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The PLA Rocket Force: Evolving Beyond the Second Artillery Corps (SAC) and Nuclear Dimension

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THE PLA ROCKET FORCE: EVOLVING BEYOND THE SECOND ARTILLERY CORPS (SAC) AND NUCLEAR DIMENSION

Since 1985, Chinese missile forces, which are under the command of the Second Artillery Force (SAF) or Second Artillery Corps (SAC) – have changed strikingly in character. The forces have shifted from a nuclear deterrent force based primarily on intermediate and medium-range missiles to a force of intercontinental- and medium-range nuclear forces combined with a powerful conventional missile arm capable of conducting precision attacks at a medium range.

Further changes took place on the eve of 2016 as the SAF was recommissioned as the PLA Rocket Force (PLARF) on December 31, 2015. Additionally, the PLARF was elevated from an independent branch to the fourth military service alongside the PLA, PLAN, and PLAAF. Though the decision to reconstitute the PLARF as a military service indicates the importance China puts on maintaining modern missile forces, at this point it seems unlikely that the PLARF's roles and responsibilities will differ substantially from the SAF.

The PRC Ministry of National Defense provided the following explanation of the role of the PLARF on its website:[1]

> (President) Xi stressed that the PLA Rocket Force is China's core strategic deterrence power. The PLA Rocket Force should strengthen the trustworthy and reliable nuclear deterrence and nuclear counter-attack capabilities, intensify the construction of medium and long range precision strike power, and reinforce the strategic check-and-balance capability, so as to build a powerful and modern Rocket Force.

According to the US-China Economic and Security Review Commission, the PLARF[2] "has at least 1,330 and potentially more than 1,895 ballistic and cruise missiles, which includes 1,000-1,200 short-range ballistic missiles, 75-100 medium range ballistic missiles, 5-20 intermediate-range ballistic missiles, 50-75 intercontinental ballistic missiles, and 200-500 ground-launched land-attack cruise missiles." [3]

The PLARF's missile systems, coupled with the PLA's rapidly developing space and counter-space platforms, have become critical components of China's emerging power projection capabilities. With the addition of new modernized missile classes and various satellite and counter-space capabilities, the PLARF is now capable of credibly deterring adversaries at intercontinental ranges and conventionally holding at risk adversary forces within 1,500 km of China. These changes are the result of major doctrinal modifications that started during the 1980s and fundamentally altered the PLARF's overarching mission as well as its position within the wider PLA.

At the same time, the development of conventional short-range ballistic missiles (SRBMs), medium-range ballistic missiles (MRBMs), and land attack cruise missiles (LACMs), as well as its improving intercontinental ballistic missiles (ICBMs) means China must modify its strategy, and develop a wide range of additional command and control, and battle management capability. These include developing a new approach to deterrence, new approaches to war fighting, and a more sophisticated capability to target enemy forces over the horizon while coordinating such attacks with joint PLA forces.

As with many aspects of China's military modernization, the overhaul and growth of China's missile capabilities has been swift and substantial. Only a little over a decade ago, China's conventional missile forces only had the capability to hit Taiwan. Now, China possesses the capability to hit the first island chain and in all likelihood the second island chain.[4] Mark Stokes of the Project 2049 predicts that China could have fully global precision strike capabilities by the year 2030.[5] In the mid-1990s China possessed only around 30-50 SRBMs, that number has grown to over 1,200.[6] Overall, in a very short period of time China has built one of the most diverse and capable missile forces in the world.

It should be noted, however, that some key uncertainties exist which are mentioned in other aspects of this analysis. The word "precision" is often used in unclassified reports without any definition or indication whether this is empirical intelligence or test data on which to base such a term. Actual estimates of precision are often made on the basis of the theoretical engineering limits of the guidance platform rather than test data, and made regardless of the overall reliability of the missile. Missile technology has advanced over the years, but systems are still deployed where it later becomes clear that their real-world capability was far more limited than their design indicated.

Accuracy per se is less critical in describing nuclear armed missiles than conventional missiles, but it is important to note that the most common definition of accuracy used in public estimates is circular error probable (CEP) (also circular error probability or circle of equal probability). This is defined as the radius of a circle, centered about the mean, whose boundary is expected to include the landing points of 50% of the missiles fired.

The basic mathematics used in defining and making these calculations have some uncertainties and the methods can vary. The more critical point, however, is that they normally assume the entire missile functions perfectly from launch through its entire flight to impact or detonation. Unless the warhead or missile have terminal guidance or homing, they also assume that the launch point and target are perfectly known, and that flight and reentry conditions are not relevant.

These are not casual issues, and it is important to note that no estimate is made of missile failures or where the other 50% of the missiles fired actually land. Major misfires can be acutely annoying in the case of nuclear weapons. Any serious deviation relative to real world warhead lethality can make a conventional warhead totally ineffective against the target involved even if it is a matter of meters in some cases. It can make it impossible for both the attacker and defender to estimate intentions and damage in the case of nuclear weapons, and create serious problems in managing an escalation ladder – if relevant.

There also historical cases where even the U.S. deployed nuclear armed cruise missiles and ballistic missiles later proved to be far less reliable and accurate than was originally assumed. Complex military bureaucracies may or may not demand meaningful test data, and targeters and policy makers may or may not understand the data they are given. There are strong indications that countries like China may not conduct enough real-world operational tests to estimate a valid derived aim point for at least some systems.

Much of the unclassified data on missile performance are also based on nominal warhead weights rather than any actual knowledge of the warhead. This can radically affect the combined range-payload of the missile – either reducing or increasing range dependent on real-world warhead weight. The actual design of a nuclear, biological, chemical, or conventional warhead

also radically affects its lethality and reliability – particularly during the reentry phase if relevant and at the points where height and effectiveness of burst/dissemination become critical. This is generally more of a problem with ballistic missiles than cruise missiles, but terminal guidance can be a separate problem with all missiles.

Three other key issues where insufficient data exist to characterize these developments include:

- The extent to which China is developing more sophisticated warheads and the level of reliable precision strike capability to use conventional missile warheads against key military and infrastructure targets.
- The linkages between the steady improvement in China's missile forces, and the development of its theater and strategic nuclear forces – a subject addressed in the next chapter.
- The degree to which China sees its missiles as a deterrent to conventional escalation and a political weapon versus an operational aspect of joint warfare linked to its air, land, and naval operations.

It is not clear that China's declared strategy matches its actual strategy or longer term force and modernization goals, or how China uses such forces in its exercises and operational plans.

PLARF Strategy and Developments

China does have a declared strategy for using its missile forces. During the 1980s, the CMC ordered the PLARF to operate according to the concept of "Dual Deterrence and Dual Operations." This doctrine was developed in response to China's perception of the recent changes in the nature of modern warfare, and the CMC believed that these changes required the PLARF to maintain both a conventional strike capability and augmented security for its nuclear deterrent. The PLARF had been founded with a mission solely focused on nuclear deterrence before it also assumed conventional responsibilities in the 1980's.

One key document that describes China's declared strategy is the *Science of Second Artillery Campaigns.* This document was issued in 2004, but still provides one of the most detailed and current public descriptions of China's strategy and goals for PLARF:[7]

> In the late 1980s, the Central Military Commission assigned the Second Artillery Force the mission to build and develop a conventional guided missile force. Especially after the Gulf War, the PLA, under the correct leadership of President Jiang Zemin (江泽民), formulated the military strategic guidelines of the new era. To meet the needs of future high tech local wars, the Central Military Commission issued the new task of "dual deterrence and dual operations" and set up a new conventional guided missile force.

The basic logic of "dual deterrence and dual operations" was that both conventional and nuclear missile capabilities could deter China's adversaries, while both conventional and nuclear operations were necessary in wartime. By nuclear operations, the PLARF refers to nuclear counter-attack and nuclear deterrence operations.

The requirements placed on the PLARF by the new service strategy had significant implications for its force structure, equipment composition, and personnel policies. In the mid-1980s, the PLARF was a force comprised mostly of medium- and intermediate-range nuclear and atomic weapons. The PLARF had few intercontinental ballistic missiles (ICBMs) and no conventional capabilities. The requirements of the new service strategy created doctrinal and practical challenges.

As the *Science of Second Artillery Campaigns* stated, several changes had to occur:[8]

> First is to shift the footing of the theoretical research of Second Artillery Force campaigns from dealing with a nuclear war in the past to participating in a high tech local war under the condition of nuclear

> deterrence; Second is to shift the focus of the research from using the single nuclear means to accomplish the mission of nuclear counter attack in the past to using two types of means, both nuclear and conventional, namely to a mission of "dual deterrence and dual operations." Third is to change the content of research from focusing on strategizing in the past to focusing on a combined use of strategizing and technical means.

The PLARF's dual deterrence and dual operations strategy easily fits into the construct of the Local Wars concept the PLA adopted in 1993, and its emphasis on developing a conventional strike capability fits into the Local Wars requirements for long-range precision strikes.

As a result, the PLARF now plays an important supporting role for the Army, Navy, and Air Force in joint operations. Long-range conventional strikes and nuclear counterattacks (assuming that China has already been attacked with nuclear weapons), targeting enemy C4ISR, and air bases. However, the PLARF is also described as being capable of conducting independent operations if necessary.

As is the case with the other key elements of PLA's forces, improvements in the realism of training appear to reflect the PLARF's ability to conduct joint and independent operations. In addition to training exercises in conjunction with other services across multiple military regions, the PLARF has practiced operating under harsh conditions, which may describe contingencies such as loss of communication with the command chain, constrained mobility, and electronic attacks.[9]

China does not have a clear separation between the assets of the conventional and nuclear assets of the PLARF. Indeed, the *Science of Second Artillery Campaigns* emphasized that "nuclear missile force deterrence actions and conventional missile strike operations must be fused together and mutually interwoven."[10] Although China's no first use policy would suggest that only conventional missiles will be active in a campaign—provided that China is not attacked by nuclear weapons—nuclear tipped missiles still have a role to play. These missiles serve as a nuclear "backstop" to escalation of a conflict. The *Science of Second Artillery Campaigns* states:[11]

> These units aim mainly to fully demonstrate their role in nuclear deterrence and prevent the war from moving towards widening or spreading, and to deter the enemy from initiating nuclear war, and thereby controlling the war by keeping it localized, limited and bearable in scope.

Moreover, China emphasizes the value of utilizing its substantial conventional missile capabilities in a conflict situation. Jeremy Medeiros notes in a September 2007 report:[12]

> The dominant theme in these writings is the offensive nature of conventional missile operations, that is, conventional missiles are not just for deterrence and retaliation. The PLA emphasizes using conventional missiles to strike first, strike hard, strike precisely, and strike rapidly. The aim of this approach is to "seize the initiative" and quickly gain "campaign control" in order to speed up the process of warfare leading to the adversary's quick capitulation. PLA writings state that the goals of such attacks are to "smash or weaken the enemy's military strength, to politically shock the 168 enemy, to shake the [enemy's] willpower [to wage] war, to check the escalation of war, and to speed up the progress of war."45 The conceptual importance of preemption and striking critical targets to joint firepower attacks is reflected in the PLA's "guiding ideology" for conventional missile operations— "forestalling the enemy and striking with focus" (xianji zhidi zhongdian tuji)—which is repeatedly stressed in PLA publications.

Jeffrey Lewis states in his 2014 book *Paper Tigers* that:[13]

> Westerners tend to think of the Second Artillery as China's nuclear force, but today conventionally armed missiles account for the majority of the inventory of missiles and launchers, as well as about half the

> brigades. Nuclear missions play a declining role in the broader portfolio of Second Artillery capabilities, a shift that has far-reaching implications.

The PLARF can undertake various activities in order to "demonstrate their role." These activities can include exercises, feints in order to confuse enemy intelligence, revealing certain capabilities, preparing launch facilities to give the appearance of escalation, increasing readiness levels, conducting missile tests (tests closer to enemy assets will send stronger messages), and possibly lowering the nuclear deterrence threshold or adjusting nuclear policy.[14] Analysts are concerned that some of these actions can be easily misinterpreted as preparation for an attack, potentially sparking an unwanted conflict.[15]

PLARF Strategy

China's recent strategy papers have reaffirmed these trends in the PLARF, along with the strategy emphasized in the *Science of Second Artillery Campaigns*. The 2013 defense white paper, supplemented with the current PRC Ministry of Defense explanation of the PLARF, provides more details available through open sources than the 2015 defense white paper. It described China's 2013 strategy for building and developing the PLARF as follows: [16]

> The PLA Second Artillery Force (PLASAF) is a core force for China's strategic deterrence. It is mainly composed of nuclear and conventional missile forces and operational support units, primarily responsible for deterring other countries from using nuclear weapons against China, and carrying out nuclear counterattacks and precision strikes with conventional missiles.
>
> Following the principle of building a lean and effective force, the PLASAF is striving to push forward its informationization transform, relying on scientific and technological progress to boost independent innovations in weaponry and equipment, modernizing current equipment selectively by applying mature technology, enhancing the safety, reliability and effectiveness of its missiles, improving its force structure of having both nuclear and conventional missiles, strengthening its rapid reaction, effective penetration, precision strike, damage infliction, protection and survivability capabilities.
>
> The PLASAF capabilities of strategic deterrence, nuclear counterattack and conventional precision strike are being steadily elevated. The PLASAF has under its command missile bases, training bases, specialized support units, academies and research institutions. It has a series of "Dong Feng" ballistic missiles and "Chang Jian" cruise missiles.

When it comes to future force goals, China's 2015 defense white paper stated that the PLARF will strengthen its capabilities and remain vigilant in peacetime. The most extensive portion of the 2015 paper referring the PLARF was limited to the following statement:[17]

> In line with the strategic requirement of being lean and effective and possessing both nuclear and conventional missiles, the PLA Second Artillery Force (PLASAF) will strive to transform itself in the direction of informationization, press forward with independent innovations in weaponry and equipment by reliance on science and technology, enhance the safety, reliability and effectiveness of missile systems, and improve the force structure featuring a combination of both nuclear and conventional capabilities. The PLASAF will strengthen its capabilities for strategic deterrence and nuclear counterattack, and medium- and long-range precision strikes.

The PRC Ministry of Defense website further explained PLARF force building in 2015 by stating:[18]

> Following the principle of building a lean and effective force and going with the tide of the development of military science and technology, the Second Artillery Force strives to raise the informationization level of its weaponry and equipment, ensure their safety and reliability, and enhance its capabilities in protection, rapid reaction, penetration, damage and precision strike. After several decades of development, it has created a weaponry and equipment system with both nuclear and conventional missiles, both solid-fueled and liquid-fueled missiles, different launching ranges and different types of warheads.

> The Second Artillery Force is endeavoring to form a complete system for war preparations, optimize its combat force structure, and build a missile operational system suited to informationized warfare. Its nuclear and conventional missile forces are kept at an appropriate level of readiness.
>
> The Second Artillery Force is making steady head-way in the construction of its battlefield system, and makes extensive use of modern mechanical equipment and construction methods. Each completed project is up to standard.
>
> The Second Artillery Force is also dedicated to logistical reforms and innovations. It has created integrated data bases for field support and informationized management platforms for logistic materials, and improved support systems for the survival of combatants in operational positions. As a result, its integrated logistical support capabilities in case of actual combat have been markedly enhanced.
>
> To ensure the absolute safety of nuclear weapons, the Second Artillery Force strictly implements rules and regulations for nuclear safety control and accreditation of personnel dealing with nuclear weapons, has adopted reliable technical means and methods, strengthens the safe management of nuclear weapons in the process of storage, transportation and training, improves mechanisms and methods for emergency response to nuclear accidents, and has put in place special safety measures to avoid unauthorized and accidental launches.

Power Projection

China's missile programs cannot be separated from its nuclear weapons capabilities but they also have a major impact on its power projection capabilities and the ongoing improvements in its naval and air forces discussed earlier. The PLARF's force development and modernization efforts indicate that China has sought to obtain both the conventional and nuclear capabilities necessary for fighting and winning Local Wars under Conditions of Informatization in the 21st century. It is also clear that the PLARF's modernization and force development is an ongoing process, one that will likely continue into the near future.

The PLARF's equipment procurement policies are in line with the Local Wars concept, although they give China and the PLA many other options. The PLARF has modernized its missile systems and built a conventional arsenal comprised entirely of modern missiles that utilize solid fuel and are road-mobile. Moreover, the PLARF's conventional missile systems are increasing in accuracy, thus augmenting the potency of a hypothetical PLARF long-range precision strike.

If current unclassified estimates are correct that PLARF possesses only about 260 nuclear warheads compared to thousands of missiles, it seems that the majority of China's missile program is focused more on conventional capabilities. At the same time, the nuclear element of the PLARF's dual mission is making progress.

The nuclear missiles are lagging behind the conventional force in its development of a solid-fueled, mobile forces – China's nuclear deterrent posture still relies heavily on less advanced fixed, liquid-fueled missiles. However, China's nuclear deterrent is modernizing with the decision to MIRV the DF-5B ICBM.

Along with progress in China's SLBMs, this raises increasing questions to the future size of its nuclear armed forces, and its targeting doctrine, along with questions about the degree to which it is responding to regional and U.S. missile defenses. This, in turn, raises questions about China's impact on U.S.-Russian nuclear arms control efforts – as does Russia's increasing emphasis on nuclear modernization and theater nuclear options in Europe.

The PLARF's modernization and force development involves other aspects in addition to is developing new missiles. The PLARF has also fundamentally changed its force structure over the last twenty years, shifting from a medium-intermediate-range nuclear force to a bifurcated

force armed with an array of missile categories, classes, and variants. The PLARF is now capable of and required to carry out a variety of missions. Capabilities such as regional conventional precision strike, which did not exist in 1995, now make up more than half of the PLARF's missile launcher arsenal.

The PLARF is currently modernizing and developing new forces with new weapons systems like the DF-21D anti-ship ballistic missile (ASBM), Anti-Satellite missiles (ASAT), and conventional DF-21C. At the operational level, some reports also indicate that the PLARF has built tunnel networks with a total length that could reach 5,000 kilometers to provide protection for its mobile missile systems. This would reduce the risk of preemption and complicate targeting by any potential adversary. [19]

Moreover, the forces with the greatest potential precision strike capability – the SRBM and LACM forces – have large numbers of reserve missiles per missile launcher, thus ensuring the possibility of sustained combat operations and repeated salvo fire. This combination of enhanced mobility, survivability, and large supplies of ammunition ensures that, in the case of any potential conflict, adversary forces in the region must operate in an environment in which there would be no sanctuaries within hundreds of kilometers of China.

It also makes the real world reliability and accuracy of Chinese forces – something that cannot be determined without access to highly classified test data – a critical issue. A large precision strike force that can do critical damage to fixed military and civilian infrastructure targets can become something approaching a force capable of mass effectiveness even if it does not come close to a nuclear level of mass destruction.

The US Official View and the Growth of China's Precision Strike Capability

There have been a number of official U.S. assessments of China's missile capabilities. Some have come from expert sources. In May 2013, the US National Air and Space Intelligence Center issued the latest version of its assessment, with contributions from the Defense Intelligence Agency Missile and Space Intelligence Center and the Office of Naval Intelligence.[20]

This assessment summarized Chinese missile developments as follows:[21]

> China has the most active and diverse ballistic missile development program in the world. It is developing and testing offensive missiles, forming additional missile units, qualitatively upgrading missile systems, and developing methods to counter ballistic missile defenses.
>
> …The Chinese ballistic missile force is expanding in both size and types of missiles. China continues to field conventionally armed SRBMs opposite Taiwan, and is developing a number of new mobile, conventionally armed MRBMs. Missiles such as the CSS-5 ASBM are key components of the Chinese military modernization program, specifically designed to prevent adversary military forces' access to regional conflicts.
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> …China continues to maintain regional nuclear deterrence, and its long-term, comprehensive military modernization is improving the capability of its ballistic missile force to conduct high-intensity, regional military operations, including "anti-access and area denial" (A2/AD) operations. The term A2/AD refers to capabilities designed to deter or counter adversary forces from deploying to or operating within a defined space. Currently, China deploys the nuclear armed CSS-2, CSS-5 Mod 1, and CSS-5 Mod 2 for regional nuclear deterrence. China is also acquiring new conventionally armed CSS-5 MRBMs to conduct precision strikes. These systems are likely intended to hold at-risk or strike logistics nodes, regional military bases including airfields and ports, and naval assets. Notably, China has likely started to deploy the DF-21D, an ASBM based on a variant of the CSS-5.
>
> …China is strengthening its strategic nuclear deterrent force with the development and deployment of new

> ICBMs…China currently has a single XIA Class SSBN that is intended to carry 12 CSS-NX-3/JL-1 missiles. In addition, China will deploy the new CSS-NX-14/JL-2 SLBM on new 12-tube JIN Class SSBNs. This missile will, for the first time, allow Chinese SSBNs to target portions of the United States from operating areas located near the Chinese coast…The CJ-10 (DH-10) is the first of the Chinese Changjian series of long-range missiles and LACMs. It made its public debut during a military parade in 2009 and is currently deployed with the Second Artillery Corps.

