as bases currently under construction are completed. Russia, in comparison, operates about 50 nuclear brigades, known as regiments in the Russian military.

Each Rocket Force missile base and missile brigade have a headquarters with multiple subordinate launch units. The Rocket Force relies extensively on underground facilities and engineering elements responsible for digging them. Launch units are based above ground on a day-to-day basis in peacetime. Underground facilities are used for storage, as well as missile-warhead assembly, check out and roll out. Launch units practice deploying into tunnels for short periods, a practice that allows the Rocket Force to

ride out a nuclear attack as suggested by the country's no-first-use policy. A recent article described a "multi-day survival training" exercise in which a launch battalion spent eight days living in tunnels before conducting an exercise. The article highlights the "poor living environment" of the tunnels for even short periods, particularly the challenge of maintaining nutrition. Cooked meals are prohibited because the heat from a kitchen would reveal the tunnel is occupied.

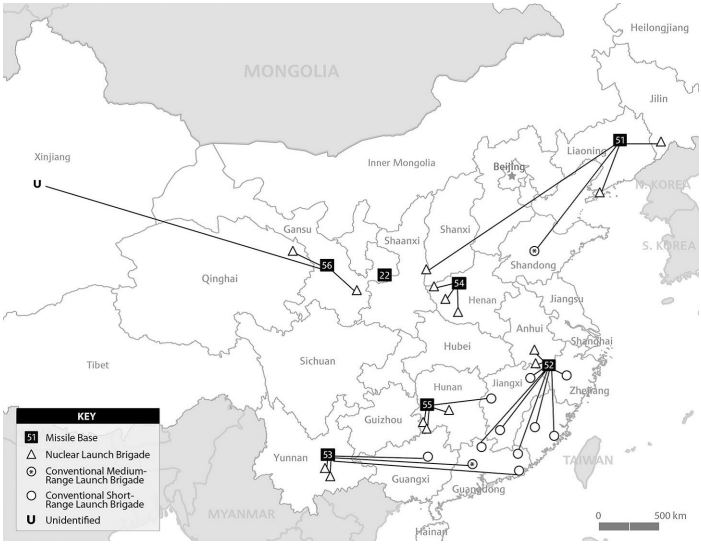
In addition to the land-based Rocket Force units, the Chinese Navy has built at least four Jin-class ballistic missile submarines in the past decade. How China would communicate with ballistic submarines and whether China would conduct continuous at sea deterrence patrols, are issues that remain unanswered. It is unclear whether naval units will develop their own nuclear warhead storage and control system outside of the PLARF Base or whether units assigned to navy fleets would receive warheads only in a crisis. Deployment of a nuclear powered ballistic missile submarine fleet may create new pressures for mating warheads in peacetime or pre-delegating launch authority in certain situations.

The dedicated command and control network of conventional missile units is linked into the integrated command platform (ICP) for all PLA regular forces.[54] The ICP is intended to give the PLA a common operational picture for conventional forces fighting jointly. There is no evidence that nuclear units are connected to this system. The command and control infrastructures supporting conventional and nuclear missile brigades are likely to be different today.

The system allows commanders to transmit commands, synthesise intelligence and monitor launches in real-time. The system facilitates command and control over mobile missile brigades from bases and enables skip-echelon command from PLARF headquarters. Conventional units do not have pre-delegated authority to launch missiles. If a brigade's communications are interrupted, units would "adopt indirect

communications or skip echelon command methods, to restore command for the unit. "[55]

PLARF and India[56]



China's Nuclear and Conventional Missile Bases and Launch Brigades

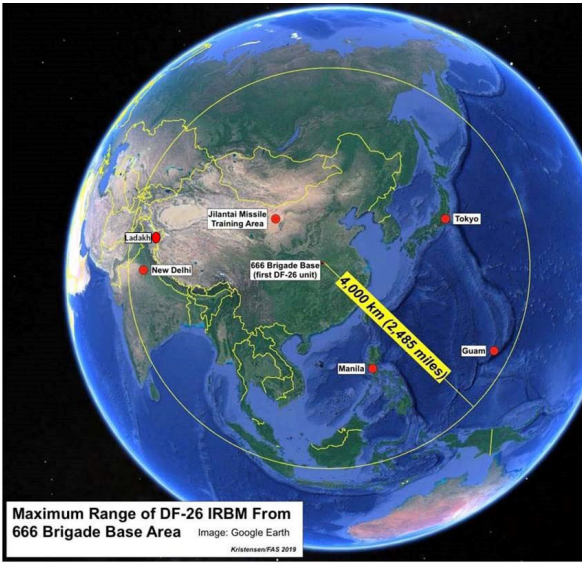
(Fiona S. Cunningham and M. Taylor Fravel, *Chinese Views on Nuclear Escalation*: https://taylorfravel.com/documents/research/fravel.2019.IS.china.nulcear.escalation.pdf)

There are about 104 missiles that can strike all or parts of India, including 12 x DF-31A(11,000 km range), 6x12 DF-31 (7,000 km range) that can reach all Indian mainland targets, and 12 x DF-21 (2,150 km range) that can reach New Delhi.

