

PART TWO

Strategic Forces

Chapter 4

China's Development of Nuclear Warheads

Wen-Chung Chai*

I. Introduction

In July 2021, the U.S. media mentioned that James Martin Center for Nonproliferation Studies in Monterey, California has determined, based on satellite images, that China is building a large number of intercontinental ballistic missile (ICBM) launch facilities in Yumen, Gansu. Meanwhile, the Chinese official media denied the allegation and claimed that the so-called “missile launch facilities” are wind turbine foundations under construction. After the media coverage, the opinions from social media on military strategies were divided. Some thought it was a deliberate misjudgment from the U.S, while others believed China was deceiving the enemies. However, the truth of this particular event is not important. When we track long-term trends, we will never change the determination on overall directions due to one-off events. As mentioned in the introduction, China started to modernize its nuclear weapons—as a natural course of action—after it had completed the modernization of traditional military equipment. It is important to the realization of their dreams as a powerful nation and a powerful military force. With traditional weapons alone, it is not possible to obtain any advantage in negotiations or international competition. While we cannot impose any restraints on China's modernization of nuclear weapons, it is still necessary to keep a close eye on China's development in nuclear weapon modernization and extract the

* Assistant Research Fellow, Division of Defense Strategy and Resources, Institute for National Defense and Security Research.

possible trends regarding Taiwan’s national security and national defense in order to prepare and minimize potential conflicts. The following section explains the factors relevant to China’s development of nuclear weapons by focusing on China’s nuclear policy, the current inventory of nuclear warheads, and the R&D direction on warheads. These three elements constitute China’s nuclear weaponry strengths in the future. Analyses and judgments are conducted on China’s number, types, and deployment methods of warheads in due course.

II. China’s Nuclear Policy

To this date, the Chinese government has not yet released a whitepaper or provided policy debates for its nuclear weapon policy. Therefore, we can only analyze and synthesize the talks from China’s leaders, the contents of China’s military strategies, and the official documents ever published to establish an overall understanding of the core elements of China’s nuclear policy. This information will be quite useful in examining China’s development of nuclear warheads.

In theory, China’s nuclear policy should not deviate from its current military strategy. The fundamental driver is to use nuclear weapons to strengthen and achieve military goals. Since the establishment of the New China, China has made multiple adjustments to its guidelines on military strategy in different time periods—from the initial “to lure the enemy in deep” to the current “victory in the local war in intelligence”. Even so, “proactive defense” has always been part of China’s military strategy, in which its fundamental spirit is robust self-defense and readiness for attacks.¹ In this context, China’s nuclear policy is undoubtedly hinged on the spirit of proactive defense. For instance, in the white paper entitled, “China’s National Defense in 2008”, the “PLA Second Artillery Force adheres to the national strategy of no prioritization in the use of nuclear weapons and ensures self-defense in the nuclear strategy...PLA Second Artillery Force’s nuclear missiles

¹ On the formation and development of China’s proactively defensive military strategy, please refer to *Military Strategy Research Department of PLA Academy of Military Science, Strategies* (Beijing: Military Science Press), December 2013, pp. 41-50.

are not aiming at any country at normal times. When the country is under the nuclear threat, Nuclear Missile Force will enhance the status of alert and prepare for a nuclear strike, to deter the enemy not to use nuclear weapons against China.”² “China’s Military Strategy” published in 2015 says that “... no use or threatening to use nuclear weapons without conditions to the country without nuclear weapons and the areas without nuclear weapons. No engagement in the nuclear arms race with any country. Nuclear weaponry is always maintained at the minimum level required to protect the national security.”³

The above statement indicates that China adopts a defensive strategy for its nuclear policy, where the use of nuclear weapons is not prioritized, and there will be no nuclear strike on countries without nuclear weapons. That said, the most important part and the part in need of clarification in its nuclear policy is the idea of “minimum deterrence”. The current proposition of China’s nuclear policy is to fight back after being hit by the first strike. If the target of deterrence is the U.S., the balance required to achieve deterrence is extremely significant. Without a large number of warheads and launch devices with high survivability, it is impossible to establish credible deterrence required for this strategy. As China understands the limitation of the “minimum deterrence” in its nuclear policy, the most direct and reasonable approach is to deploy more nuclear warheads on the PLA Navy’s nuclear ballistic missile submarines to ensure its nuclear deterrence without disrupting the existing political statement. In the foreseeable future, and