The U.S. Department of Defense and U.S. Congress have also issued a long series of annual assessments. The 2016 edition of the DoD report on *Military and Security Developments Involving the People's Republic of China,* and the *2015 Report to Congress of the US-China Economic Security Review Commission,* describe the current structure and trends in the PLARF in some detail.

The US summarized Chinese missile developments in its 2016 DoD report as follows:[22]

> The Rocket Force, renamed from the PLASAF late last year, operates China's land-based nuclear and conventional missiles. It is developing and testing several new classes and variants of offensive missiles, including a hypersonic glide vehicle; forming additional missile units; upgrading older missile systems; and developing methods to counter ballistic missile defenses.
>
> The force possesses approximately 1,200 short-range ballistic missiles (SRBM) in its inventory. China is increasing the lethality of its conventional missile force by fielding the CSS-11 (DF-16) ballistic missile with a range of 800-1,000 km. The CSS-11, coupled with the already deployed conventional land-attack and anti-ship variants of the CSS-5 (DF-21C/D) medium-range ballistic missile (MRBM), will improve China's ability to strike not only Taiwan, but other regional targets. These ballistic missile systems are complimented by the CJ-10 ground-launched cruise missile (GLCM). The CJ-10 has a range in excess of 1500 km and offers flight profiles different from ballistic missiles that can enhance targeting options.

The 2016 report continued describing Chinese MRBM and ICBM developments, as well as highlighting the development of the multiple independently-targetable re-entry vehicle (MIRV), which will be discussed in greater detail in the next chapter. [23]

> China is fielding a growing number of conventionally armed MRBMs, including the CSS-5 Mod 5 (DF-21D) anti-ship ballistic missile (ASBM). The CSS-5 Mod 5, with a range of 1,500 km and maneuverable warhead, gives the PLA the capability to attack ships, including aircraft carriers, in the western Pacific Ocean.
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> China unveiled the DF-26 intermediate-range ballistic missile (IRBM) during the September 2015 parade in Beijing. When fielded, the DF-26 will be capable of conducting precision strikes against ground targets and contribute to strategic deterrence in the Asia-Pacific region. The official parade announcer also referenced a nuclear version of the DF-26, which, if it shares the same guidance capabilities, would give China its first nuclear precision strike capability against theater targets.
>
> The PLARF continued to modernize its nuclear forces by enhancing its silo-based intercontinental ballistic missiles (ICBM) and adding more survivable, mobile delivery systems. China's ICBM arsenal to date consists of approximately 75-100 ICBMs, including the silo-based CSS-4 Mod 2 (DF-5) and multiple independently-targetable reentry vehicle (MIRV)-equipped Mod 3 (DF-5B); the solid-fueled, road-mobile CSS-10 Mod 1 and 2 (DF-31 and DF-31A); and the shorter range CSS-3 (DF-4). The CSS-10 Mod 2, with a range in excess of 11,200 km, can reach most locations within the continental United States. China also is developing a new road-mobile ICBM, the CSS-X-20 (DF-41) capable of carrying MIRVs.

The 2016 DoD report provided considerable detail regarding China's precision strike capabilities – although it did not define "precision strike," describe the empirical basis for measuring accuracy, describe the warheads involved and their lethality, or describe missile reliability. This is critical because estimates of accuracy based purely on the potential limits of estimates or the limits of the guidance platform can be highly uncertain and are often based on theoretical

estimates of warhead size that do not indicate anything about warhead sophistication and lethality. The 2016 DoD report notes: [24]

> **Short-Range Ballistic Missiles (SRBMs) (less than 1,000 km**). The PLA Rocket Force, formerly called the PLASAF, had approximately 1,200 SRBMs at the end of 2015. The force fields advanced variants with improved ranges and accuracy in addition to more sophisticated payloads, while gradually replacing earlier generations that do not possess true precision strike capability.
>
> **Medium-Range Ballistic Missiles (MRBMs) (1,000-3,000 km).** The PLA is fielding conventional MRBMs to increase the range at which it can conduct precision strikes against land targets and naval ships operating far from China's shores out to the first island chain.
>
> **Intermediate-Range Ballistic Missiles (IRBMs) (3,000-5,500 km).** The PLA is developing a nuclear and conventional road-mobile IRBM, which increases its capability for near-precision strike out to the "second island chain." The PLAN also is improving its over-the-horizon (OTH) targeting capability with sky wave and surface wave over the horizon (OTH) radars, which can be used in conjunction with reconnaissance satellites to locate targets at great distances from China, thereby supporting long-range precision strikes, including employment of ASBMs.
>
> **Land-Attack Cruise Missiles (LACMs).** The PLA continues to field air- and ground-launched LACMs for standoff precision strikes. Air-launched cruise missiles include the YJ-63, KD-88, and the CJ-20 (the air-launched version of the CJ-10 ground-launched cruise missile still fielded in the PLASAF). China recently adapted the KD-88 LACM, with an advertised range of more than 100 km, and may be testing a longer-range version. China also is developing the CM-802AKG LACM, an export system that can strike both land and ship targets from fighters or bombers.
>
> **Ground Attack Munitions.** The PLAAF has a small number of tactical air-to-surface missiles (ASM) as well as precision-guided munitions including all-weather, satellite-guided bombs, anti-radiation missiles, and laser-guided bombs. China is developing smaller-sized ASMs such as the AR-1, HJ-10 anti-tank, Blue Arrow 7 laser-guided, and KD-2 missiles in conjunction with its increasing development of UAVs. Additionally, China is also adapting to UAVs GPS-guided munitions such as the FT-5 and LS-6 that are similar to the U.S. Joint Direct Attack Munitions (JDAM).
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> **Anti-Ship Cruise Missiles (ASCMs)**. The PLAN is deploying a wide range of advanced ASCMs. The most capable include the domestically produced ship-launched YJ-62 ASCM and the Russian SS-N-22/SUNBURN supersonic ASCM, which is fitted on China's SOVREMENNY-class DDGs acquired from Russia. China's submarine force is also increasing its ASCM capability, with the long-range YJ-18 ASCM replacing the older YJ-82 on the SONG, YUAN, and SHANG classes. The YJ-18 is similar to the Russian SS-N-27B/SIZZLER ASCM, which is capable of supersonic terminal sprint and is fielded on eight of China's 12 Russian-built KILO SS. In addition, PLAN Aviation employs the 200 km range YJ-83K ASCM on its JH-7 and H-6G aircraft. China has also developed the YJ-12 ASCM for the PLAN. The new missile provides an increased threat to naval assets, due to its long range and supersonic speeds. It is capable of being launched from H-6 bombers.

The *2014 Report to Congress of the US-China Economic Security Review Commission* described the progress in China's missile industry as follows:[25]

> China is able to rapidly develop and produce a diverse array of advanced ballistic and cruise missiles. China maintains the largest and most lethal short-range ballistic missile force in the world; fielded the world's first anti-ship ballistic missile in 2010; deployed its military's first long-range, air-launched land-attack cruise missile in 2012; and will widely deploy its military's first indigenous advanced, long-range submarine launched anti-ship cruise missile in the next few years, if it has not already. Furthermore, the PLA is developing hypersonic glide vehicles as a core component of its next-generation precision strike capability. Hypersonic glide vehicles could render existing U.S. missile defense systems less effective and potentially obsolete.

It then went on to discuss China's conventional strike capabilities in some detail, albeit with the same lack of specifics regarding "precision" and strike capability as the 2016 DoD report:[26]

> **Short-Range Ballistic Missiles (less than 621 miles):** In 2002, China had 350 short-range ballistic missiles. After a rapid expansion, China today has the world's largest short-range ballistic missile force, with 1,000–1,200 missiles. The force also has become more lethal as China has gradually replaced older missiles lacking a true precision-strike capability with new short-range ballistic missiles and variants of existing short-range ballistic missiles that feature longer ranges and improved accuracies and payloads.
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> China's short-range ballistic missile force consists mainly of multiple variants of the DF–11 and DF–15. All of these missiles are solid-propelled and road-mobile; most variants have a maximum range of more than 373 miles, allowing them to strike targets throughout Taiwan.136 Moreover, the Second Artillery in 2010–2011 fielded a new short-range ballistic missile, the DF–16. The DF–16 reportedly has a higher reentry velocity than the DF–11 and DF–15 and an extended range of 621 miles. In addition to increasing China's ability to penetrate Taiwan's missile defenses, the DF–16 for the first time allows the Second Artillery to target large sections of the East China Sea with short-range ballistic missiles.
>
> China also is developing several new road-mobile short-range ballistic missiles: the CSS–9, the CSS–14, the CSS–X–15, and the CSS–X–16. These missiles have maximum ranges of between 93– 174 miles 138 and presumably feature greater accuracy and precision than previous models. According to Mr. Fisher, ''China's development of new classes of short-range ballistic missiles is prompted by the requirement to strengthen its ability to coerce or attack Taiwan, but also by commercial pressures to offer better short-range ballistic missiles to capture export markets. Short-range ballistic missiles are produced at two, possibly three Chinese factories, and it is Chinese government policy to promote vigorous competition between them and to support export efforts.''
>
> During a conflict with Taiwan, China likely would use its short-range ballistic missiles to strike critical military infrastructure and command and control nodes as well as key political and economic centers. Chinese military doctrine suggests the Second Artillery would fire large salvos from multiple axes to confuse, overwhelm, and exhaust Taiwan's ballistic missile defenses. The Second Artillery has been conducting increasingly larger missile exercises; to date, its live-fire exercises have included salvoes of at least ten missiles.140 Mr. Murray testified to the Commission that China's expanding and modernizing missile force could rapidly defeat Taiwan's defenses, despite Taipei's significant investments in ballistic missile defenses.
>
> **Theater-Range Ballistic Missiles (621 miles to 3,418 miles):** In 2008, the PLA fielded its first conventional theater-range ballistic missile, the DF–21C medium-range ballistic missile. With a range of more than 1,087 miles, the DF–21C gives China the ability to target U.S. forces in Japan and South Korea. China also may have deployed a second conventional medium-range ballistic missile in 2010–2011: a DF–16 variant with a maximum range of 746 miles.
>
> China plans to deploy a new conventional intermediate-range ballistic missile that can strike land targets out to at least 1,864 miles and potentially as far as 3,418 miles.142 This missile, which probably will be operationally deployed in the next five years, could allow China to threaten U.S. forces in Guam, Northern Australia, and Alaska, and U.S. bases in the Middle East and the Indian Ocean, depending on its ultimate range. Moreover, according to Ian Easton, research fellow at the Project 2049 Institute, ''If the PLA's conventional intermediate-range ballistic missile program is successful, it is possible that China could develop the means to threaten Hawaii and the West Coast of the United States with a conventional intermediate-range ballistic missile by sometime in the early-to-mid 2020s.''
>
> **Antiship Ballistic Missiles:** In 2010, China deployed the world's first antiship ballistic missile, the DF–21D. The DF–21D has a maximum range of more than 932 miles and is armed with a maneuverable warhead, providing China with the ability to threaten U.S. Navy aircraft carriers operating east of Taiwan from secure sites on the Chinese mainland. China may be developing an even longer-range antiship ballistic missile capable of striking ships operating in maritime areas as far as Guam.144 The Second Artillery appears to have already formed two antiship ballistic missile brigades— not testing or training units—in Qingyuan City (southeastern China) and Laiwu City (northeastern China). The antiship ballistic missile brigade in Qingyuan reportedly conducted one of its first major field training exercise in spring 2011.

> **Ground-Launched Land-Attack Cruise Missiles:** In 2007–2008, the Second Artillery introduced its first ground-launched land-attack cruise missile, the CJ–10. China's large inventory of CJ–10s— 200–500 missiles deployed on 40–55 road-mobile launchers— suggests the missile plays a central role in China's regional strike strategy. The CJ–10 reportedly features a stealthy design and has a maximum range over 932 miles, giving the PLA the ability to hold at risk U.S. forces in Japan and South Korea.149 Although it appears to be primarily intended for conventional missions, a 2013 NASIC report suggests the missile also could carry a nuclear warhead.

One key question about these developments is the extent to which U.S. advances in airpower have forced China to focus on missile development and forces in ways that can potentially "leap forward" ahead of forces relying on manned aircraft, fixed air bases, and carriers. Like the development of battle ships versus carriers before World War II, or the German emphasis on armor before 1939, it is sometimes difficult to identify what really is a revolution in military affairs.

Japanese Views

Regional powers certainly focus on Chinese missile capabilities. The 2015 Japanese Defense White Paper provided the following summary of the PLARF:[27]

> China has made independent efforts to develop nuclear capabilities and ballistic missile forces since the mid- 1950s, seemingly with a view to ensuring deterrence, supplementing its conventional forces, and maintaining its voice in the international community. With regard to the nuclear strategy, it is recognized that China employs a strategy where it can deter a nuclear attack on its land by maintaining a nuclear force structure able to conduct retaliatory nuclear attacks on a small number of targets such as cities in the adversary's country.
>
> China possesses various types and ranges of ballistic missiles: intercontinental ballistic missile (ICBM); submarine-launched ballistic missile (SLBM); intermediate-range ballistic missile/medium-range ballistic missile (IRBM/MRBM); and short-range ballistic missile (SRBM). The update of China's ballistic missile forces from a liquid propellant system to a solid propellant system is improving their survivability and readiness. Moreover, it is believed that China is working to increase performance by extending ranges, improving accuracy, mounting warheads, and by other means.
>
> China's main ICBM strategic nuclear asset had been the fixed-site liquid-fuel DF-524. However, China has deployed the DF-31, which is a mobile type ICBM with a solid propellant system mounted onto a transporter erector-launcher (TEL), and the DF-31A, a model of the DF-31 with extended range. According to some analysts, China has already deployed the DF-31A and will increase its numbers. Regarding SLBM, China currently appears to be deploying Jin-class nuclear-powered ballistic missile submarines (SSBNs) to carry the JL-2, whose range is believed to be approximately 8,000 km, which is currently under development. Once the JL-2 reaches a level of practical use, it is believed that China's strategic nuclear capabilities will improve by a great margin.
>
> As for the IRBM/MRBM covering the Asia-Pacific region including Japan, China has deployed the solid propellant DF-21, which can be transported and operated on a TEL, in addition to the liquid-propellant DF-3 missiles. These missiles are capable of carrying nuclear warheads. It is believed that China possesses conventional ballistic missiles with high targeting accuracy based on the DF-21, and it has been pointed out that China has deployed conventional anti-ship ballistic missiles (ASBMs), which could be used to attack ships at sea including aircraft carriers. In addition to IRBM/MRBM, China possesses the DH-10 (CJ-10), a cruise missile with a range of at least 1,500 km, as well as the H-6 (Tu-16), bombers that are capable of carrying nuclear weapons and cruise missiles. It is deemed that these missiles will complement ballistic missile forces, covering the Asia-Pacific region including Japan. Concerning SRBM, China possesses a large number of solid-propellant DF-16, DF-15, and DF-11, and they are believed to be deployed facing Taiwan. It is believed that their ranges cover also a part of the Southwestern Islands including the Senkaku Islands, which are inherent territories of Japan.
>
> Furthermore, in order to acquire striking force that will enable penetration of the missile defense shield, China is considered to be developing a hypersonic glide vehicle which is launched by mounting to a

> ballistic missile. Attention will be paid to the relevant developments.
>
> China announced that it had conducted tests on midcourse missile interception technology in January 2010 and 2013. Attention will be paid to China's future trends in ballistic missile defense.

South Korean Views

The 2014 South Korean defense white paper provided a similar, but briefer description of the PLARF:[28]

> The 2nd Artillery Force controls nuclear and conventional ballistic missiles and focuses on improving capabilities in relation to strategic threats, nuclear counter-attack and precision strikes of conventional missiles. In December 2013, it test-launched the DF-41 strategic missile and the JL-2 submarine-launched ballistic missile.
>
> As part of its efforts to become a space power, China successfully launched the Chang'e 3 probe and succeeded in landing the probe safely on the surface of the moon in December 2013.

Shifts in Force Structure, Equipment Composition, and Personnel

The PLARF has responded to the CMC's concept of "Dual Deterrence and Dual Operations" by fundamentally altering its force structure, equipment composition, and personnel policies. Force structure changes are illustrated by the proliferation of missile categories and units within the PLARF as well as by the dual development of conventional and nuclear weapon systems.

Providing the weapons to meet its nuclear and conventional objectives have largely similar capabilities: they both require missile systems that are mobile and survivable. However, the differing requirements of nuclear and conventional missile campaigns mean that the PLARF requires both conventional missiles accurate enough to target mobile or small targets and nuclear missiles capable of evading and surviving enemy nuclear attacks. Neither capability is simple nor easy to achieve; the PLARF is still making progress towards both.

As the previous U.S. reporting on the Chinese program has shown, the PLARF has made significant progress in all of these capabilities compared to its position in 1985. In the conventional field, the PLARF, which had no conventional missiles in 1985, now has the largest conventional missile arsenal in the Asia-Pacific.[29]

Since 1985, the PLARF has developed conventional systems that are mobile, solid-fueled, and may well be precise or near-precise in accuracy if all of the elements of the missile system are reliable and consistently function perfectly within their design tolerances.[30] Moreover, it has also developed indigenous cruise missiles where achieving precision-strike capability has proved to present fewer engineering changes and related warhead penetration, accuracy, and operational lethality problems than is the case with ballistic missiles. In addition, these conventional systems now enjoy increased survivability due to the development of a reportedly 5,000-kilometer-long tunnel network[31] and improving PLAAF air defenses.[32]

Chinese nuclear forces have also made significant progress. Since 1985, the PLARF has retired much of its liquid-fueled nuclear missile arsenal. In turn, these systems have been replaced by new, solid-fueled, mobile missile systems. Unlike the conventional forces, however, the nuclear forces—particularly the ICBMs—still retain a number of liquid-fueled missiles. Consequently, while the PLARF's nuclear delivery modernization continues, it has yet to achieve a fully modern force in terms of missile booster, although the Former Soviet Union demonstrated that

such missiles can be used to carry a high load of MIRVs with limited technical upgrades and by using advanced thermonuclear and boosted weapons designs that have far lower weights than the original warhead.

All of these developments have occurred within the context of the PLARF's efforts to create a force capable of winning Local Wars along China's periphery. Consequently, the PLARF has developed its strongest capabilities in precision-strike weapon systems that can hit targets within 600 km of China's borders: the DoD has estimated that the PLARF has 1,200-1,700 SRBMs and GLCMs.[33]

In addition, the DoD has reported that the PLARF is increasing its numbers of MRBMs, anti-ship ballistic missiles (ASBMs), and long-range GLCMs. Consequently, the PLARF enables the PLA to mitigate some of the weaknesses still existent in its other branches. This dynamic, combined with the PLARF's proven anti-satellite capability, illustrates the importance of the PLARF to the PLA's Local Wars concept.