Location of PLA Rocket Force

Brigades operating anti-ship missiles like the DF-21D and DF-26 are located mainly in China's southern and northern provinces. It puts them within range of virtually the entire South and East China Seas and South Korea, Japan, and Guam. It is important to note that only one Rocket Force brigade is located in far-western China, which is likely to be equipped

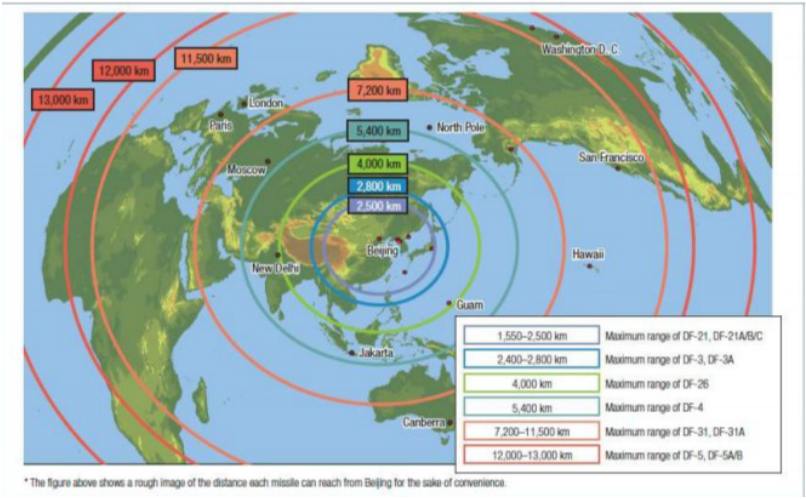
with a nuclear-armed DF-21 rather than conventionally armed missiles. It may indicate that PLA leaders consider there is a lower potential need to carry out conventional strikes against ground targets in Central and South Asia.



Organisation of Chinese missile forces into multiple locations, but only a smaller number of bases, maybe puzzling to external observes. This is because Chinese missile units are organised into what the PLA refers to as 'bases.' There are six bases, each located in a different geographical area. Each base has a number of subordinate missile brigades, with each brigade maintaining one or more garrisons, various underground facilities (UGFs), rail transfer points, and field launch positions. Of these six bases, only the two are located close to India, and assessed to have India targeting missions, which are listed in this table.

Sea-based missiles do not have a fixed location. On the other hand, China's land-based missile bases can be geo-located. Including only the nuclear forces and locations most relevant to targeting India, the map shows that the bases are concentrated in the far north, with three DF-21

bases in the country's south.



Japanese Estimate of Chinese Missile Ranges, 2018

(Defense of Japan 2018 (Annual White Paper) Digest, http://www.mod.go.jp/e/publ/w_paper/, p. 92)

It is estimated that 104 Chinese missiles could strike all or parts of India. These include about a dozen DF-31A and six to twelve DF-31 missiles capable of reaching all Indian mainland targets. Another dozen DF-21s have important military targets and towns in range. The remaining missiles can target sections of India's northeast and east coast. As China deploys more road-mobile missiles in future, it will be easier for it to move missiles from the interior to new survivable positions within India' range.

Integration of PLARF with Joint Operations

PLA is trying its level best to integrate Rocket Force units into joint operations. Despite the recent emphasis, the PLA may experience difficulties integrating units into joint operations. A report on efforts to better coordinate between the theatre commands and the Rocket Force noted that while the knowledge of their service was quite good, the understanding of joint operations exhibited "noticeable gaps". Rocket

Force command and control continue to remain centralised and has not been delegated to theatre commanders. This can adversely affect future joint campaigns. Stove-piped command and control setup would make it complicated to coordinate actions of Rocket Force missile brigades and those forces assigned directly to a theatre command in a fast-moving operation without clear command authorities and an integrated communications network. However, the Rocket Force is trying to enhance coordination with the theatre commands and other services and is taking steps to improve the coordination.