² State Council Information Office of the People’s Republic of China, “China’s National Defense in 2008,” January 2009, https://web.archive.org/web/20090123104120/http://www.gov.cn/jrzq/2009-01/20/content_1210075.htm.

³ State Council Information Office of the People’s Republic of China, “China’s Military Strategy,” May 2015, <http://www.scio.gov.cn/zfbps/ndhf/2015/Document/1435161/1435161.htm>. In April 1995, China issued a statement and commitment of no use or threatening to use nuclear weapons, without conditions, to the countries without nuclear weapons or to the regions without nuclear weapons. It is currently the only country announcing security assurance for nuclear weapons among the permanent members of the United Nations Security Council. Please refer to the *People’s Republic of China’s national report in the performance of Treaty on the Non-Proliferation of Nuclear Weapons*, published by Permanent Mission of the People’s Republic of China to the United Nations Office at Geneva and Other International Organizations in Switzerland, April 29, 2019, http://www.china-un.ch/chn/dbtyw/cjkk_1/Bj_1/t1665265.htm; “List of countries in possession of nuclear weapons,” *Wiki*, <https://www.wikiwand.com/zh-mo/%E6%A0%B8%E6%AD%A6%E5%99%A8%E6%93%81%E6%9C%89%E5%9C%8B%E5%88%97%E8%A1%A8>.

as China continues to strengthen its nuclear weaponry, it may discard the strategy for “minimum deterrence” and adopt a more agile and flexible nuclear policy. For instance, the U.S. adopted a “flexible response” strategy in the 1960s. The tenet of this strategy is to respond with the same weapon the enemy uses. If it is impossible to use traditional weapons for deterrence, the use of nuclear weapons may be prioritized. In this way, China can revert its disadvantage of a passive response in the use of nuclear weapons and obtain dominance in force through “vertical escalation”. With appropriate political control, traditional weapons and nuclear weapons can be effectively combined to properly respond to a wide range of military threats.

III. Assessment of China’s Warhead Inventory

In general, there are two most direct and most commonly used indicators in the review of a country’s nuclear military power: the number of warheads and the quantity of all types of warhead launch devices. Warheads are small in size and easy to hide. When the military is unwilling to disclose relevant information for confidentiality, it is difficult for outsiders to come up with an accurate estimate. Warhead launch devices are large in size, and outside parties can easily find out the construction process. Hence, the gap is not too wide between the estimated number and the actual number. Furthermore, China is a totalitarian regime and exercises far more strict control on confidential data than democratic countries. It is only possible to conduct an analysis based on open information from governments and private think tanks. A preliminary understanding of China’s nuclear strengths and weaknesses can be established by guesstimating its inventory of nuclear warheads and combing through these warheads’ types, numbers, payloads, ranges, and launch devices.

Currently, there is a large divergence among authoritative institutions in different countries regarding the estimated number of China’s warheads. For instance, the U.S. Department of Defense thinks it is less than 200. Meanwhile, the Stockholm International Peace Research Institute (SIPRI) and the Research Center for

Nuclear Weapons Abolition (RECNA) estimate it to be 350. On the other hand, the Federation of American Scientists (FAS) approximates it to be 272. It is possible that the U.S. Department of Defense applies a higher standard in the estimation of warhead numbers; hence, its guesstimate is lower than the numbers produced by other sources. Given its long-term observation of the PLA's military development and the professional caliber of the personnel, this number should not deviate too much from the fact. Hence, the general approximation of China's number of nuclear warheads ranges between 200 and 300. Table 4-1 summarizes the projected value of China's number of warheads and launch devices in 2020.⁴