Figure 1.1: List of China's Ballistic Missile Designations

Table 1 **China's Ballistic Missiles: Designations**

US designation	PLA service designation	Export designation	Missile type	Reported maximum range (km)	Fuel	Deployment
CSS-1 mod 1	DF-2	-	MRBM	1,050	Liquid	Transportable
CSS-1 mod 2	DF-2A	-	MRBM	1,250	Liquid	Transportable
CSS-2 mod 1	DF-3	-	IRBM	3,000	Liquid	Transportable
CSS-2 mod 2	DF-3A	-	IRBM	3,000	Liquid	Transportable
CSS-3	DF-4	-	ICBM	5,500	Liquid	Transportable
CSS-4 mod 1	DF-5	-	ICBM	12,000	Liquid	Silo
CSS-4 mod 2	DF-5A	-	ICBM	13,000	Liquid	Silo
CSS-4 mod 3	DF-5B	-	ICBM	13,000	Liquid	Silo
CSS-5 mod 1	DF-21	-	MRBM	1,750	Solid	Road-mobile
CSS-5 mod 2	DF-21A	-	MRBM	1,750	Solid	Road-mobile
CSS-5 mod 4	DF-21C	-	MRBM	1,750	Solid	Road-mobile
CSS-5 mod 5	DF-21D	-	MRBM	1,500	Solid	Road-mobile
CSS-6 mod 1	DF-15	M-9	SRBM	600	Solid	Road-mobile
CSS-6 mod 2	DF-15A	-	SRBM	850	Solid	Road-mobile
CSS-6 mod 3	DF-15B	-	SRBM	725	Solid	Road-mobile
CSS-7 mod 1	DF-11	M-11	SRBM	300	Solid	Road-mobile
CSS-7 mod 2	DF-11A	-	SRBM	600	Solid	Road-mobile
CSS-8	-	M-7	SRBM	150	Solid/Liquid	Road-mobile
CSS-9 mod 1	-	B-611	SRBM	150	Solid	Road-mobile
CSS-9 mod-X-2	-	B-611M	SRBM	260	Solid	Road-mobile
CSS-10 mod 1	DF-31	-	ICBM	7,000	Solid	Road-mobile
CSS-10 mod 2	DF-31A	-	ICBM	11,000	Solid	Road-mobile
CSS-11 mod 1	DF-16	-	MRBM	1,000	Solid	Road-mobile
CSS-X-12?	-	-	n.k.	n.k.	n.k.	n.k.
CSS-X-13?	-	-	n.k.	n.k.	n.k.	n.k.
CSS-14 mod-X-1	-	P-12	SRBM	150	Solid	Road-mobile
CSS-14 mod-X-2	-	BP-12A	SRBM	280	Solid	Road-mobile
CSS-X-15	-	M-20	SRBM	280	Solid	Road-mobile
CSS-X-16	-	SY400	SRBM	200	Solid	Road-mobile
CSS-X-17?	-	-	n.k.	n.k.	n.k.	n.k.
CSS-X-18?	-	-	n.k.	n.k.	n.k.	n.k.
CSS-X-19?	-	-	n.k.	n.k.	n.k.	n.k.
CSS-X-20	DF-41	-	ICBM	15,000	Solid	Road-mobile
*	DF-26	-	IRBM	3,500+	Solid	Road-mobile

*No CSS designation has been publicly associated with the new DF-26 IRBM
(Numbers -12, -13, -17, -18, -19 have not been associated with a known system in open-source press.)

Source: IISS, *China's ballistic missiles: more systems; improved designs,* 2016, p. 14.

Trends in Total Missile Forces

The trends in these developments – which have played out over the course of nearly three decades – are illustrated by shifts in the number of missile forces in the PLARF order of battle from 1985-2015. The data in **Figures 1.2, 1.4, and 1.5** are drawn from the IISS and show the historical trends in Second Artillery Personnel and missile strength.

- **Figure 1.2** provides detailed quantitative data on the SAF's order of battle since 1985.
- **Figures 1.2 to 1.5** compare both absolute and relative trends – absolute numbers alone do not indicate institutional change; it is necessary to tie changes in absolute numbers to changes in relative force structure.

- **Figure 1.3** depicts the number of missiles that China possesses in 2016 with data from IHS. This is contrasted with the IISS data that focuses on missile launcher numbers.
- **Figures 1.4 and 1.5** also demonstrate such a change between 1985 and 2015: the SAF's evolving force structure illustrates a shift from a medium-/intermediate-range nuclear force to a bifurcated force dually dedicated to conventional short-medium range missions and a nuclear force capable of medium-range and intercontinental strikes.
- **Figure 1.6** shows the range of China's missiles and how they affect its full range of operations – in Asia and in extending its sea-air extension of operations in the second island chain and in areas affecting the South China Sea.

These figures have some uncertainties, but they still provide several key indicators of China's shift from a medium-/intermediate-range nuclear force to a multi-mission force. The first such indicator is the diminishing number of missile launchers solely suited to nuclear missions. Even if an observer ignores the DF-21C/D and counts the DF-21 series as a nuclear-only class, the IISS estimates indicate that percentage of the PLARF's missile launcher strength suited only for nuclear missions drops from 100% in 1985 to slightly over 40% in 2012.

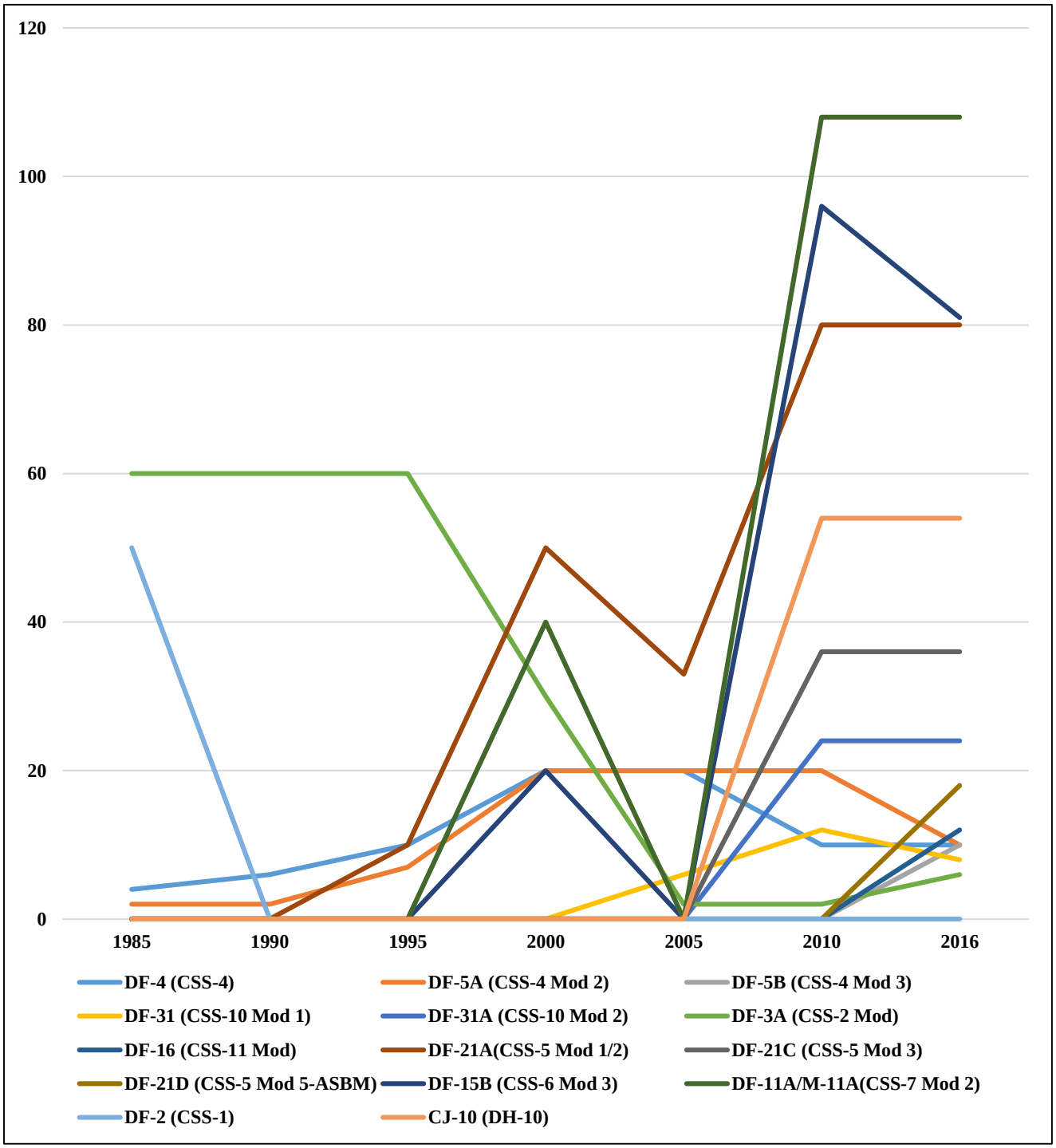
Roughly 80% of the current PLARF arsenal can conduct effective conventional missions and thus contribute to victory in non-nuclear Local Wars under Conditions of Informatization. As the Figures show, the reason for this significant change has been the introduction of precision or near-precision strike SRBMs and LACMs.

When SRBMs first appeared on the graph in 2000, the IISS estimates that they accounted for 30% of the PLARF's missile launchers; by 2015, SRBMs accounted for approximately 41%. This change is complemented by the introduction of cruise missiles: by 2010, LACMs accounted for roughly 11% of PLARF strength. These trends occur in contrast to the effective destruction of the PLARF's nuclear intermediate-range ballistic missile (IRBM) force. In 1985, the PLARF's nuclear IRBMs accounted for over 50% of the force; by 2015, the total was roughly 1.2%.

The second major indicator of a shift in PLARF doctrine and capability is the significant growth in the relative size of the ICBM arsenal. Not only does the ICBM force increase in relative size from 5% to 12%, but also much of the growth is due to modern DF-31 and DF-31A ICBMs. This trend may be an indication of a shifting priority from regional and Eurasian deterrence missions to intercontinental deterrence missions. Consequently, not only have the PLARF's equipment holdings revealed a shift from nuclear to nuclear and conventional missions, it is possible that the same equipment holdings also indicate a shift in the priority of nuclear deterrence missions.

The third indicator is the change in the geographic range of the force. In 1985, 100%[34] of the PLARF's missile force could reach the critical US base on Guam, located in the second island chain.[35] In 2012, the composition of the PLARF is such that only roughly 15% of the PLARF's capabilities can hit the US base on Guam. This change indicates a significant shift in priorities from the second island chain and beyond to China's immediate periphery. Such a shift is fully in line with the Local Wars concept.

Figure 1.2: Historical Quantitative Data on the PLARF Missile Launcher Capabilities- Part I



Source: IISS, *Military Balance* 1985-2016, adapted by Anthony H. Cordesman and Joseph Kendall at the Center for Strategic and International Studies.

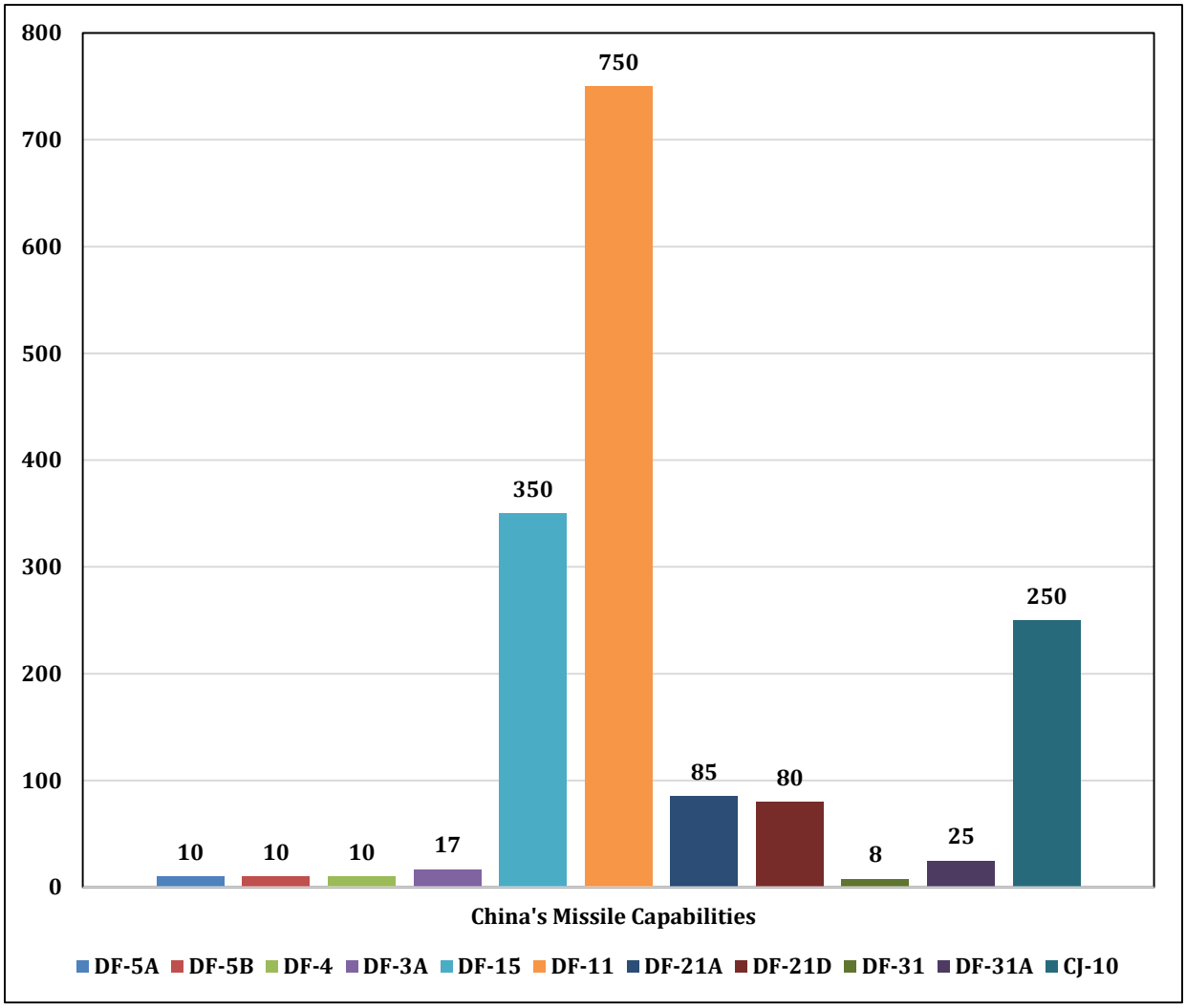
Note: All IISS numbers regarding missiles refer only to launchers not the number of missiles themselves.

Figure 1.2: Historical Quantitative Data on the PLARF Missile Launcher Capabilities - Part II

		1985	1990	1995	2000	2005	2010	2016
ICBM	**DF-4 (CSS-4)**	4	6	10+	20+	20	10	10
	DF-5A (CSS-4 Mod 2)	2	2	7	20+	20	20	10
	DF-5B (CSS-4 Mod 3)	0	0	0	0	0	0	10
	DF-31 (CSS-10 Mod 1)	0	0	0	0	6	12	8
	DF-31A (CSS-10 Mod 2)	0	0	0	0	0	24	24
IRBM	**DF-3A (CSS-2 Mod)**	60	60	60+	30+	2	2	6
MRBM	**DF-16 (CSS-11 Mod)**	0	0	0	0	0	0	12
	DF-21A (CSS-5 Mod 1/2)	0	0	10	50+	33	80	80
	DF-21C (CSS-5 Mod 3)	0	0	0	0	0	36	36
	DF-21D (CSS-5 Mod 5-ASBM)	0	0	0	0	0	0	18
SRBM	**DF-15B (CSS-6 Mod 3)**	0	Some	Some	20	Some	96	81
	DF-11A/M-11A (CSS-7 Mod 2)	0	Some	Some	40	Some	108	108
	DF-2 (CSS-1)	50	0	0	0	0	0	0
LACM	**CJ-10 (DH-10)**	0	0	0	0	0	54	54

Source: IISS, *Military Balance* 1985-2016, adapted by Anthony H. Cordesman and Joseph Kendall at the Center for Strategic and International Studies.

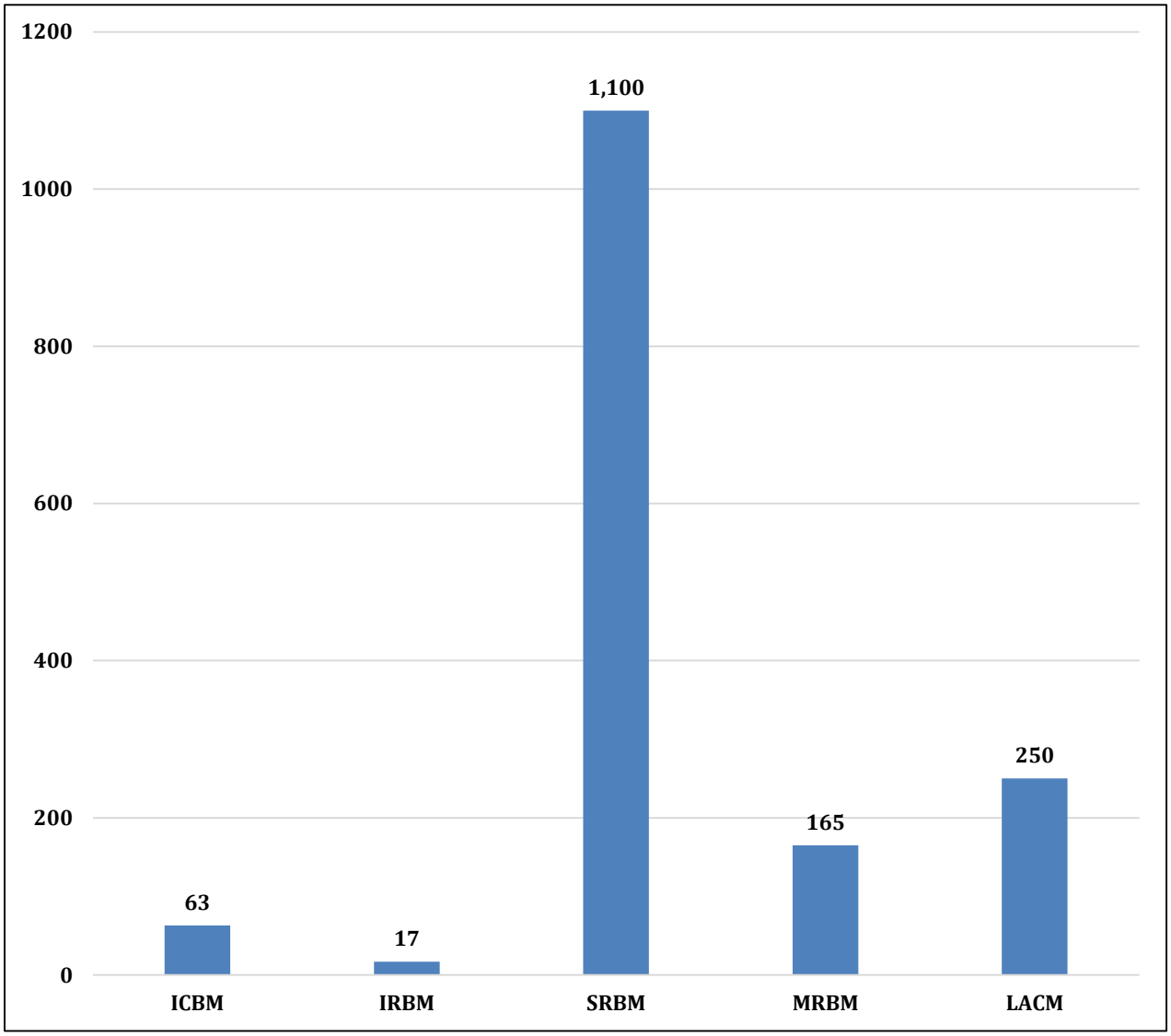
Figure 1.3: China's 2016 Missile Capabilities



Source: "China Strategic Weapons Systems", *Jane's Sentinel Security Assessment*, March 3, 2016.