There are valid reasons for the slow pace of integration. Both the conventional and nuclear missiles of different systems may share logistics, maintenance and training requirements. But Theatre Commanders may not have a complete understanding of Rocket Force units. Transferring control of conventional units to the theatre commands would require the creation of parallel and redundant structures. CMC leaders will therefore want to maintain tight central control over China's conventional and nuclear missile systems, given their unique ability to strike targets abroad and potentially initiate a conflict due to carelessness or poor judgment.

There is a possibility that ultimately the PLA may be going to fully integrate conventional Rocket Force units into the Theater command and control mechanisms.

Communications

The PLA has invested in multiple redundant communications links between its headquarters near Beijing and its missile bases to ensure reliable communications following a nuclear attack. The communications depend on fibre optic cables and wired, wireless and satellite communications to provide redundancy. Its automated command and control system for missile force brigades allows for "skip-echelon" command and control arrangements. Leaders could directly command a launch battalion from

headquarters in Beijing, which ensures command and control of the battalion even if its communications with intermediate links in the chain of command, the missile force base or brigade, are severed.

China's existing intelligence, surveillance and reconnaissance (ISR) capabilities provide it with a short period of strategic warning of an incoming attack, which may give its missile units enough time to take cover or hide from an incoming attack. The PLA has not yet deployed offshore or satellite-based radars to significantly increase the length of strategic warning it would receive of a nuclear attack. China's missile force has stated its intent to improve the strategic warning capabilities.

Vulnerabilities of the Chinese Nuclear Command and Control System

China does not have an exclusive nuclear command-and-control system. Some Chinese communication capabilities play a role in supporting both nuclear and conventional military operations. PLA is acutely aware of the country's nuclear Command, Control, Communications and Intelligence (C3I) system's potential vulnerabilities, particularly against cyber infiltrations. It can be presumed safely that China has implemented protection measures for its nuclear C3I system like installing air gaps and employing electro-magnetic shielding technologies. However, the installation of such protective measures is no silver bullet. The Nuclear Command and Control System will still be vulnerable to sophisticated cyber interference efforts.[57]

Dual Use Missiles and Comingling

All of the conventional and nuclear ground-based ballistic missiles are under the control of the PLARF. Some of these missiles, such as the DF-21, feature both conventional and nuclear-armed variants. The DF-

26, is technologically capable of switching between either a conventional or nuclear payload. Mobility of these systems increases the possibility of nuclear and conventional units operating far from home garrisons and within proximity of one another. This organisational, technological, and geographic overlap may make it difficult for China's adversaries to determine which systems are nuclear and which are conventional. It is not clear whether any DF-26 missiles carrying nuclear warheads have been deployed.[58] It is the longest-range system in the PLARF, explicitly designed for compatibility with conventional and nuclear payloads alike.

The PLA's rationale for pursuing this strategy appears to be a cost-savings measure and a belief in strategic ambiguity. Any adversary thinking of attacking China's conventional force in a crisis or conflict would be worried about inadvertently hitting nuclear weapons and catastrophically escalate the situation. A CCTV (China TV) report from 2017 about a PLARF launch brigade (the 646 Brigade, out of Korla) states that it is equipped with a new type of intermediate-range SSM, likely to be the DF-26. The report also makes clear that this brigade "simultaneously possesses both nuclear and conventional strike capabilities."[59] The Brigade Political Commissar Zhou Lusheng says in the report: "Our mission is the two major operations, the two major deterrences [a reference to both nuclear and conventional capabilities]… A nuclear-conventional dual-use brigade must train to simultaneously possess two different operational postures… meaning that personnel of such a brigade have a higher workload."

Zhang Lei, a Battalion Commander, wrote: "We must study both nuclear and conventional, meaning one man must be proficient in two billets." The article describes a drill in which the brigade practices firing a precision munition. Integration of the DF-26 missile into the Rocket Force can be done in two ways. It is not clear which approach China is adopting. One choice is to keep the Rocket Force's existing structure and make separate conventional and nuclear DF-26 brigades. This choice would not utilise

the option "change the warhead, not the missile". China may posture individual DF-26 brigades for both nuclear and conventional operations, making it more challenging to characterise DF-26 missiles.[60]