Table 4-1 shows that the less than 20 warheads owned by China have the explosive power of megatons of TNT equivalent, and its remaining warheads have yielded the explosive power equivalent to 200k to 300k TNT each. Based on the explosive power of these warheads, the PLA may only have two or three types currently in service. As far as the deployment methods are concerned, most of China's warheads are land-based. Examples are the missile launch facilities or transporter erector launchers (TELs), with the latter better in mobility and less likely to be detected or targeted by enemies. China's number of submarine-launched ballistic missiles is too small. Even if they all survive the enemy's first strike, they cannot constitute credible deterrence for the second strike.⁵ The PLA's

⁴ Office of the Secretary of Defense, *Military and Security Developments Involving the People's Republic of China 2020* (Washington, D.C.: Department of Defense, 2020), p. ix; "World Nuclear Forces," *Stockholm International Peace Research Institute*, https://sipri.org/sites/default/files/2021-06/yb21_10_wnf_210613.pdf; "Chinese Nuclear Weapons Capability," *Research Center for Nuclear Weapons Abolition*, https://www.recna.nagasaki-u.ac.jp/recna/bd/files/03_china2021_en.pdf; Hans Kristensen and Matt Korda, "The Pentagon's 2020 China Report," *Federation of American Scientists*, September 1, 2020, <https://fas.org/blogs/security/2020/09/the-pentagons-2020-china-report/>.

⁵ Currently, there are a total of 48 submarine-launched ballistic missiles (SLBMs) deployed by the PLA Navy. In comparison, the U.S. Navy's each Ohio class submarine is equipped with 20 Trident II submarine-launched ballistic missiles (SLBM) and each missile can carry up to 14 nuclear warheads. In theory, a single Ohio class missile submarine can carry nuclear warheads equivalent to China's total number. In practice, the ballistic missile submarines currently in service in the U.S. Navy has deployed over 200 submarine-launched ballistic missiles (SLBM), carrying 900 warheads or so. The difference is day and night between the U.S. Navy and the PLA Navy in the number of warheads carried by each submarine or the nuclear strike capability of ballistic missile submarines fleets. See Hans Kristensen, "US SSBN Patrols Steady, But Mysterious Reduction in Pacific in 2017," *Federation of American Scientists*, May 24, 2018, <https://fas.org/blogs/security/2018/05/ssbnpa-trols1960-2017/>.

number of air-based nuclear warheads is even lower. Currently, there are only air-delivered nuclear warheads. The air-launched ballistic missiles and cruise missiles are still under development. Given a constantly expanding scope covered by sensors, it is impossible to use bombers to launch nuclear warheads by going through the enemy’s anti-aircraft network. Hence, the PLA’s R&D of air-based nuclear warheads will likely focus on air-launched ballistic missiles and cruise missiles. As the latter is rather mature in technology, air-launched nuclear cruise missiles should be one pillar of China’s strategic triad.

Table 4-1 Estimates of China’s Number of Warheads and Catapults (2020)

Catapult No.	Payload (No. of warheads x explosive power)	No. of catapults	No. of warheads
DF-4	1 x 3.3 mt	6	6
DF-5A	1 x 4-5 mt	10	10
DF-5B	5 x 200 – 300kt MIRV	10	50
DF-5C	5 x 200 – 300kt MIRV	0	0
DF-21A	1 x 200 – 300kt	20	20
DF-21E	1 x 200 – 300kt	20	20
DF-26	1 x 200 – 300kt	200	20
DF-31	1 x 200 – 300kt	6	6
DF-31A	1 x 200 – 300kt	36	36
DF-31AG	1 x 200 – 300kt	36	36
DF-41	3 x 200 – 300kt MIRV	0	0
JL- 2	1 x 200 – 300kt	48	48
JL- 3	3 x 200 – 300kt	0	0
H- 6K	1 x bomb	20	20
H- 6N	1 x ALBM	0	0
H- 20	2 X ALCM	0	0
Total		412	272

Source: Hans Kristensen and Matt Korda, “The Pentagon’s 2020 China Report,” *Federation of American Scientists*, September 1, 2020, <https://fas.org/blogs/security/2020/09/the-pentagons-2020-china-report/>.