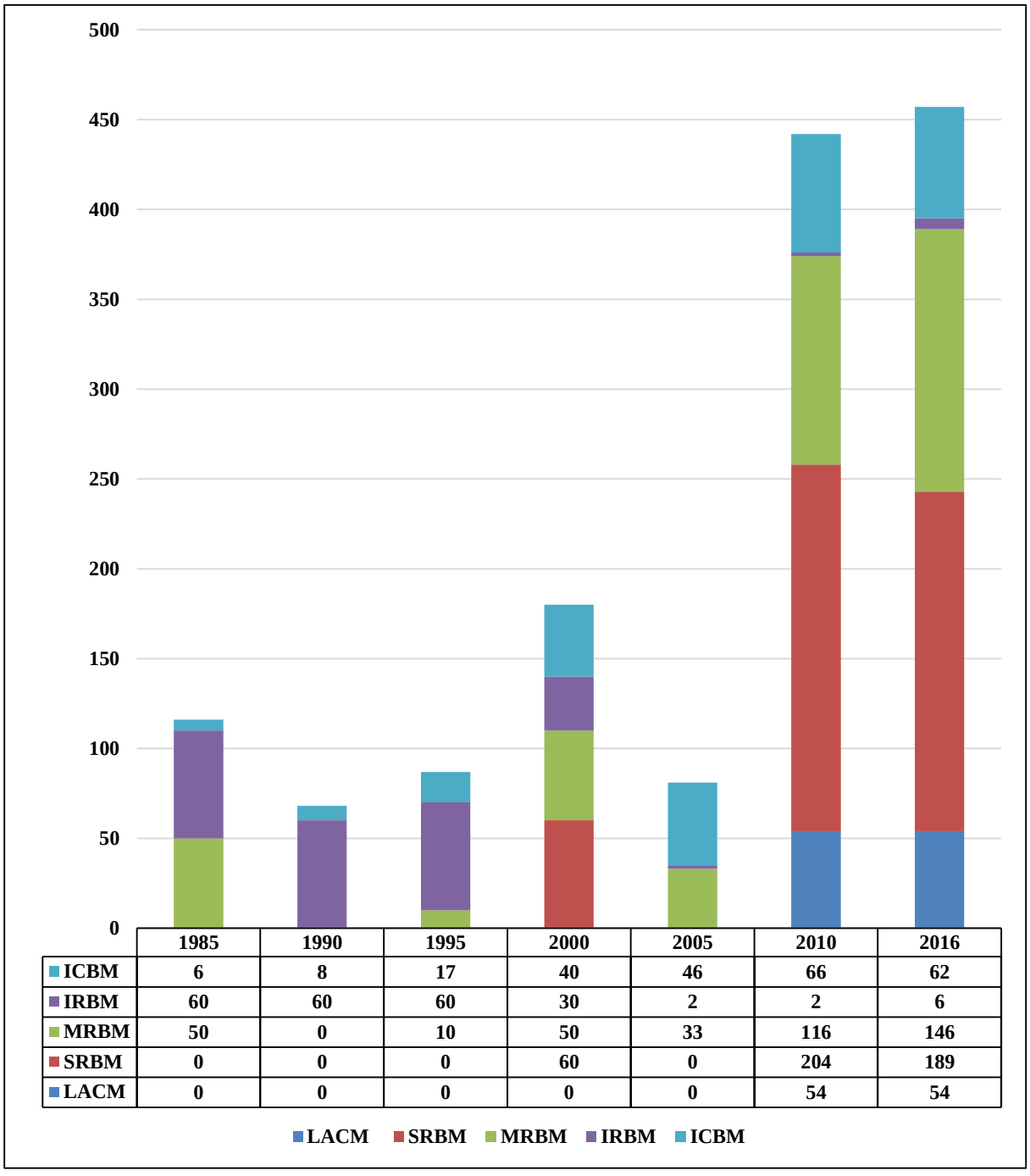
Note: Missile range estimates were averaged for the purpose of visual clarity.

Figure 1.3: China's 2016 Missile Capabilities by Classification-Part II



Source: "China Strategic Weapons Systems", *Jane's Sentinel Security Assessment*, March 3, 2016

Figure 1.4: Historical Size and Composition of the PLARF Launcher Arsenal

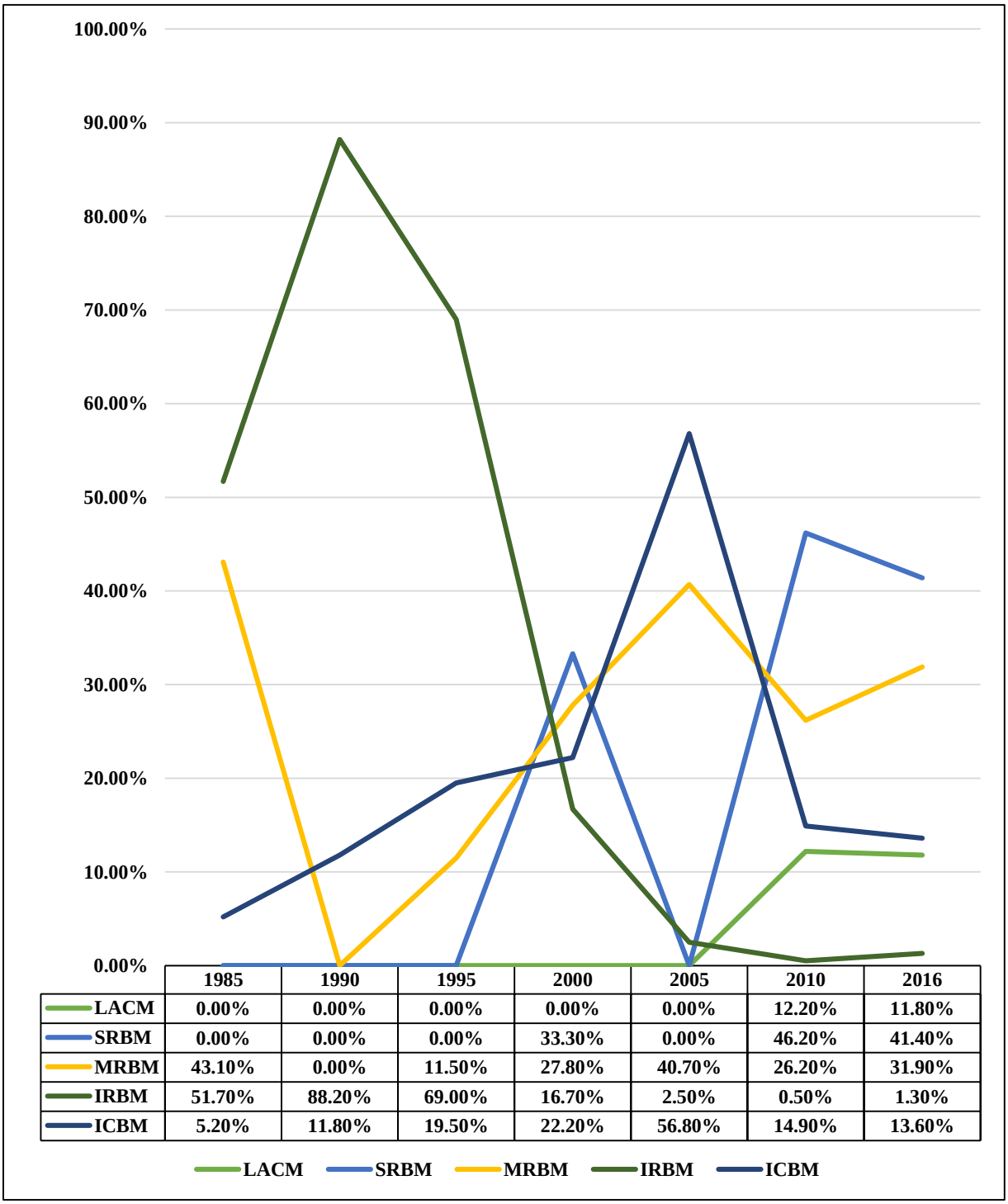


	1985	1990	1995	2000	2005	2010	2016
ICBM	6	8	17	40	46	66	62
IRBM	60	60	60	30	2	2	6
MRBM	50	0	10	50	33	116	146
SRBM	0	0	0	60	0	204	189
LACM	0	0	0	0	0	54	54

Note: IISS lists total SRBM missile launcher numbers, not SRBM missile launchers for 2005. Consequently, while it is possible to estimate the number of launchers, such estimates are very rough given uncertainty regarding missile-to-launcher ratios and the uneven distribution of both types of equipment to missile forces. Consequently, the authors have chosen to leave to leave the field for 2005 SRBM numbers blank, but it should be kept in mind that there was a sustained increase in SRBM launcher numbers between 2000 and 2010.

Source: IISS, *Military Balance* 1985-2016, adapted by Anthony H. Cordesman and Joseph Kendall at the Center for Strategic and International Studies.

Figure 1.5: The PLARF's Changing Force Structure, 1985-2016 (Percent)

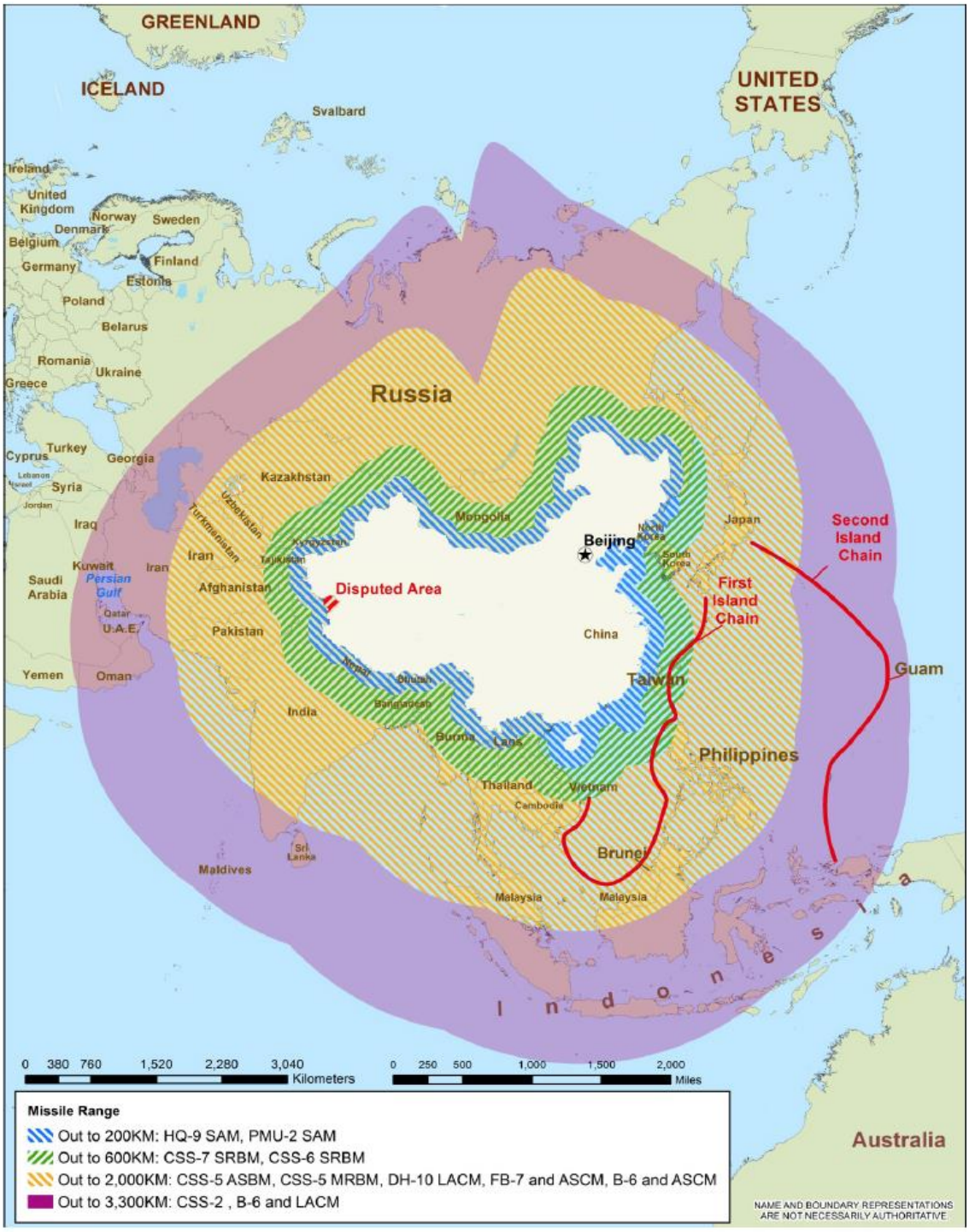


	1985	1990	1995	2000	2005	2010	2016
LACM	0.00%	0.00%	0.00%	0.00%	0.00%	12.20%	11.80%
SRBM	0.00%	0.00%	0.00%	33.30%	0.00%	46.20%	41.40%
MRBM	43.10%	0.00%	11.50%	27.80%	40.70%	26.20%	31.90%
IRBM	51.70%	88.20%	69.00%	16.70%	2.50%	0.50%	1.30%
ICBM	5.20%	11.80%	19.50%	22.20%	56.80%	14.90%	13.60%

Note: Due to rounding, numbers may not add up to 100.

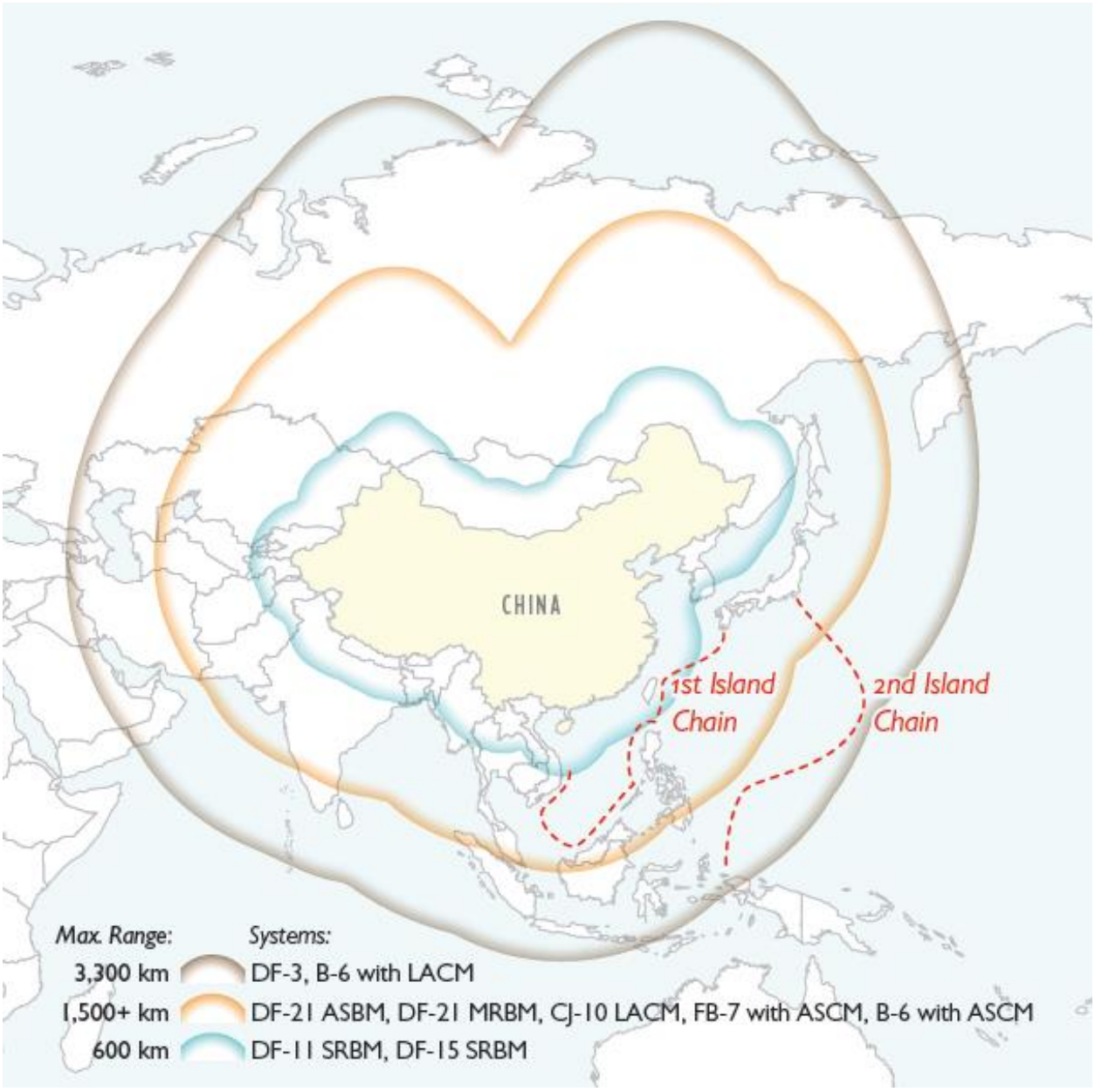
Source: IISS, *Military Balance* 1985-2016, adapted by Anthony H. Cordesman and Joseph Kendall at the Center for Strategic and International Studies.

Figure 1.6: The Expanding Range of China's Theater Missile Forces – Part I



Source: DoD, *Report to Congress on Military and Security Developments Involving the People's Republic of China 2014*, April 2014, 85.

Figure 1.6: The Expanding Range of China's Theater Missile Forces – Part II



Note: the PLA's conventional forces are currently capable of striking targets well beyond China's immediate periphery (counter-intervention capability). Not included are ranges for naval surface- and sub-surface-based weapons, whose employment distances from China would be determined by doctrine and the scenario in which they are employed.

Source: DoD, *Report to Congress on Military and Security Developments Involving the People's Republic of China 2013*, May 2012, 42.

Figures 1.2, 1.4, **and 1.5** rely on missile launcher statistics provided by the IISS. However, the arsenal of actual missiles, not just missile launchers, also has important implications for the

PLARF's force structure and these are shown in **Figure 1.3**. The number of missiles per missile launcher indicates military planning, operational concepts, and PLARF progress towards its stated goals. Using DoD-reported data through 2012 – the subsequent reports did not include any updates – it is possible to analyze the PLARF's missile holdings.

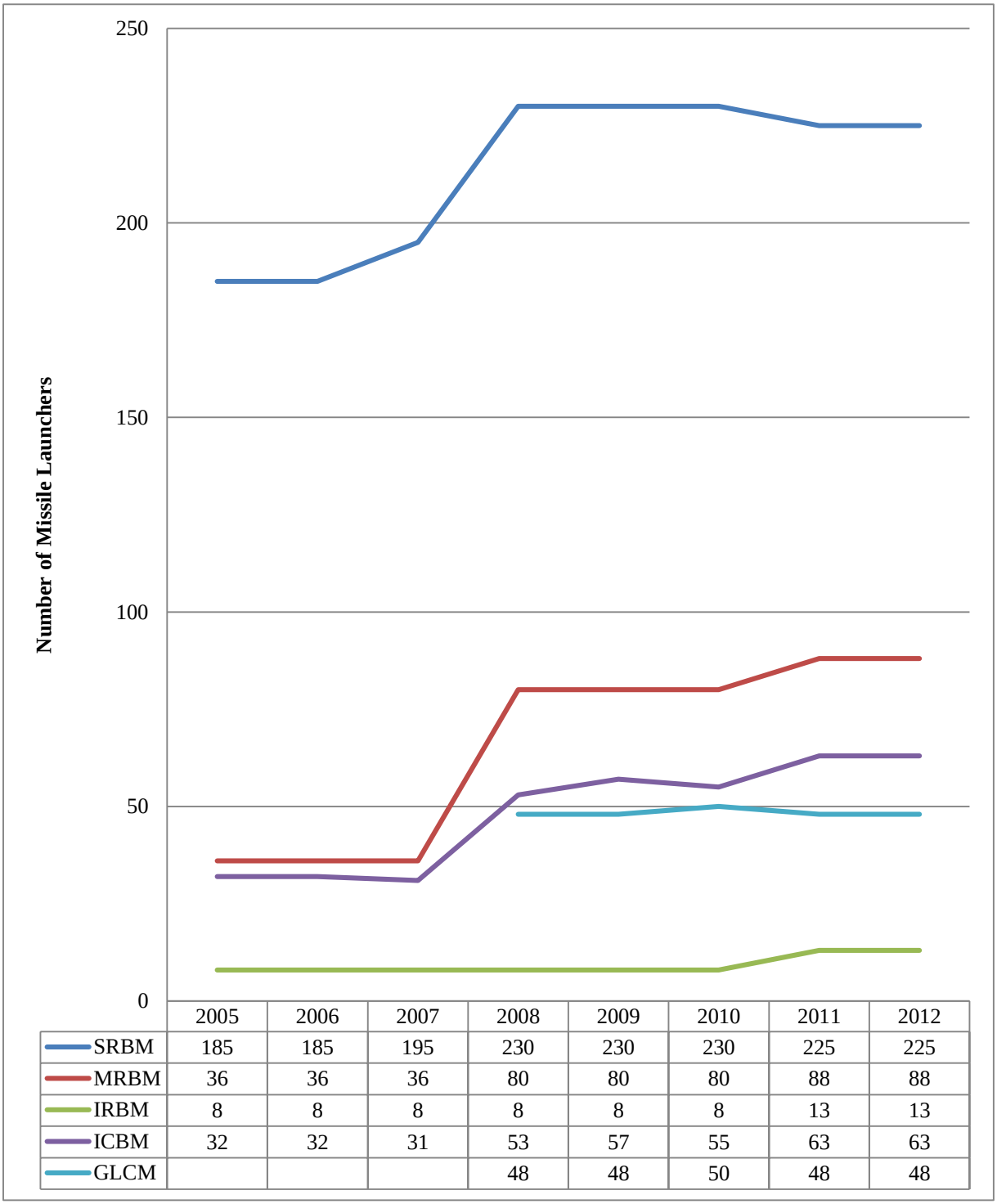
Figures 1.7 and 1.8 have significant implications.