Generally, conventional missile units share some infrastructure with nuclear missile units. The PLA commingles conventional and nuclear units for organisational efficiency reasons, but those decisions have implications for its force posture. It dampens U.S.' incentives to pre-emptively attack China's conventional missile capabilities for fear of triggering nuclear escalation. The U.S DoD 2019 report on China stated, "China's comingling of some of its conventional and nuclear missile forces, and ambiguities in China's NFU conditions could complicate deterrence and escalation management during a conflict. Once a conflict has begun, China's dispersal of mobile missile systems to hide sites could further complicate the task of distinguishing between nuclear and conventional forces and, thus, increase the potential for accidental attacks on the latter. "[61]

Multifunctionality of weapons and military assets that could be targeted in a conflict could lead to inadvertent escalation. Deployment of offensive weapons capable of threatening both nuclear and conventional targets may cause misinterpretation. For example, recently developed underwater unmanned vehicles can threaten an enemy's nuclear ballistic missile submarines and its attack submarines. Even if the United States wants to intimidate China's attack submarines only and not its submarines with ballistic missile, there would be a real risk that China would suspect that its sea-based nuclear deterrent capabilities are in danger.[62]

Hans Kristensen of the Federation of American Scientists clarifies, if China was to fire a conventionally armed dual-use missile, but the target country was unable to distinguish whether its payload was nuclear or conventional, it may erroneously assume it is under nuclear attack and respond with an in-kind strike back against China. Likewise, the very scenario China

sets up for ambiguity could come true. In times of war, an opponent may plan to strike what it thinks to be the PLA's conventional missiles, but accidentally hit its nuclear force. This could then make China believe that its actual nuclear deterrent capability was the intended target.[63]

Chapter VII

Advancements in Technology and Non-Nuclear Strategic Weapons

Strategic Wepons

Advances in technology, space weapons, cyber weapons, autonomous lethal weapons, artificial intelligence (AI) based decision systems, hypersonic glide vehicles, anti-satellite weapons, missile defences and conventional missiles are making the line between nuclear and non-nuclear conventional weapons blur and overlapping. Both can now be considered strategic weapons. Geography is not a hindrance today to the delivery of strategic space, cyber or conventional missile weapons. The speed with which a cyber weapon interrupts an adversary system, once the command is given to activate a payload of malicious code, is much shorter than an inter-continental ballistic missile flight time. Anti-satellite (ASAT) weapons could destroy satellites in low earth orbit within 30 minutes. Space, cyber and conventional missile weapons are hard to defend against and have been characterised as offence dominant.

Latest developments in the miniaturisation of electronics, command-and-control information systems and space systems have radically improved the accuracy of the guidance systems of long-range (over 500 km)

missiles capable of delivering conventional warheads to targets that could earlier only be destroyed with nuclear weapons. Non-nuclear long-range conventional systems are being used in regional wars like Iraq, the Balkans, Afghanistan, Libya and Syria. Non-hardened strategic nuclear facilities are now susceptible to existing subsonic non-nuclear cruise missiles. It is unclear whether the precision, accuracy and lethality of warheads will be enough to destroy hardened targets like ICBM silos, underground command posts and mobile missiles. Some experts feel that there will be barely any difference between the impact of using a low yield nuclear weapon with that of a large scale conventional attack.

Non-Nuclear Strategic Weapons

China considers space weapons, cyber weapons and conventional missiles as strategic weapons because these can be used to attack important targets such as the adversary's military infrastructure, satellites, critical infrastructure, aircraft carriers, forward deployed forces and allies in a conflict. These are more similar to nuclear weapons than conventional bombs and bullets because they can inflict a lot of damage to these targets rapidly and efficiently across great distances and are challenging to defend against.

Space, cyber, and conventional missile weapons are seen as strategic weapons because they have many of the characteristics that make nuclear weapons ideal for gaining strategic leverage through escalation threats. The cross-domain deterrence literature presents space weapons, cyber weapons, conventional missiles and unmanned aerial vehicles, among other new technologies, as providing states with new opportunities to coerce one another more effectively, exploiting their comparative advantages in different technologies.[64] Nuclear weapons have four characteristics that differentiate them from conventional weapons: range, destructiveness, efficiency and the difficulty of defending against a nuclear attack.