Almost all of China's nuclear warheads are launched by ballistic missiles, covering short, medium, long, and intercontinental ranges. Ballistic missiles return to the earth extremely fast, and the countermeasures are difficult. If the maneuverable reentry vehicle (MaRV) is deployed for warheads on DF-21 missiles, it is even more challenging for the enemy to implement anti-missile interception. While China has made a breakthrough in the multiple independently targetable reentry vehicle (MIRV) technology, its number of warheads stays within 300. It is possibly because of the inability to achieve warhead miniaturization, as mentioned extensively in the "Cox Report" published in 1999. Therefore, China needs a holistic approach and a comprehensive analysis in its modernization of nuclear weapons, especially when it comes to enhancing the performance and range of ballistic missiles and issues related to nuclear warheads, such as the types, functions, deployment, mobility, and survivability. For the purpose of deterrence, the Chinese military should not pursue a large inventory of nuclear artillery. It should rather focus on the maintenance and deployment of the sufficient number and survivability of warheads, which reduces the prohibitive costs of nuclear warhead deployment and maintenance. In this way, it also allows for the allocation of resources on the structural optimization of nuclear army forces and the survivability increase of nuclear warheads.

IV. Future Development of China's Nuclear Warhead

In December 2015, Xi Jinping instructed in the ceremony for the PLA Ground Force's establishment of Rocket Force and Strategic Support Force (SSF) to prepare the strategic requirement for the new force to carry out "comprehensive deterrence and warfighting" operations with "both nuclear and conventional" capabilities and enhance "credible and reliable nuclear deterrence and counterstrike capabilities", "medium- and long-range precision strike capabilities", and the ability to contribute to the "strategic balance" between China and its main strategic

competitors.”⁶ Compared with the previously released white paper entitled, “The Diversified Employment of China’s Armed Forces”, the PLA Rocket Force is given the additional strategic requirement for “comprehensive deterrence and warfighting”.⁷ This means that the PLA Rocket Force should be equipped with a broad spectrum of capabilities in tactical deterrence, limited nuclear wars, and all-out nuclear wars. The section below explains China’s potential development in nuclear warheads to ensure “comprehensive deterrence and warfighting” capabilities. Only nuclear warheads are adequate in supporting all of the Rocket Force’s missions and the effective implementation of the strategic goals of “comprehensive deterrence and warfighting”.

1. Miniaturization

In the early days of nuclear weapon development, all countries competed in large equivalent warheads. However, the heavy weight, complexity in launch and support systems, and high costs in operation and maintenance have turned different nations to the R&D of nuclear warhead miniaturization. Nuclear warhead miniaturization offers many benefits, including a significant increase in the number of warheads a ballistic missile can carry. When combined with the MIRV warhead technology, it can strike a larger number of targets and make it more difficult for the opponent’s anti-missile defense. Most importantly, the rapid advancement of technology has empowered miniaturized nuclear warheads with huge destruction capabilities. The W-88 nuclear warhead deployed on the U.S. Navy Trident II ballistic missile is only c. 800lb in weight. However, its explosive power is 475k tons of TNT equivalent. For the nuclear bomb drop in Hiroshima, the U.S. used 50 kg (110 lb.) to generate the explosive power of 15k tons of TNT equivalent. In keeping up with this trend, China’s top priority is centered on the R&D and the deployment of miniaturized nuclear warheads to strengthen the strike capability and maximize the number of nuclear warheads each platform can carry.

⁶ “Xi Jinping Presented PLA Ground Force, Rocket Force, and Strategic Support Force was Flags, and Gave Speeches,” *cpcnews.cn*, January 2, 2016, <http://cpc.people.com.cn/BIG5/n1/2016/0102/c64094-28003839.html>.

⁷ State Council Information Office of the People’s Republic of China, “The Diversified Employment of China’s Armed Forces,” April 2013, http://www.gov.cn/zhengce/2013-04/16/content_2618550.htm.