- **Figure 1.7** shows DoD-reported numbers for year-on-year growth in PLARF missile launchers.
- **Figure 1.8** shows DoD-reported PLARF missile strength from 2002 onwards, on a year-on-year basis.

These figures show that, unlike other missile categories, the SRBM and LACM launchers are assigned a relatively large number of missiles per launcher. Moreover, trend lines indicate growing gaps between missile and missile launcher numbers leading to larger and larger reserve stockpiles of SRBMs and LACMs. This may indicate that the PLARF plans to fire repeated salvos of SRBMs and LACMs during hypothetical contingencies.

Unlike the PLARF's inventory of medium- and longer-range missiles, potential adversaries could face multiple salvos per SRBM or GLCM launcher, possibly in a counter-air role as has been proposed by RAND.[36] Such a capability falls perfectly in line with the conventional requirements of Local Warfare under Conditions of Informatization and, when supplemented by an increasingly secure nuclear second-strike capacity, provide the PLA with critical capabilities necessary for fighting and winning Local Wars while deterring further escalation.

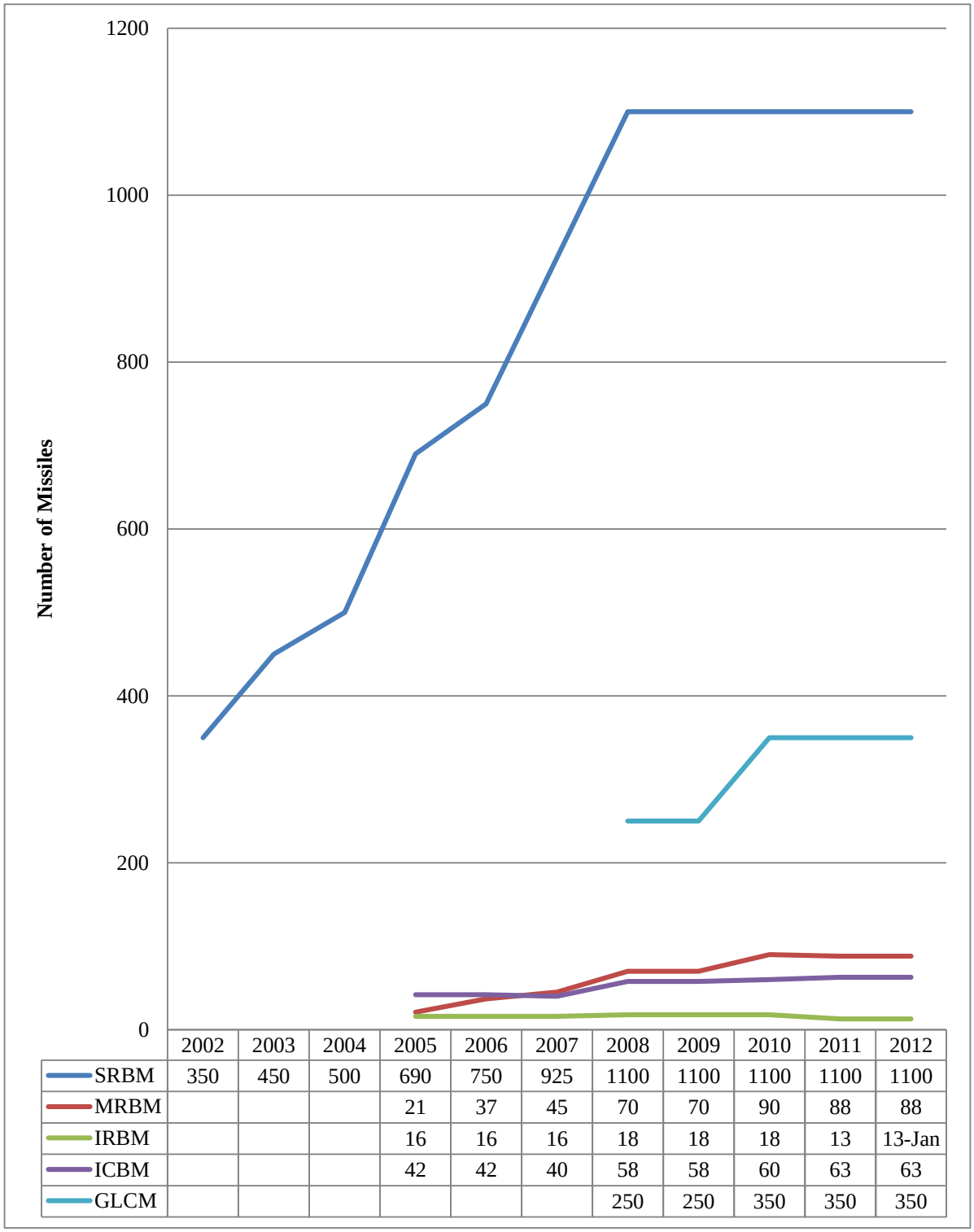
Figure 1.7: Year-on-Year Missile Launcher Strength, 2005-2012



	2005	2006	2007	2008	2009	2010	2011	2012
SRBM	185	185	195	230	230	230	225	225
MRBM	36	36	36	80	80	80	88	88
IRBM	8	8	8	8	8	8	13	13
ICBM	32	32	31	53	57	55	63	63
GLCM				48	48	50	48	48

Source: DOD, *Military Power of the People's Republic of China* 2005-2008; *Military and Security Developments Involving the People's Republic of China* 2009-2012.

Figure 1.8: Year-on-Year Missile Inventory, 2005-2012



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SRBM	350	450	500	690	750	925	1100	1100	1100	1100	1100
MRBM				21	37	45	70	70	90	88	88
IRBM				16	16	16	18	18	18	13	13-Jan
ICBM				42	42	40	58	58	60	63	63
GLCM							250	250	350	350	350

Source: DOD, *Military Power of the People's Republic of China* 2005-2008; *Military and Security Developments Involving the People's Republic of China* 2009-2012.

Shifts in Equipment Composition

As noted earlier, the trends in **Figure 1.4** reflect several important trends in the modernization of the PLARF. Since 1985, in line with the PLA concept of winning Local Wars under Conditions of Informatization, the PLARF has reduced its relative holdings of non-mobile, liquid-fueled missiles with nuclear warheads and shifted to a force structure heavily comprised of mobile, solid-fueled conventional missile systems.

SRBMs

It is important to note that China is scarcely the only power deploying SRBMs. A US National Air and Space Intelligence Center estimate of regional balance in short-range ballistic missile forces is shown in **Figure 1.9**. It shows that many other powers have such systems, and these figures do not include US capability to launch cruise missiles and South Korea's decision to acquire SRBMs. The NASIC summarizes key regional trends as follows:[37]

> Several countries are now producing and/or developing SRBM systems, while many other countries have purchased missiles or missile technologies from one or more of the missile producers.
>
> The Russian SS-1C Mod 1, also called the SCUD B, has been exported to more countries than any other type of guided ballistic missile, and has proven to be a versatile and adaptable weapon.
>
> For example, North Korea has produced its own version of the SCUD B and the SCUD C, which is an extended-range version of the SCUD B. Although the SCUD was originally designed as a tactical battlefield support weapon, many countries view it and other SRBM systems as strategic weapons to be used against urban areas.
>
> … Other countries could modify SCUD missiles to significantly improve their accuracy and use them against high-value military targets and cities.
>
> New SRBM systems are in development in several countries. China has deployed a very large force of modern solid-propellant SRBMs in the vicinity of Taiwan, and according to Taiwanese government officials, China has recently started to deploy a new SRBM known as the Dong Feng 16 (DF-16/CSS-11 Mod 1).

Since 1985, the PLARF has steadily increased the number of Short-Range Ballistic Missiles (SRBMs) in its arsenal. All are mobile and solid-fueled, enabling the PLARF to conduct rapid strikes against regional threats while limiting the risk of preemption. What is striking about China's SRBM capabilities is the massive proliferation in recent years. In the mid-1990s, China possessed somewhere between 30-50 SRBMs, they current have around 1,100-1,200. Moreover, in line with the Local Wars concept, the PLARF has increased the range of its SRBMs to improve their regional utility, created numerous variants for different purposes, and improved their accuracy.

On this last point, the 2011 DoD report stated, "The PLA continues to field advanced variants with improved ranges and more sophisticated payloads that are gradually replacing earlier generations that do not possess true precision strike capability."[38] The 2013 DoD on Chinese military power report noted that, "the PLA is also introducing new SRBM variants with improved ranges, accuracies, and payloads."[39]

Figures 1.10 and 1.11 showed the rise in SRBM strength as well as a plateau and later a slight decrease in SRBM missile launcher numbers. However, this drop in force numbers does not necessarily indicate a drop in SRBM combat power. As the 2015 DoD Report stated:[40]

> The Second Artillery Force had more than 1,200 SRBMs at the end of 2014. The Second Artillery Force continues to field advanced variants with improved ranges and accuracy in addition to more sophisticated payloads, while gradually replacing earlier generations that do not possess true precision strike capability.

The DoD has since confirmed what has been reported throughout the decade in open-source literature: the PLARF is creating new variants of both its DF-11 and DF-15 SRBMs that have improved range and, most importantly, significantly improved circular error probability (CEP). Consequently, a reduction in overall force numbers, if the result of a reduction in older SRBMs that are concurrently being replaced with fewer – but newer – models, will most likely result in an overall increase in PLARF SRBM combat power.

A RAND report released in 2009 illustrates this point effectively. Comparing open-source information on various PLARF SRBM classes and their variants, the report estimated the number of SRBMs needed to completely, albeit temporarily, neutralize the Republic of China (ROC or Taiwanese) Air Force. The report drew two conclusions: first, older, less accurate SRBMs had very little conventional utility in precision-strike operations. Second, newer SRBMs with significantly improved CEPs are capable of achieving ambitious operational objectives with a much smaller quantity of SRBMs than earlier variants of the same class. **Figures 1.10 and 1.11** illustrate these developments.

- **Figure 1.10** is a graph that shows open-source data collected and used by RAND to estimate the parameters of the PLARF's SRBM capability.
- **Figure 1.11** uses that data to compute the number of SRBMs necessary to achieve a given probability of neutralizing a single runway.

As these Figures show, the replacement of newer SRBMs with precision strike capabilities has a significant impact on the combat utility of each individual SRBM. For example, the replacement of a DF-15 with a DF-15A, according to the RAND data, would augment the PLARF's combat power by 500% – in other words, it would take 5 DF-15s to achieve the same kill probability as a single DF-15A. Consequently, replacing older SRBMs with newer ones, even if not on a one-to-one basis, will significantly augment the PLARF's SRBM-based combat power. Thus, while the growth in SRBM numbers indicates growth in the PLARF's SRBM capacity, the converse is not automatically true – a reduction in SRBM numbers may simply reflect the impact of missile modernization and represent an increase in overall capability.

Figure 1.9: NASIC Estimate of the Regional Balance of Short-range Ballistic Missiles (SRBMs)

MISSILE	PROPELLANT	DEPLOYMENT MODE	MAXIMUM RANGE (km)	Number of Launchers (By Country)*
RUSSIA				Fewer than 200
SCUD B (SS-1c Mod 1)	Liquid	Road-mobile	300	
SS-1c Mod 2	Liquid	Road-mobile	240+	
SS-21 Mod 2	Solid	Road-mobile	70	
SS-21 Mod 3	Solid	Road-mobile	120	
SS-26	Solid	Road-mobile	300	
Iskander-E	Solid	Road-mobile	280	
CHINA				More than 200
CSS-11 Mod 1	Solid	Road-mobile	800+	
CSS-6 Mod 1	Solid	Road-mobile	600	
CSS-6 Mod 2	Solid	Road-mobile	850+	
CSS-6 Mod 3	Solid	Road-mobile	725+	
CSS-7 Mod 1	Solid	Road-mobile	300	
CSS-7 Mod 2	Solid	Road-mobile	600	
CSS-8	Solid/Liquid	Road-mobile	150	
CSS-9 Mod 1	Solid	Road-mobile	150	
CSS-9 Mod-X-2	Solid	Road-mobile	260	
CSS-14 Mod-X-1	Solid	Road-mobile	150	
CSS-14 Mod-X-2	Solid	Road-mobile	280	
CSS-X-16	Solid	Road-mobile	200	
CSS-X-15	Solid	Road-mobile	280	
NORTH KOREA				Fewer than100
SCUD B	Liquid	Road-mobile	300	
SCUD C	Liquid	Road-mobile	500	
Toksa	Solid	Road-mobile	120	
ER SCUD	Liquid	Road-mobile	700-995	
INDIA				Fewer than 75
Prithvi I	Liquid	Road-mobile	150	
Prithvi II	Liquid	Road-mobile	250	
Dhanush	Liquid	Ship-based	400	
Agni I	Solid	Road-mobile	700	
PAKISTAN				Fewer than 50
Hatf-9	Solid	Road-mobile	60	
Hatf-1	Solid	Road-mobile	50	
Shaheen I	Solid	Road-mobile	750	
Ghaznavi	Solid	Road-mobile	250	
IRAN				Fewer than100
Fateh-110	Solid	Road-mobile	200-300	
Shahab 1	Liquid	Road-mobile	300	
Shahab 2	Liquid	Road-mobile	500	
CSS-8 (M-7)	Solid/Liquid	Road-mobile	150	
Qiam -1	Liquid	Road-mobile	unknown	
SYRIA				Fewer than100
SCUD D	Liquid	Road-mobile	700	

Note: All ranges are approximate.
* The missile inventory may be larger than the number of launchers; launchers can be reused to fire additional missiles

Source US National Air and Space Intelligence Center, Defense Intelligence Agency Missile and Space Intelligence Center and Office of Naval Intelligence, *Ballistic & Cruise Missile Threat*, NASIC, May 2013, 11-13.

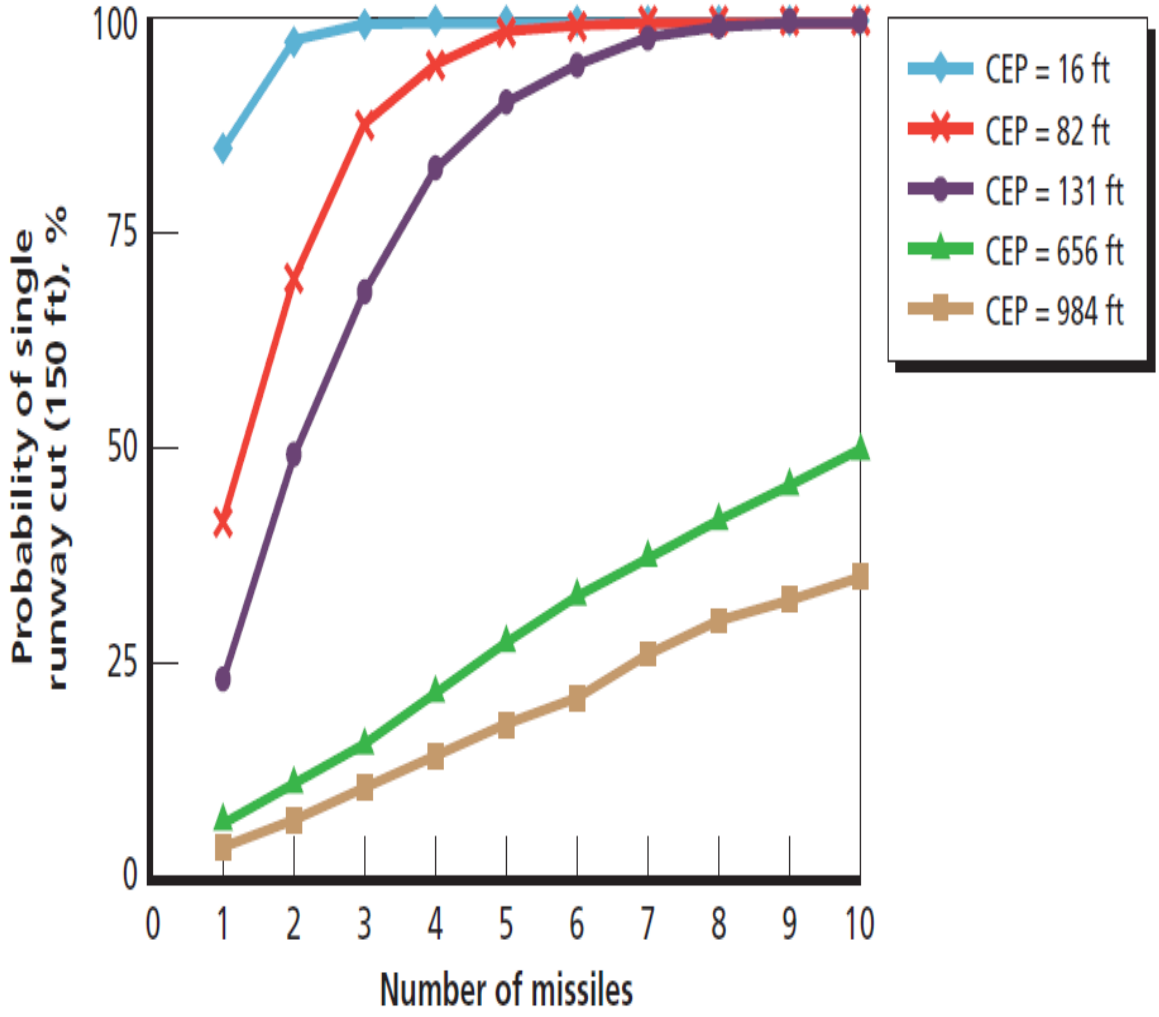
Figure 1.10: RAND Data on PRC SRBMs and the "Notional SRBM" Model (2009)

Characteristics of CSS-7, CSS-6, and Notional SRBM

	CSS-7		CSS-6			Notional
Characteristic	DF-11	DF-11A	DF-15	DF-15A	DF-15B	SRBM
Range (km)	280–350	350–530	600	600	600	>280
Warhead (kg)	800	500	500	600	600	500
CEP (m)	600	20–30; 600 for oldest version	300	30–45	5	5, 25, 40, 200, 300
Number of missiles	675–715			315–355		900
Number of launchers	120–140			90–110		200

Source: Shlapak, et al, *A Question of Balance: Political Context and Military Aspects of the China-Taiwan Dispute*, RAND, 2009, 34, http://www.rand.org/pubs/monographs/MG888.html.

Figure 1.11: SRBMs Needed to Obtain Given Probabilities of Neutralizing a Single Runway



Source: Shlapak, et al, *A Question of Balance: Political Context and Military Aspects of the China-Taiwan Dispute*, RAND, 2009, 41, http://www.rand.org/pubs/monographs/MG888.html.

Cruise Missiles

Cruise missiles often do not receive the same attention as ballistic missiles but they serve as both a method of delivering nuclear weapons and can provide precision strikes with conventional weapons. As such, they are as important – if not more important in terms of probable use and the ability to conduct lethal attacks – than most SRBMs and MRBMs without high-yield nuclear weapons.