PLA recommends the coordinated employment of space, cyber and Electronic Warfae (EW) as strategic weapons to "paralyse the enemy's operational system of systems" and "sabotage the enemy's war command system of systems" initially in a conflict. PLA considers cyber capabilities alongside space and nuclear deterrence a critical component in its overall integrated strategic deterrence posture.[65]

China does not threaten to use a nuclear weapon on Taiwan in a limited war. China thinks that non-nuclear strategic weapons would cause enough pain and disruption to make U.S. decision-makers hesitate to intervene in a war over Taiwan. However, it would not affect so much damage that the United States would view China as an existential threat. China has shown varying degrees of risk tolerance level across its force postures for its space, cyber and conventional missile weapons.[66] It can threaten to disrupt American critical infrastructure with cyber attacks, turn American satellites into hazardous space debris with anti-satellite weapons and sink a U.S. aircraft carrier deployed off China's shores with a ballistic missile. Of course, U.S. can do much more damage to China.

Some Chinese experts believe that certain non-nuclear weapons could reduce the enemy's situational awareness of the battlefield. They think that the fog of war resulting from such strikes by undermining the enemy's C3I system's efficacy will be a tactical military advantage for China. It is unknown whether the Chinese professionals are considering the negative consequences of degrading U.S. situational awareness and communication capabilities for China.

Some scholars in China believe that cyber technology can have a positive impact on crisis stability. The growth of cyber technology makes cross-border communications easier, not only between decision-makers but also between the general public in different countries. The public will come to know about the escalation risks of nuclear confrontations and force national leaders to adopt conciliatory measures and defuse military

tensions. They think that technology can help in improving nuclear weapons management in a detailed and timely manner. The government can detect any signs of an anomaly quickly and reduce the chances of an accidental launch of nuclear weapons.

Strategic Substitution

The theory of 'strategic substitution' explains how and why states develop space, cyber and conventional missile postures to maximise their strategic leverage in a limited war, given that nuclear weapons are not well-suited to the task. It assumes that states want to maximise their strategic leverage to coerce an adversary into a limited war without turning it to a total war. States can make more credible threats to use non-nuclear strategic weapons in a limited war because they are less destructive than nuclear weapons and do not increase total war risk. Commander of the U.S. Strategic Command, Gen John Hyten, in mid-2017, remarked that while the nuclear triad is "where deterrence starts" for the United States, "today it's more than just nuclear. It requires the integration of all our capabilities - nuclear, space, cyber, missile defense, electronic warfare, and conventional forces."[67]

In Chinese military writings, strategic deterrence is not synonymous with nuclear deterrence. The military component of strategic deterrence relies not only on nuclear weapons but also on space and cyber warfare and conventional military capabilities. China feels that conventional weapons are becoming more capable and offer much greater flexibility than nuclear weapons. The *2013 Science of Strategy* contains a discussion of the "conventionalisation of deterrence." It notes that, given the improvements to conventional weapons since the end of the Cold War, they have "become a powerful deterrence means for achieving political objectives."

China has developed non-nuclear strategic weapons, including conventional ballistic missiles, counter-space weapons and cyber attack

capabilities.[68] China intends to use these capabilities first to gain military and coercive advantages in a conventional conflict. China is confident that nuclear use can be avoided because these non-nuclear strategic weapons give it more rungs on the nuclear threshold's escalation ladder. Chinese leaders hope that the first use of conventional missiles, anti-satellite weapons, or large scale cyber attacks would impose sufficient costs on an adversary in a limited conventional conflict that it could terminate the conflict below the nuclear threshold.[69]

A paper published by China's National Defense University shows that conventional missiles were more functional than nuclear missiles. As nuclear weapons become less usable, more countries are thus relying on conventional missiles for both deterrence and warfighting roles.[70]

Conclusion

China's missile forces are undergoing organisational reforms, technological developments and operational changes. In the nuclear domain, China's missile forces have evolved into a force of increasingly advanced road-mobile solid-fueled missiles, some of which can be equipped with multiple warheads. China is also developing a sea-based leg for its nuclear deterrent and there are initial reports of a next-generation strategic nuclear-capable bomber.

Creation of the theatre commands and the PLA's emphasis on joint operations have catalysed the Rocket Force's focus on jointness. Introduction and expansion of conventional units in the Rocket Force has made the organisation more relevant to conventional warfare. There are challenges in integrating Rocket Force units into joint operations as deployment of dual-use missile systems and the possible collocation of conventional and nuclear missiles could create risks of unintentional escalation in a conflict.

Introduction of new nuclear platforms could create new opportunities and pressures for changes in China's nuclear policies. SSBN operational deployments will likely involve mated warheads and missiles, leading

the Rocket Force to advocate peacetime mating of warheads and land-based missiles. Conversely, a more diverse and dispersed nuclear force could increase China's confidence in the survivability of its second-strike capability, causing it to forego more assertive changes to its nuclear posture.

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