2. Multiple models

In the foreseeable future, the variety of China's platforms for carrying nuclear warheads will dramatically increase. These platforms include intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), aerial bombs, air-launched cruise missiles, and ballistic missiles. The methods used by platforms to launch nuclear warheads are not necessarily the same. There are also significant differences in weights, ranges, and payloads. Different nuclear warhead models must be designed to effectively accommodate the various requirements of these platforms. For instance, submarine-launched ballistic missiles (SLBMs) cannot launch a thermal nuclear warhead with the power of megatons TNT equivalent, given the size and the weight of the warhead. To meet the strategic goal of "comprehensive deterrence and warfighting", China needs to develop and deploy different types of nuclear warheads for different missions and platforms to achieve tactical deterrence and engage in limited nuclear wars and all-out nuclear wars. On the other hand, China may simplify the large variety of ballistic missiles to reduce the cost of operations and maintenance of nuclear warheads. It may also launch platforms and develop different models of nuclear warheads and ballistic missiles that can launch multiple types of nuclear warheads.

3. Specialization

The specialization of nuclear warheads is the integration of miniaturization and variety in the types mentioned above, designed to strike specific targets. During the Cold War, the Soviet Union and the U.S. developed and deployed many specialized nuclear warheads, such as neutron bombs and nuclear landmines against tanks and armored units; nuclear torpedoes, nuclear mines, and nuclear depth bombs against the targets on the water surface and beneath waters; and nuclear electromagnetic pulse (NEMP) warheads to neutralize the enemy's communication system with a nuclear blast in the air. While these warheads come with smaller equivalents, they still cause lethal damages to the targets. Noteworthy, there are no significant collateral damages; hence, no heavy casualties of innocent civilians, which translates to a greater possibility of practical use in real battles. The PLA Rocket

Force has about 1,200 short-range ballistic missiles (SRBM).⁸ The development of various specialized nuclear warheads to be deployed on these missiles can greatly boost the flexibility in utilizing nuclear warheads and empower various nuclear warheads with wider strategic and tactical capabilities.

V. Conclusion

Based on the above analysis of China’s nuclear policy, types, and the number of nuclear warheads, a summary can be drawn regarding China’s shortcomings in nuclear weaponry and its areas for improvement. In reference to the achievements by the U.S. and Russia in the nuclear warhead technology during the Cold War, a comparison and an inference can be established on China’s possible directions and long-term trend in the R&D of nuclear warheads. Each nuclear warhead may not be large in size, but its quantity, model design, and deployment method are tied to a nation’s nuclear policy and military strategy and may even have a profound influence on the nuclear arms race between superpowers. In the examination of China’s nuclear warheads, the following developments and trends can be summarized:

In line with the modernization of traditional military strengths, China is also enhancing the performance of its nuclear weaponry, including ballistic missiles and nuclear warheads.

“Comprehensive deterrence and warfighting” is currently a strategic goal for the PLA Rocket Force. To prepare for nuclear wars in different scenarios, China needs multiple types of nuclear warheads.

China is expected to pursue miniaturization, variety, and specialization in the R&D and deployment of nuclear warheads going forward to ensure across-the-board and highly flexible nuclear strike capabilities for the PLA Rocket Force.

Miniaturized and specialized nuclear warheads serve a wide range of purchases

⁸ Defense Intelligence Agency, *China Military Power: Modernizing A Force to Fight and Win* (Washington, D.C.: Defense Intelligence Agency, 2019), p. 91.

and are extremely likely to be used in real battles. The abuse of nuclear weaponry may cause vertical escalation and breach the nuclear threshold, eventually leading to total nuclear war.

As China's number of nuclear warheads and ballistic missiles continues to increase, the U.S. may ask China to engage in nuclear arms talks. If China's assets of nuclear weaponry exceed those of the U.S., it will be required to limit and reduce both. Furthermore, strategic arms may be the main battlefield between China and the U.S. in the foreseeable future.