The US National Air and Space Intelligence Center estimate of the regional balance in short-range ballistic missile forces is shown in **Figure 1.12**. *It should be stressed that this assessment does not include sea-launched or air-launched cruise missiles, which sharply understate the well-proven capabilities of US forces and the potential threat perceived by China.*

The NASIC summarizes key regional trends as follows:[41]

> Unlike ballistic missiles, cruise missiles are usually categorized by intended mission and launch mode (instead of maximum range). The two broadest categories are LACMs and antiship cruise missiles. Each type can be launched from an aircraft, ship, submarine, or ground-based launcher.
>
> A LACM is an unmanned, armed aerial vehicle designed to attack a fixed or mobile ground-based target. It spends the majority of its mission in level flight, as it follows a preprogrammed path to a predetermined target. Propulsion is usually provided by a small jet engine.
>
> Because of highly accurate guidance systems that can place the missile within a few feet of the intended target, the most advanced LACMs can be used effectively against very small targets, even when armed with conventional warheads. LACM guidance usually occurs in three phases: launch, midcourse, and terminal.
>
> During the launch phase, a missile is guided using only the inertial navigation system. In the midcourse phase, a missile is guided by the inertial navigation system updated by one or more of the following systems: a radar-based terrain contour matching system, a radar or optical scene matching system, and/or a satellite navigation system such as the US Global Positioning System or the Russian Global Navigation Satellite System. The terminal guidance phase begins when a missile enters the target area and uses either more accurate scene matching or a terminal seeker (usually an optical or radar-based sensor).
>
> Defending against LACMs will stress air defense systems. Cruise missiles can fly at low altitudes to stay below enemy radar and, in some cases, hide behind terrain features. Newer missiles are incorporating stealth features to make them even less visible to radars and infrared detectors. Modern cruise missiles also can be programmed to approach and attack a target in the most efficient manner. For example, multiple missiles can attack a target simultaneously from different directions, overwhelming air defenses at their weakest points. Furthermore, LACMs may fly circuitous routes to get to the target, thereby avoiding radar and air defense installations.
>
> Some developmental systems may incorporate chaff or decoys as an added layer of protection, though concealment will remain a cruise missile's main defense. The cruise missile threat to US forces will increase over the next decade. At least nine foreign countries will be involved in LACM production during the next decade, and several LACM producers will make their missiles available for export.
>
> The success of US Tomahawk cruise missiles has heightened interest in cruise missile acquisition in many countries. Many cruise missiles available for purchase will have the potential to perform precision-strike missions. Many of these missiles will have similar features: a modular design, allowing them to be manufactured with a choice of navigational suites and conventional warhead options; the incorporation of stealth technology; the ability to be launched from fighter-size aircraft; and the capability to fly high-subsonic, low-altitude, terrain-following flight profiles.
>
> The cruise missile threat to US forces will continue to increase. At least nine foreign countries will be involved in LACM production during the next decade, and several of the LACM producers will make their missiles available for export.
>
> The CJ-10 (DH-10) is the first of the Chinese Changjian series of long-range missiles and LACMs. It made its public debut during a military parade in 2009 and is currently deployed with the Second Artillery Corps.
>
> Iran recently announced the development of the 2,000-km range Meshkat cruise missile, with plans to deploy the system on air-, land-, and sea-based platforms.
>
> The Club-K cruise missile "container launcher" weapons system, produced and marketed by a Russian firm, looks like a standard shipping container. The company claims the system can launch cruise missiles from cargo ships, trains, or commercial trucks.
>
> The first flight test of the Brahmos, jointly developed by India and Russia, took place in June 2001. India plans to install Brahmos on a number of platforms, including destroyers, frigates, submarines, maritime patrol aircraft, and fighters. Russia and India are also working on a follow-up missile, the Brahmos 2, which was flight-tested in 2012. Pakistan continues to develop the Babur (Hatf-VII) and the air-launched Ra'ad (Hatf-VIII). Each missile was flight tested in 2012.

The Japanese 2014 defense white paper made only a short statement regarding Chinese SRBMs:[42]

> Concerning SRBM, China possesses a large number of solid-propellant DF-15 and DF-11, and they are believed to be deployed facing Taiwan. It is believed that their ranges cover also a part of the Southwestern Islands including the Senkaku Islands, which are inherent territories of Japan.

While Chinese and other cruise missiles achieve considerable attention in non–governmental reporting, their importance is badly understated in the official reporting – which is the focus of this report. Also, there is no matching literature on the balance in air and sea-launched cruise missiles. Cruise missiles need far more attention in official reports, dialogue, and arms control negotiations, and cannot meaningfully be separated from the balance of ballistic missiles.

A 2014 publication by the National Defense University's Center for the Study of Chinese Military Affairs focuses on Chinese cruise missile development and direction and is a step towards greater attention and understanding of this underreported aspect of the PLA. Cruise missiles and their development apparatuses have long been a part of the PLA's and even received protection during the upheaval of the Cultural Revolution.

Today, China has made striking progress in developing and fielding high-end cruise missiles, both anti-ship (ASCM) and land attack (LACM). Chinese cruise missile doctrine appears to emphasize a scenario that involves Taiwan-based targets and the prevention of US intervention.[43] Accordingly, extensive studies have been made in order to determine how best to penetrate missile defenses and deter carrier groups from approaching the battlefield.[44]

Indeed, cruise missiles form a vital part of China's A2/AD concept and present a serious threat to any force that engages the PLA in battle. The PLA has a wide variety of cruise missiles that can be launched from land, air, sea, and sub-surface platforms. China envisions using multi-axis missile salvos containing SRBMs, LACMS, and other applicable missile capabilities to penetrate missile defenses and incur substantial damage during a Local War situation. Thanks to help from Russian technicians and an increasingly skilled indigenous R&D sector, Chinese cruise missiles can conceivably strike targets thousands of kilometers away. Potential ASCM targets include aircraft carriers, AEGIS-equipped destroyers and potential LACM targets include Taiwan and American bases in the Asia-Pacific as far as Guam.[45]

While these modern cruise missiles are rendering older missiles obsolete, these older missiles may still have use in exhausting anti-cruise missile defenses through large saturation attacks carried out in conjunction with modern missiles. Saturation attacks with modern cruise missiles are not out of the question either. Despite Chinese concerns about whether or not their missiles can penetrate American missile defenses, there exists a clear cost-efficiency advantage for the attacker; missile defense is extremely difficult and costly compared to missile attack. In short, quantity may have a quality all its own.[46] But unlike the PLA of old, which could only field a handful of modern systems with large numbers of older systems, the PLA is building a cruise missile force that can contain large numbers of both modern and older systems.

What is even more striking is the apparent neglect that the US has had in publically discussing its own cruise missile development, particularly ASCM's.[47] Some Flight IIA *Arleigh Burke* class destroyers are not equipped with Harpoon missiles, the sole American ASCM which was developed in the 1960's and entered service in the 1970's.[48] Although the LRASM is being developed by DARPA to rectify this issue, it is still in a development stage.

Figure 1.12: NASIC Estimate of the Regional Balance of Land Attack Cruise Missiles

MISSILE	LAUNCH MODE	WARHEAD TYPE	RANGE (km)	IOC
CHINA				
YJ-63	Air	Conventional	Undetermined	Undetermined
DH-10	Undetermined	Conventional or nuclear	Undetermined	Undetermined
FRANCE				
APACHE-AP	Air	Submunitions	100+	2002
SCALP-EG	Air and ship	Penetrator	250+	2003
Naval SCALP	Sub and surface ship	Penetrator	250+	2013+
UAE				
BLACK SHAHEEN*	Air	Penetrator	250+	2006
GERMANY, SWEDEN, SPAIN				
KEPD-350	Air	Penetrator	350+	2004
INDIA, RUSSIA				
Brahmos 1	Air, ground, ship, and sub	Conventional	less than 300	2010+
Brahmos 2	Air, ground, ship, and sub	Conventional	less than 300	2013+
ISRAEL				
Popeye Turbo	Air	Conventional	300+	2002
PAKISTAN				
RA'AD	Air	Conventional or nuclear	350	Undetermined
Babur	Ground	Conventional or nuclear	350	Undetermined
RUSSIA				
AS-4	Air	Conventional or nuclear	300+	Operational
AS-15	Air	Nuclear	2,800+	Operational
SS-N-21		Nuclear	12,800+	Operational
Kh-555	Air	Conventional	Undetermined	Undetermined
Kh-101	Air	Conventional	Undetermined	2013
3M-14E	Ground, ship, and sub	Conventional	275	Undetermined
SOUTH AFRICA				
MUPSOW	Air and ground	Conventional	150	2002
Torgos	Air and ground	Conventional	300	Undetermined
TAIWAN				
Wan Chien	Air	Conventional	250+	2006
HF-2E	Ground	Conventional	Undetermined	Undetermined
UNITED KINGDOM				
Storm Shadow	Air	Penetrator	250+	2003
IRAN				
Meshkat	Air, ground, and ship	Conventional	Undetermined	Undetermined

Note: All ranges are approximate and represent the range of the missile only. The effective system range may be greatly increased by the range of the launch platform.

*The BLACK SHAHEEN is an export version of the SCALP-EG.

Source US National Air and Space Intelligence Center, Defense Intelligence Agency Missile and Space Intelligence Center and Office of Naval Intelligence, *Ballistic & Cruise Missile Threat*, NASIC, May 2013, 11-13.

MRBMs

A US National Air and Space Intelligence Center estimate of the regional balance in MRBMs and IRBMs is shown in **Figure 1.13**. It again illustrates a broad set of trends in the regional balance that both affects and is affected by China, and once again, these figures do not include US capability to launch cruise missiles. The NASIC summarizes key regional trends as follows:[49]

> New MRBM and/or IRBM systems are in development in China, North Korea, Iran, India, and Pakistan. These are strategic systems, and many will be armed with nonconventional warheads. All of these countries… have tested nuclear weapons. Neither Russia nor the United States produce or retain any MRBM or IRBM systems because they are banned by the Intermediate-Range Nuclear Forces Treaty, which entered into force in 1988.
>
> China continues to maintain regional nuclear deterrence, and its long-term, comprehensive military modernization is improving the capability of its ballistic missile force to conduct high-intensity, regional military operations, including "anti-access and area denial" (A2/AD) operations.
>
> The term A2/AD refers to capabilities designed to deter or counter adversary forces from deploying to or operating within a defined space. Currently, China deploys the nuclear armed CSS-2, CSS-5 Mod 1, and CSS-5 Mod 2 for regional nuclear deterrence. China is also acquiring new conventionally armed CSS-5 MRBMs to conduct precision strikes. These systems are likely intended to hold at-risk or strike logistics nodes, regional military bases including airfields and ports, and naval assets.
>
> Notably, China has likely started to deploy the DF-21D, an ASBM based on a variant of the CSS-5. North Korea has an ambitious ballistic missile development program and has exported missiles and missile technology to other countries, including Iran and Pakistan. North Korea has also admitted its possession of nuclear weapons. It has displayed new IRBMs and older No Dong MRBMs in recent military parades.
>
> … India continues to develop and improve its ballistic missiles. All of India's long-range missiles use solid propellants. Indian officials have stated that the Agni II MRBM is deployed. The Agni III IRBM has been flight tested four times since 2006, and has been pronounced ready for deployment. The Agni IV IRBM has been flight tested twice since 2010, with the 2011 launch successful.
>
> Pakistan continues to improve the readiness and capabilities of its Army Strategic Force Command and individual strategic missile groups through training exercises that include live missile firings. Pakistan has tested its solid-propellant Shaheen 2 MRBM six times since 2004, and this missile system probably will soon be deployed.

The 2014 Japanese defense white paper summarized these developments as follows:[50]

> As for the IRBM/MRBM covering the Asia-Pacific region including Japan, China has deployed the solid-propellant DF-21, which can be transported and operated on a TEL, in addition to the liquid-propellant DF-3 missiles. These missiles are capable of carrying nuclear warheads. It is believed that China possesses conventional ballistic missiles with high targeting accuracy based on the DF-21, and it has been pointed out that China has deployed conventional anti-ship ballistic missiles (ASBM), which could be used to attack ships at sea including aircraft carriers.
>
> In addition to IRBM/MRBM, China also possesses the DH-10 (CJ-10), a cruise missile with a range of at least 1,500 km, as well as the H-6 (Tu-16), bombers that are capable of carrying nuclear weapons and cruise missiles. It is deemed that these missiles will complement ballistic missile forces, covering the Asia-Pacific region including Japan.
>
> China announced that it had conducted tests on midcourse missile interception technology in January 2010 and 2013. Attention will be paid to China's future trends in ballistic missile defense.

Chinese development of mobile, solid-fueled Medium-Range Ballistic Missiles (MRBMs) provides a further indication of a larger institutional shift towards missile forces, as "the PLA is acquiring and fielding conventional MRBMs to increase the range at which it can conduct

precision strikes against land targets and naval ships, including aircraft carriers, operating far from China's shores out to the first island chain."[51] The 2015 DoD report reiterated this point, assessing, "China is fielding a growing number of conventionally armed MRBMs."[52] This trend is evident in the development of the more precise DF-21C and DF-21D missile systems – although again, the unclassified estimates of precision involved seems to be based on design and platform potential rather than empirical test data.

Indeed, the PLARF's nuclear-armed forces underwent similar modernization. The need to deter nuclear attacks on the mainland and—according to the *Science of Second Artillery Campaigns*—to reduce the scope of conventional warfare,[53] forced the PLARF to increase the survivability of its nuclear counter-attack forces. In turn, this requirement necessitated mobility, rapid deployment, and quick firing of the missile system.

The PLARF replaced the aging, liquid-fueled DF-2 MRBM with the solid-fueled mobile DF-21A/B MRBM. Between 1985 and 2000, the PLARF not only entirely retired the DF-2 but replaced it with nuclear-tipped DF-21s, missile for missile. Such a change in MRBM holdings illustrates several important elements of the PLARF nuclear modernization: a shift from liquid to solid fuel, a shift from transportable to mobile systems, and a shift to more accurate missiles.

These trends are fully detailed in **Figure 1.14**, which provides a visual representation of the data and trends described above. Important elements to notice are: the rapid expansion in SRBM numbers, the brief dip in MRBM numbers (the DF-2 to DF-21 series transition), the drawdown of IRBMs (China has yet to develop a mobile solid-fueled IRBM), the growth in ICBMs as the PLARF seeks an invulnerable second-strike capability, and the sudden appearance of cruise missile units.

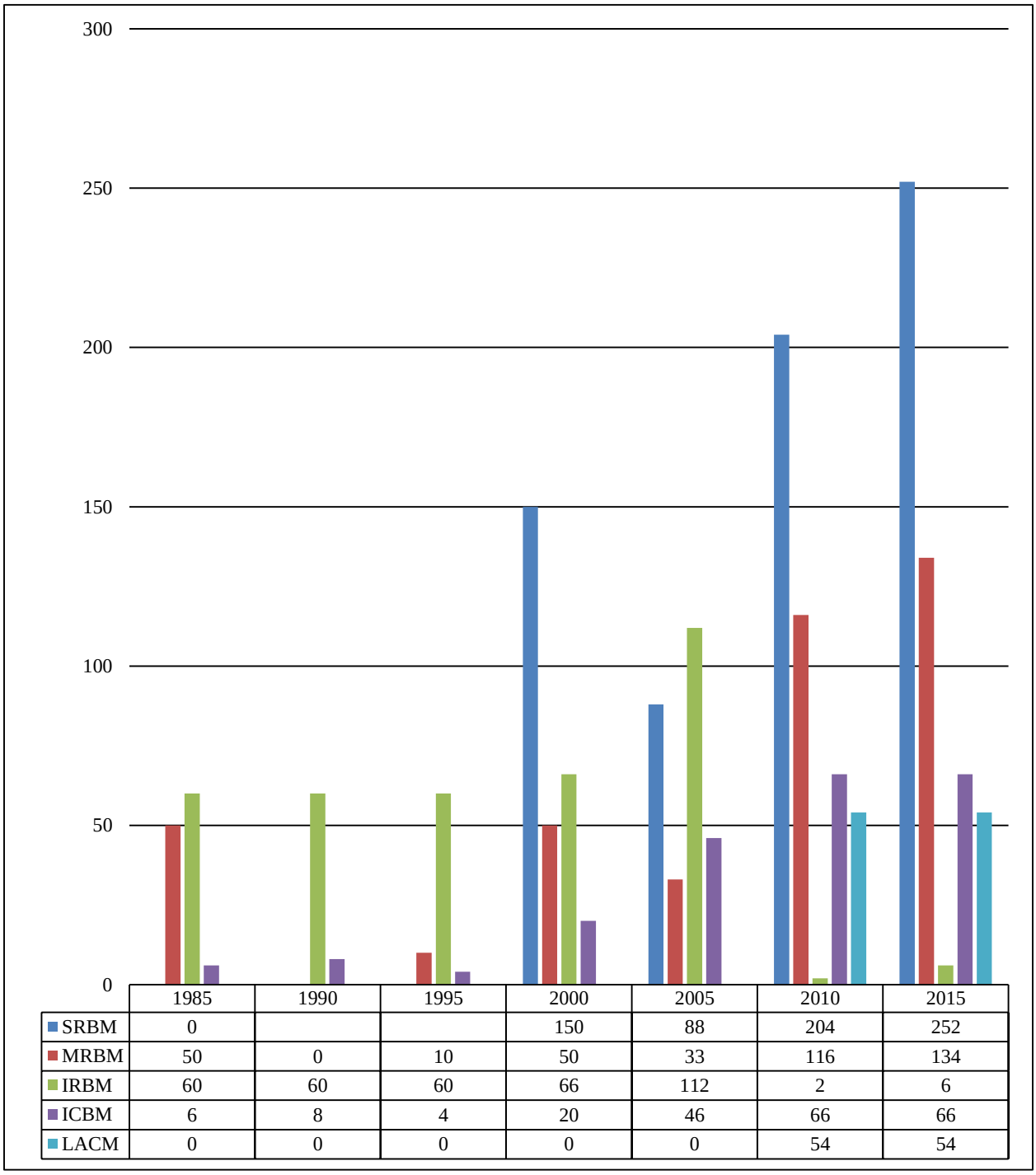
Figure 1.13: NASIC Estimate of the Regional Balance of MRBMs and IRBMs

MISSILE	NUMBER OF STAGES	PROPELLANT	DEPLOYMENT MODE	MAXIMUM RANGE (km)	NUMBER OF LAUNCHERS*
China					
CSS-2	1	Liquid	Transportable	3,000	5 to 10 (Limited Mobility)
CSS-5 Mod 1	2	Solid	Road-mobile	1,750+	Fewer than 50
CSS-5 Mod 2	2	Solid	Road-mobile	1,750+	Fewer than 50
CSS-5 Conventional	2	Solid	Mobile	1,750+	Fewer than 30
CSS-5 ASBM	2	Solid	Mobile	1,500+	Unknown
Saudi Arabia (Chinese-produced)					
CSS-2 (conventional)	1	Liquid	Transportable	3,000	Fewer than 50 (Limited Mobility)
North Korea					
No Dong	1	Liquid	Road-mobile	1,250	Fewer than 50
IRBM	1	Liquid	Road-mobile	3,000+	Fewer than 50
India					
Agni II	2	Solid	Rail-mobile	2,000+	Fewer than 10
Agni III	2	Solid	Rail-mobile	3,200+	Not yet deployed
Agni IV	2	Solid	Rail-mobile	3,500+	Not yet deployed
Pakistan					
Ghauri	1	Liquid	Road-mobile	1,250	Fewer than 50
Shaheen 2	2	Solid	Road-mobile	2,000	Unknown
Iran					
Shahab 3	1	Liquid	Silo & road-mobile	2,000	Fewer than 50
Sejjil	2	Solid	Road-mobile	2,000	Unknown
IRBM/ICBM	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined

Note: All ranges are approximate.
* The missile inventory may be larger than the number of launchers; launchers can be reused to fire additonal missiles

Source US National Air and Space Intelligence Center, Defense Intelligence Agency Missile and Space Intelligence Center and Office of Naval Intelligence, *Ballistic & Cruise Missile Threat*, NASIC, May 2013, 16.

Figure 1.14: Development of Ballistic and Cruise Missile Launchers, 1985-2015



	1985	1990	1995	2000	2005	2010	2015
SRBM	0			150	88	204	252
MRBM	50	0	10	50	33	116	134
IRBM	60	60	60	66	112	2	6
ICBM	6	8	4	20	46	66	66
LACM	0	0	0	0	0	54	54

Source: IISS, *Military Balance* 1985-2015.

ICBMs and SLBMs

A US National Air and Space Intelligence Center estimate of regional balance of ICBMs and SLBMs – made in 2013 – is shown in **Figure 1.15**. This Figure again illustrates a broad set of

trends in the regional balance – a balance that that both affects and is affected by China. The NASIC summarizes key regional trends as follows:[54]

ICBMs

Russia retains about 1,200 nuclear warheads on ICBMs. Most of these missiles are maintained on alert, capable of being launched within minutes of receiving a launch order. Although the size of the Russian ICBM force will continue to decrease because of arms control agreements, aging missiles, and resource constraints, Russia probably will retain the largest ICBM force outside the United States. Efforts to maintain and modernize the force are underway. Russia successfully tested a new type of mobile ICBM in 2012 according to Russian press reports. The Russian SS-27 Mod 1 ICBM, a missile designed with countermeasures to ballistic missile defense systems, is now deployed in silos in six regiments. Russia began deployment of the road-mobile version of the SS- 27 Mod 1 in 2006. A MIRV version of the SS-27, the SS-27 Mod-2 (RS-24), was deployed in 2010.

In addition, Russian officials claim a new class of hypersonic vehicle is being developed to allow Russian strategic missiles to penetrate missile defense systems, and the Russian press has indicated deployment of a new rail-mobile ICBM is being considered. Furthermore, Russia has stated that a new heavy liquid-propellant ICBM is under development to replace the aging SS-18. Russia's goal is to begin its deployment in the 2018-2020 timeframe.

In 2011, the New Strategic Arms Reduction Treaty, which limits the United States and Russia to no more than 1,550 warheads each (including those on ICBMs, SLBMs, and heavy bombers), entered into force.

China is strengthening its strategic nuclear deterrent force with the development and deployment of new ICBMs. China retains a relatively small number of nuclear armed, liquid-propellant CSS-3 limited range ICBMs and CSS-4 ICBMs capable of reaching the United States. It is also modernizing solid-propellant CSS-10 Mod 1 and the longer range CSS-10 Mod 2 ICBMs have been deployed to units within the Second Artillery Corps. The CSS-10 Mod 1 is capable of reaching targets throughout Europe, Asia, and parts of Canada and the northwestern United States. The longer range CSS-10 Mod 2 will allow targeting of most of the continental United States. China may also be developing a new road-mobile ICBM capable of carrying a MIRV payload, and the number of warheads on Chinese ICBMs capable of threatening the United States is expected to grow to well over 100 in the next 15 years.

North Korea continues development of the TD-2 ICBM/SLV, which could reach the United States if developed as an ICBM. Launches in July 2006, April 2009, and April 2012 ended in failure, but a December 2012 launch successfully placed a satellite in orbit. In an April 2012 military parade, North Korea unveiled the new Hwasong-13 road-mobile ICBM. This missile has not yet been flight tested. Either of these systems could be exported to other countries in the future. Continued efforts to develop the TD-2 and the newly unveiled ICBM show the determination of North Korea to achieve long-range ballistic missile and space launch capabilities.

Since 2008, Iran has conducted multiple successful launches of the two-stage Safir SLV. In early 2010, Iran unveiled the larger Simorgh SLV. Iran will likely continue to pursue longer range ballistic missiles and more capable SLVs, which could lead to the development of an ICBM system. Iran could develop and test an ICBM capable of reaching the United States by 2015.

India conducted the first flight test of the Agni V ICBM in April 2012. An even longer range Agni VIIs reportedly in the design phase.

SLBMs

Russia maintains a substantial force of nuclear powered ballistic missile submarines (SSBNs) with intercontinental-range missiles. Russia is developing new and improved SLBM weapon systems to replace its current inventory of Cold War vintage systems. Upgraded SS-N-23s are intended to replace older SS-N-23s on DELTA IV Class SSBNs. The SS-NX-32/Bulava is a new solid-propellant SLBM that is primarily intended for deployment on new DOLGORUKIY class SSBNs. Russian SLBMs are capable of launch from surfaced and submerged SSBNs from a variety of launch locations.

China currently has a single XIA Class SSBN that is intended to carry 12 CSS-NX-3/JL-1 missiles. In addition, China will deploy the new CSS-NX-14/JL-2 SLBM on new 12-tube JIN Class SSBNs. This

> missile will, for the first time, allow Chinese SSBNs to target portions of the United States from operating areas located near the Chinese coast.
>
> India is developing a new ballistic missile-capable submarine, the INS Arihant. The K-15 is reportedly ready for induction when the Arihant is deemed ready.

Japan provided a somewhat similar summary in its 2014 defense white paper:[55]

> China has made independent efforts to develop nuclear capabilities and ballistic missile forces since the middle of the 1950s, seemingly with a view to ensuring deterrence, supplementing its conventional forces, and maintaining its voice in the international community. With regard to the nuclear strategy, it is recognized that China employs a strategy where it can deter a nuclear attack on its land by maintaining a nuclear force structure able to conduct retaliatory nuclear attacks on a small number of targets such as cities in the enemy country.
>
> China possesses various types and ranges of ballistic missiles: intercontinental ballistic missiles (ICBM); submarine-launched ballistic missiles (SLBM); intermediate-range ballistic missiles/medium-range ballistic missiles (IRBM/ MRBM); and short-range ballistic missiles (SRBM).
>
> The update of China's ballistic missile forces from a liquid propellant system to a solid propellant system is improving their survivability and readiness. Moreover, it is also believed that China is working to increase performance by extending ranges, improving accuracy, mounting warheads, introducing Maneuverable Reentry Vehicles (MaRV) and Multiple Independently Targetable Reentry Vehicles (MIRV), and other means.
>
> China has deployed the DF-31, which is a mobile type ICBM with a solid propellant system mounted onto a Transporter Erector Launcher (TEL), and the DF-31A, a model of the DF-31with extended range. According to some analysts, China has already deployed the DF-31A and will increase its numbers[19]. Regarding SLBM, China currently appears to be developing a new JL-2 whose range is believed to be approximately 8,000 km, and constructing and commissioning Jin-class nuclear-powered ballistic missile submarines (SSBN) to carry the missiles. Once the JL-2 reaches a level of practical use, it is believed that China's strategic nuclear capabilities will improve by a great margin.

The numbers of Chinese ICBMs shown earlier in **Figure 1.4 and Figure 1.5** have shown a steady increase in the ICBM force, but one that understates the actual rise in Chinese capabilities because obsolete ICBMs have been retired as more modern versions were produced. During this time period, the PLARF reduced its holdings of its relatively vulnerable, liquid-fueled, and non-mobile DF-4s while it deployed DF-5, DF-31, and DF-31A ICBM systems.

As a result, it is necessary to combine the analysis of absolute ICBM numbers with an analysis of the relative modernization of the ICBM arsenal. Such a combined analysis is not necessary for the other missile classes because the ICBM category is the only one in which the deployment of modern systems occurred at the same time as obsolete missiles were discarded; the culling of obsolete MRBMs happened before modern versions were produced, no modern IRBMs have been developed, and the PLARF never had obsolete SRBMs or LACMs.

Figure 1.15 shows that the introduction of the DF-31 and DF-31A significantly increased the percentage of the ICBM force that is modern, and **Figure 1.17** shows the expanding range of China's conventional weapons, ICBMs, and MRBMs. This figure shows that China can now reach any target in the world, including the US.

As a result, the growth in ICBM numbers during the 2005-2013 period understates the growth in the PLARF's intercontinental deterrence capability and its increasing survivability. Paired with improved PLAAF AD and the development of the PLARF's tunnel network, the modernization of the PLARF's ICBM arsenal has positive implications for the PLARF's ICBM survivability, and thus for one of the PLARF's two core missions. Moreover, China's newer missiles, such as

the DF-5B, DF-31A and DF-41, are now believed to be equipped with MIRV warheads or capable of being MIRVed.

In December 2012, China successfully conducted a second test of its DF-31A missile, allowing it to reach any city in the US. The missile is believed to have had three warheads per missile and a range of approximately 7,000 miles. While the Chinese DF-5 has similar capabilities, the DF-5 requires a stationary launch pad and contains only one nuclear warhead. In contrast, the DF-31A is portable and can be launched from the back of a truck, train, or tank.[56] China appears to have supplied missiles to Saudi Arabia, Iran, Iraq, Libya, Pakistan, Syria, and North Korea.[57]

The US assessment of China's military capabilities has long focused on China's growing nuclear and missile forces and increasing capability to target the US and Japan in ways that directly affect the regional balance of power and the potential risk of US involvement any regional crisis or conflict. The 2011 DoD report on *Military and Security Developments Affecting the People's Republic of China* stated that,[58]

> China has prioritized land-based ballistic and cruise missile programs. It is developing and testing several new classes and variants of offensive missiles, forming additional missile units, upgrading older missile systems, and developing methods to counter ballistic missile defenses.
>
> The PLA is acquiring large numbers of highly accurate cruise missiles, many of which have ranges in excess of 185 km. This includes the domestically-produced, ground-launched DH-10 land-attack cruise missile (LACM); the domestically produced ground- and ship-launched YJ-62 anti-ship cruise missile (ASCM); the Russian SS-N-22/SUNBURN supersonic ASCM, which is fitted on China's SOVREMENNY-class DDGs acquired from Russia; and, the Russian SS-N-27B/SIZZLER supersonic ASCM on China's Russian-built, KILO-class diesel-electric attack submarines.
>
> By December 2010, the PLA had deployed between 1,000 and 1,200 short-range ballistic missiles (SRBM) to units opposite Taiwan. To improve the lethality of this force, the PLA is introducing variants of missiles with improved ranges, accuracies, and payloads.
>
> China is developing an anti-ship ballistic missile (ASBM) based on a variant of the CSS-5 medium-range ballistic missile (MRBM). Known as the DF-21D, this missile is intended to provide the PLA the capability to attack large ships, including aircraft carriers, in the western Pacific Ocean. The DF-21D has a range exceeding 1,500 km and is armed with a maneuverable warhead.
>
> China is modernizing its nuclear forces by adding more survivable delivery systems. In recent years, the road mobile, solid propellant CSS-10 Mod 1 and CSS-10 Mod 2 (DF-31 and DF-31A) intercontinental-range ballistic missiles (ICBMs) have entered service. The CSS-10 Mod 2, with a range in excess of 11,200 km, can reach most locations within the continental United States.
>
> China may also be developing a new road-mobile ICBM, possibly capable of carrying a multiple independently targetable re-entry vehicle (MIRV).
>
> …China's nuclear arsenal currently consists of approximately 55-65 intercontinental ballistic missiles (ICBMs), including the silo-based CSS-4 (DF-5); the solid-fueled, road-mobile CSS-10 Mods 1 and 2 (DF-31 and DF-31A); and the more limited range CSS-3 (DF-3). This force is complemented by liquid-fueled CSS-2 intermediate-range ballistic missiles and road-mobile, solid-fueled CSS-5 (DF-21D) MRBMs for regional deterrence missions. The operational status of China's single XIA-class ballistic missile submarine (SSBN) and medium-range JL-1 submarine-launched ballistic missiles (SLBM) remain questionable.
>
> By 2015, China's nuclear forces will include additional CSS-10 Mod 2s and enhanced CSS-4s. The first of the new JIN-class (Type 094) SSBN appears ready, but the associated JL-2 SLBM has faced a number of problems and will likely continue flight tests. The date when the JIN-class SSBN/JL-2 SLBM combination will be fully operational is uncertain. China is also currently working on a range of technologies to attempt to counter U.S. and other countries' ballistic missile defense systems, including maneuvering re-entry vehicles, MIRVs, decoys, chaff, jamming, thermal shielding, and anti-satellite (ASAT) weapons. PRC official media also cites numerous Second Artillery Corps training exercises featuring maneuver,

> camouflage, and launch operations under simulated combat conditions, which are intended to increase survivability. Together with the increased mobility and survivability of the new generation of missiles, these technologies and training enhancements strengthen China's nuclear force and enhance its strategic strike capabilities.
>
> The introduction of more mobile systems will create new command and control challenges for China's leadership, which now confronts a different set of variables related to deployment and release authorities. For example, the PLA has only a limited capacity to communicate with submarines at sea, and the PLA Navy has no experience in managing a SSBN fleet that performs strategic patrols with live nuclear warheads mated to missiles. Land-based mobile missiles may face similar command and control challenges in wartime, although probably not as extreme as with submarines.
>
> Beijing's official policy towards the role of nuclear weapons continues to focus on maintaining a nuclear force structure able to survive an attack, and respond with sufficient strength to inflict unacceptable damage on the enemy. The new generation of mobile missiles, maneuvering and MIRV warheads, and penetration aids are intended to ensure the viability of China's strategic deterrent in the face of continued advances in U.S. and, to a lesser extent, Russian strategic intelligence, surveillance, and reconnaissance; precision strike; and missile defense capabilities.
>
> Beijing has consistently asserted that it adheres to a "no first use" (NFU) policy, stating it would use nuclear forces only in response to a nuclear strike against China. China's NFU pledge consists of two stated commitments: China will never use nuclear weapons first against any nuclear-weapon state, and China will never use or threaten to use nuclear weapons against any non-nuclear-weapon state or nuclear-weapon-free zone. However, there is some ambiguity over the conditions under which China's NFU policy would apply, including whether strikes on what China considers its own territory, demonstration strikes, or high altitude bursts would constitute a first use.
>
> Moreover, some PLA officers have written publicly of the need to spell out conditions under which China might need to use nuclear weapons first; for example, if an enemy's conventional attack threatened the survival of China's nuclear force, or of the regime itself. However, there has been no indication that national leaders are willing to attach such nuances and caveats to China's "no first use" doctrine.
>
> Beijing will likely continue to invest considerable resources to maintain a limited nuclear force, also referred to by some PRC writers as "sufficient and effective" to ensure the PLA can deliver a damaging retaliatory nuclear strike.

The DoD provided updates in the 2013 edition of *Military and Security Developments Affecting the People's Republic of China* that described China's nuclear-armed missile developments as follows:[59]

> The Second Artillery controls China's nuclear and conventional ballistic missiles. It is developing and testing several new classes and variants of offensive missiles, forming additional missile units, upgrading older missile systems, and developing methods to counter ballistic missile defenses. (p. 5-6)
>
> By December 2012, the Second Artillery's inventory of short-range ballistic missiles (SRBM) deployed to units opposite Taiwan stood at more than 1,100. This number reflects the delivery of additional missiles and the fielding of new systems. To improve the lethality of this force, the PLA is also introducing new SRBM variants with improved ranges, accuracies, and payloads.
>
> China is fielding a limited but growing number of conventionally armed, medium-range ballistic missiles, including the DF-21D anti-ship ballistic missile (ASBM). The DF-21D is based on a variant of the DF-21 (CSS-5) medium-range ballistic missile (MRBM) and gives the PLA the capability to attack large ships, including aircraft carriers, in the western Pacific Ocean. The DF-21D has a range exceeding 1,500 km and is armed with a maneuverable warhead. (p. 5-6)
>
> The Second Artillery continues to modernize its nuclear forces by enhancing its silo-based intercontinental ballistic missiles (ICBMs) and adding more survivable mobile delivery systems. In recent years, the road-mobile, solid-propellant CSS-10 Mod 1 and CSS-10 Mod 2 (DF-31 and DF-31A) intercontinental-range ballistic missiles have entered service. The CSS-10 Mod 2, with a range in excess of 11,200 km, can reach

> most locations within the continental United States. China may also be developing a new road-mobile ICBM, possibly capable of carrying a multiple independently targetable re-entry vehicle (MIRV). (p. 5-6)
>
> **Land-Based Platforms.** China's nuclear arsenal currently consists of approximately 50-75 ICBMs, including the silo-based CSS-4 (DF-5); the solid-fueled, road-mobile CSS-10 Mods 1 and 2 (DF-31 and DF-31A); and the more limited range CSS-3 (DF-4). This force is complemented by liquid-fueled CSS-2 intermediate-range ballistic missiles and road-mobile, solid-fueled CSS-5 (DF-21) MRBMs for regional deterrence missions. By 2015, China's nuclear forces will include additional CSS-10 Mod 2 and enhanced CSS-4 ICBMs. (p. 31)

The 2014 DoD report updated these data by stating that:[60]

> China's nuclear arsenal currently consists of the silo-based CSS-4 (DF-5); the solid-fueled, road-mobile CSS-10 Mod 1 and Mod 2 (DF-31 and DF-31A); and the more limited-range CSS-3 (DF-4). This force is complemented by road-mobile, solid-fueled CSS-5 (DF-21) MRBMs for regional deterrence missions. By 2015, China's nuclear forces will include additional CSS-10 Mod 2s.
>
> **Sea-Based Platforms.** China continues to produce the JIN-class SSBN, with three already delivered and as many as two more in various stages of construction. The JIN-class SSBNs will eventually carry the JL-2 submarine-launched ballistic missile with an estimated range of 7,400 km. The JIN-class and the JL-2 will give the PLA Navy its first long-range, sea-based nuclear capability. After a round of successful testing in 2012, the JL-2 appears ready to reach initial operational capability in 2013. JIN-class SSBNs based at Hainan Island in the South China Sea would then be able to conduct nuclear deterrence patrols. (p. 31-32)
>
> **…Future Efforts.** China is working on a range of technologies to attempt to counter U.S. and other countries' ballistic missile defense systems, including maneuverable reentry vehicles (MaRVs), MIRVs, decoys, chaff, jamming, thermal shielding, and anti-satellite (ASAT) weapons. China's official media also cite numerous Second Artillery training exercises featuring maneuver, camouflage, and launch operations under simulated combat conditions, which are intended to increase survivability. Together with the increased mobility and survivability of the new training enhancements strengthen China's nuclear force and enhance its strategic strike capabilities. Further increases in the number of mobile ICBMs and the beginning of SSBN deterrence patrols will force the PLA to implement more sophisticated command and control systems and processes that safeguard the integrity of nuclear release authority for a larger, more dispersed force. (p. 32)

Outside sources provide further insights into these developments. The IISS reported in 2013 that:[61]

> In July 2012, unnamed US officials reportedly said that China had test-fired a DF-41 intercontinental ballistic missile, although little information was provided. The DF-41 would, if deployed, be the first land-based missile able to reach the entire continental United States. The July test was reported to include a multiple independently targetable re-entry vehicle (MIRV), though it is unclear whether MIRVed warheads have yet been deployed on China's current longest-range ICBM, the DF-31A. This continues to be produced, with satellite imagery from 2011 suggesting that the 809 Brigade in Datong was receiving DF-31s in place of DF-21s. Taiwan's 2010 report on Chinese military power claimed that the Second Artillery had also deployed a few new DF-16 MRBMs.
>
> Within a month, China also conducted a successful test of the JL-2 ballistic missile. The JL-2 is the submarine-launched version of the DF-31 road-mobile ICBM, to be deployed on the Type-094 nuclear-ballistic-missile submarine. Successful development and deployment of the hitherto troubled JL-2 would give China a more secure second-strike deterrent, as the four Type-094 submarines currently in the water would then be able to provide continuous at-sea deterrence.

China's deployment anti-ship ballistic missile (ASBM) is another facet of China's growing ballistic missile based deterrent, as Andrew Erickson has explained: [62]

> A number of sources agree with the US Department of Defense assessment that China has completed development of the DF-21D anti-ship ballistic missile (ASBM). Andrew Erickson, in his article titled "China Channels Billy Mitchell: Anti-Ship Ballistic Missiles Alters Region's Military Geography," states that, China's DF-21D anti-ship ballistic missile (ASBM) is no longer merely an aspiration. Beijing has

successfully developed, partially tested and deployed in small numbers the world's first weapons system capable of targeting the last relatively uncontested U.S. airfield in the Asia-Pacific from long-range, land-based mobile launchers.

This airfield is a moving aircraft carrier strike group (CSG), which the Second Artillery, China's strategic missile force, now has the capability to at least attempt to disable with the DF-21D in the event of conflict. With the ASBM having progressed this far, and representing the vanguard of a broad range of potent asymmetric systems, Beijing probably expects to achieve a growing degree of deterrence with it.

Figure 1.15: NASIC Estimate of the Regional Balance of ICBMs and SLBMs

ICBMs

MISSILE	NUMBER OF STAGES	WARHEADS PER MISSILE	PROPELLANT	DEPLOYMENT MODE	MAXIMUM RANGE (km)	NUMBER OF LAUNCHERS*
Russia						
SS-18 Mod 5	2 + PBV	10	Liquid	Silo	10,000+	About 50
SS-19 Mod 3	2 + PBV	6	Liquid	Silo	9,000+	About 50
SS-25	3 + PBV	1	Solid	Road-mobile	11,000	More than 150
SS-27 Mod 1	3 + PBV	1	Solid	Silo & road-mobile	11,000	About 80
SS-27 Mod-2	3 + PBV	Multiple	Solid	Silo & road-mobile	11,000	About 20
New ICBM	At least 2	Undetermined	Solid	Road-mobile	5,500+	Not yet deployed
China						
CSS-3	2	1	Liquid	Transportable	5,5000+	10 to 15
CSS-4 Mod 1	2	1	Liquid	Silo	12,000+	About 20
CSS-10 Mod 1	3	1	Solid	Road-mobile	7,000+	5 to 10
CSS-10 Mod 2	3	1	Solid	Road-mobile	11,000+	More than 15
North Korea						
Taepo Dong-2	2 or 3	1	Liquid	Fixed	5,500+	Unknown**
Hwasong-13	Undetermined	Undetermined	Undetermined	Road-mobile	5,500+	Unknown
India						
Agni V	3	1	Solid	Undetermined	5,000+	Not yet deployed

SLBMs

MISSILE	NUMBER OF STAGES	WARHEADS PER MISSILE	PROPELLANT	SUBMARINE CLASS	MAXIMUM RANGE (km)	NUMBER OF LAUNCHERS
RUSSIA						
SS-N-18	2 + PBV	3	Liquid	DELTA III	5,500+	96
SS-N-23	3 + PBV	4	Liquid	DELTA IV	8,000+	96
SS-NX-32 Bulava	3 + PBV	6	Solid	DOLGORUKIY (BOREY) TYPHOON	8,000+	16; Not yet deployed 20; Not yet deployed
CHINA						
CSS-NX-3/JL-1	2	1	Solid	XIA	1,700+	12; Not yet deployed
CSS-NX-14/JL-2	3	1	Solid	JIN	7,000+	12; Not yet deployed
INDIA						
K-15	2	1	Solid	ARIHART	700	12; Not yet deployed

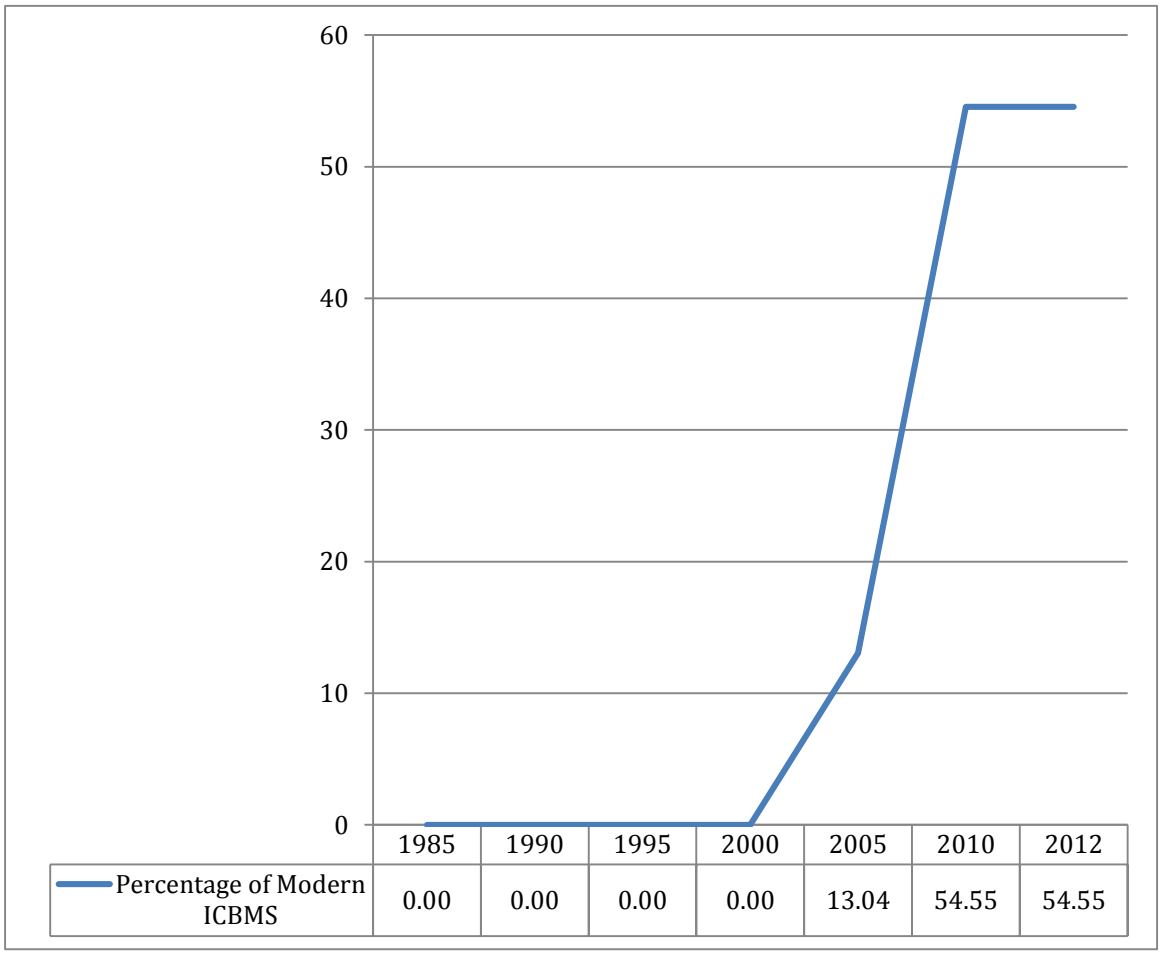
Note: All ranges are approximate.

* The missile inventory may be much larger than the number of launchers; launchers can be reused to fire additional missiles.

** Launches of the TD-2 space vehicle have been observed from both east and west coast facilities.

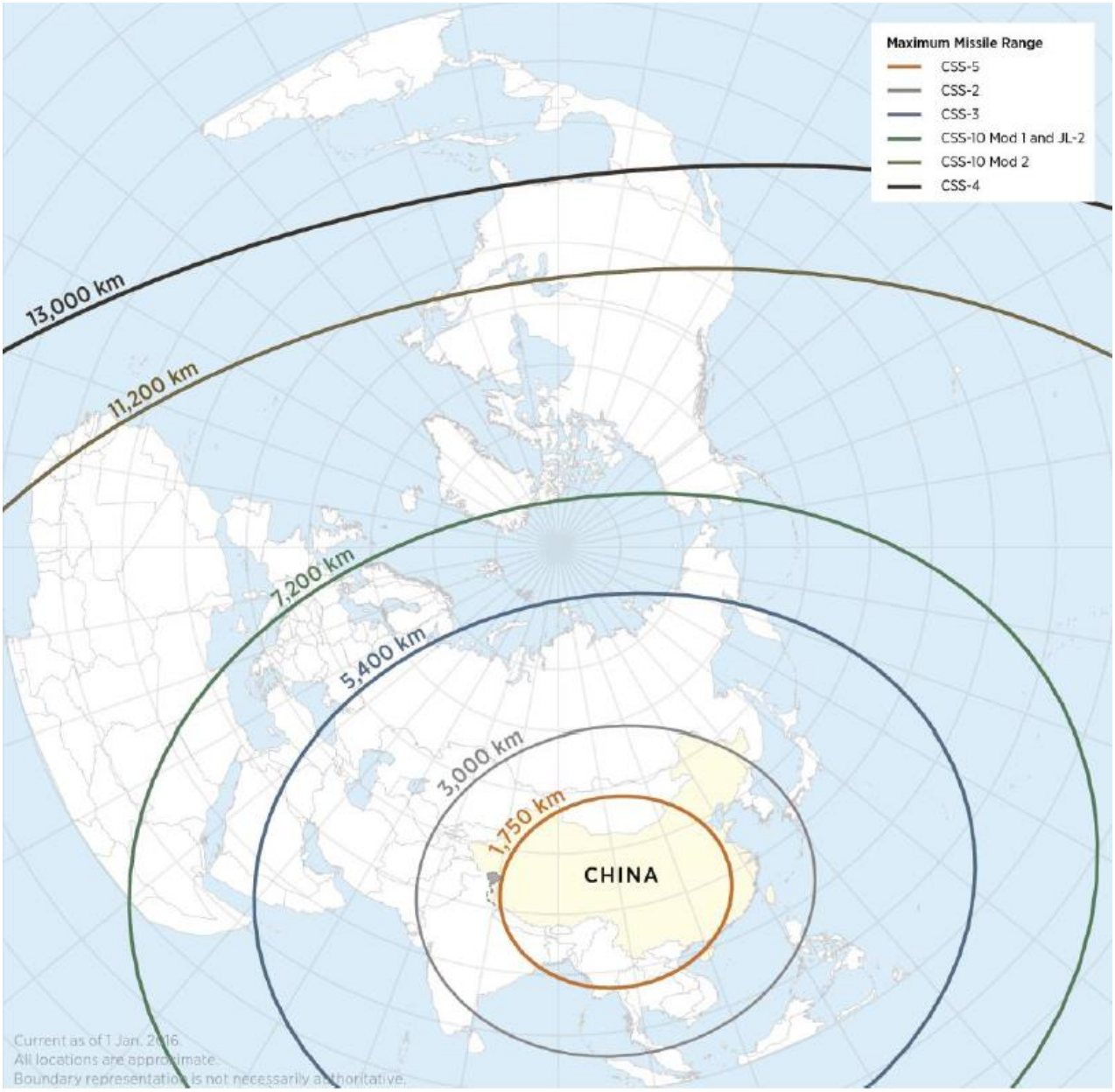
Source: Adapted from US National Air and Space Intelligence Center, Defense Intelligence Agency Missile and Space Intelligence Center and Office of Naval Intelligence, *Ballistic & Cruise Missile Threat*, NASIC, May 2013, 21.

Figure 1.16: Percentage of Modern ICBMs in the PLARF's Arsenal, 1985-2012



Source: *Military Power of the People's Republic of China* 2005-2009; *Military and Security Developments Involving the People's Republic of China* 2009-2012.

Figure 1.17: The Expanding Range of China's Medium and Intercontinental Ballistic Missile Forces – Part I

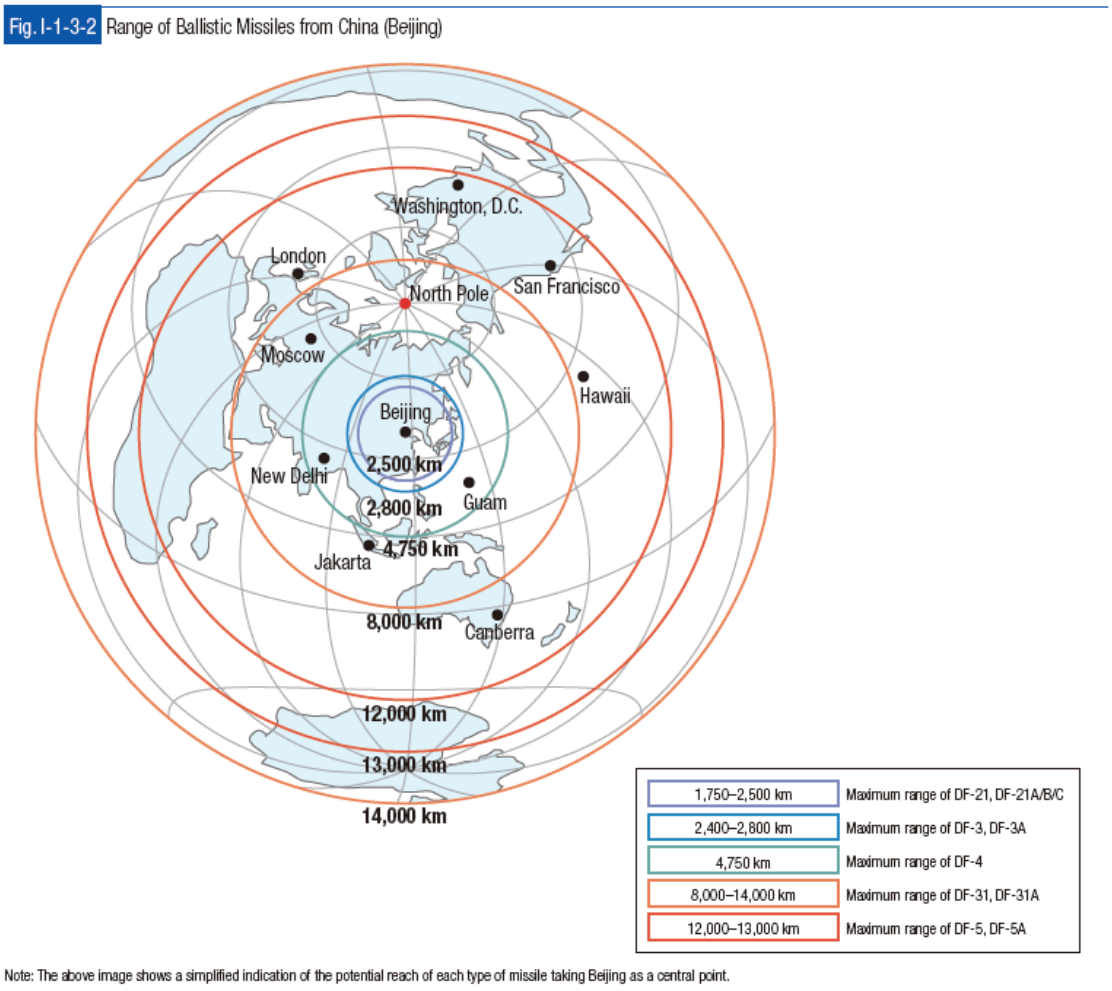


Source: DoD, *Report to Congress on Military and Security Developments Involving the People's Republic of China 2016*, April 2016, 24.

Figure 1.17: China's Conventional Strike Capabilities – Part II

Source: DoD, *Report to Congress on Military and Security Developments Involving the People's Republic of China 2016*, April 2016, 23.

Figure 1.18: The Expanding Range of China's ICBM and Longer-Range Forces



Source: Japanese Ministry of Defense, *Defense of Japan 2014.*

Chinese Missile Defense Capabilities

There are other important aspects of China's missile and space programs. China has steadily shifted to an emphasis on missile defense capabilities. The 2010 Chinese defense white paper made an official statement that argued against international missile defense programs. The paper also included sections on the desire to prohibit biological and chemical weapons, prevent an arms race in outer space, promote military expenditure transparency, and work towards conventional arms control. In the section on non-proliferation, the PRC wrote:[63]

> China maintains that the global missile defense program will be detrimental to international strategic balance and stability, will undermine international and regional security, and will have a negative impact on the process of nuclear disarmament. China holds that no state should deploy overseas missile defense systems that have strategic missile defense capabilities or potential, or engage in any such international collaboration.

The 2013 and 2015 white papers did mention missile defense once, but did not address the issue in much depth. In sharp contrast, however, the 2015 DoD report on *Military and Security Developments Involving the People's Republic of China* noted that:[64]

> China has made efforts to go beyond defense from aircraft and cruise missiles to gain a BMD capability in order to provide further protection of China's mainland and strategic assets. China's existing long-range SAM inventory offers limited capability against ballistic missiles. New indigenous radars, the JL-1A and JY-27A, are designed to address the ballistic missile threat, with the JL-1A advertised as capable of precision tracking of multiple ballistic missiles.
>
> China's SA-20 PMU2 SAMs, one of the most advanced SAM Russia offers for export, has the advertised capability to engage ballistic missiles with ranges of 1,000 km and speeds of 2,800 meters per second (m/s). China's domestic CSA-9 long-range SAM system is expected to have a limited capability to provide point defense against tactical ballistic missiles with ranges up to 500 km.
>
> China is proceeding with the research and development of a missile defense umbrella consisting of kinetic energy intercept at exo-atmospheric altitudes (greater than 80 km), as well as intercepts of ballistic missiles and other aerospace vehicles within the upper atmosphere. In January 2010 and again in January 2013, China successfully intercepted a ballistic missile at mid-course, using a ground-based missile.

China tested an advanced missile defense system on January 11, 2010. The test, entitled the *Test of the Land-based Mid-course Phase Anti-ballistic Missile Interception Technology*, targeted a missile during the mid-course phase when it was exo-atmospheric. According to press reports, the US DoD stated, "We detected two geographically separated missile launch events with an exo-atmospheric collision also being observed by space-based sensors."[65]

Reportedly, China carried out a second land-based mid-course missile interception test on January 27, 2013 in the Xinjiang Uyghur Autonomous Region. Although no other information was given, the Chinese Defense Ministry remarked that the test was "defensive in nature" and appeared to be successful. In all likelihood, the system is a reconfigured DF-21C or DF-25 (KS/SC-19), both of which are two-stage medium-range (1500-1700 km) ballistic missiles capable of carrying a 600 kg payload – in this case, an exo-atmospheric kill vehicle. However, China likely remains far from an operational anti-missile shield.[66]

China is also working to increase its tactical ballistic missile defense capabilities – which add another level of deterrence and defense capabilities. China is beginning to produce its own variant of the S300 and recently has made a deal with Russia to procure the S-400 air defense system which will extend China's ballistic missile defense reach.[67]

Improved Personnel

The doctrinal, operational, tactical, and technical requirements generated by the PLARF's modernization and development program have required a PLARF comprised of technically proficient officers and men with higher levels of human capital and academic achievement. This necessity has led to a shift in personnel policies toward greater formal military education of officers and men, greater recruitment of university graduates, and more intensive and realistic military training.

China has not neglected missile force training and readiness. The 2009 revision of the PLA's *Outline of Military Training and Evaluation* emphasized joint training, training in "complex electromagnetic environments," and the use of opposition forces to increase training realism;[68] the PLARF seeks to develop these training techniques so as to better conduct integrated joint operations under conditions of informatization.

It is impossible to discern how significant an impact these new training regulations have had on PLARF forces, but Chinese media reports corroborate the new emphasis on "realistic training."[69] These reports frequently describe training exercises along the lines of the 2009 Outline of Military Training and Education, discussed previously – one story in *Jiefangjun Huabao* described joint training at the brigade level.[70] Such efforts, if carried out on a sustained and well-resourced basis, form a significant means of augmenting PLARF combat skills.

The 2010 Chinese defense white paper asserted that one of the main drivers of greater military spending is greater investments in training and education. If accurate, such spending has led to specialized military education institutions such as the Non-Commissioned Officer (NCO) School of the Second Artillery Force, which has been reported by Chinese media to have trained several thousand NCOs in the last several years.[71] Officers have also enjoyed the benefits of improving military education, as Chinese media has reported that officer's colleges have begun developing warfighting simulators and other training and education equipment based on information-technology.[72]

The Chinese report on *The Diversified Employment of China's Armed Forces*, issued in 2013, explained the PLARF's combat readiness and training expectations as follows,[73]

> The PLASAF keeps an appropriate level of readiness in peacetime. It pursues the principles of combining peacetime needs with wartime needs, maintaining vigilance all the time and being ready to fight. It has formed a complete system for combat readiness and set up an integrated, functional, agile and efficient operational duty system to ensure rapid and effective responses to war threats and emergencies.
>
> If China comes under a nuclear threat, the nuclear missile force will act upon the orders of the CMC, go into a higher level of readiness, and get ready for a nuclear counterattack to deter the enemy from using nuclear weapons against China.
>
> If China comes under a nuclear attack, the nuclear missile force of the PLASAF will use nuclear missiles to launch a resolute counterattack either independently or together with the nuclear forces of other services. The conventional missile force is able to shift instantly from peacetime to wartime readiness, and conduct conventional medium- and long-range precision strikes.
>
> The Second Artillery Forces carry out confrontational training of reconnaissance vs. counter-reconnaissance, jamming vs. counter-jamming, and precision strikes vs. protection and counterattack, in complex battlefield environments. They are strengthening safety protection and operational skills training under nuclear, biological and chemical (NBC) threats. Units of different missile types are organized to conduct live-firing launching tasks annually.

This appears to be a continued priority for the PLARF. The Ministry of National Defense reported in 2015 that it had enhanced "on-base, simulated, web-based and realistic training, explores the characteristics and laws of training in complex electromagnetic environments and integrated training of missile bases…[and] has been made in building the 'Informationized Blue Force' and battle laboratories."[74] They continue to report that a cadre of trainers has been composed of academics from the Chinese Academy of Engineering, as well as experienced officers and specialists.

The recruitment of qualified personnel with undergraduate or graduate academic degrees has become a major PLARF imperative. PLA media frequently cite some percentage of personnel in a given unit as undergraduate degree holders, emphasizing a self-reported increase in undergraduate degree holders. In one specific instance, it was claimed that a certain PLARF brigade's officers were 85% undergraduate degree holders.[75]

The PRC Ministry of Defense website also discussed the PLARF's operational capabilities and personnel training as follows in 2015:[76]

> In terms of training, the Second Artillery Force takes specialized skills as the foundation, focuses on officers and core personnel, centers its attention on systems integration and aims at improving overall operational capabilities. It actively conducts specialized training, integrated training and operational training exercises.
>
> Specialized training mainly involves the study of basic and specialized missile theories, and the training in operating skills of weapons and equipment. Integrated training mainly consists of whole-process coordinated training of all elements within a combat formation. Operational training exercises refer to comprehensive training and exercises by missile brigades and support units in conditions similar to actual combat.
>
> The Second Artillery Force has adopted a rating system for unit training and an accreditation system for personnel at critical posts. It enhances on-base, simulated, web-based and realistic training, explores the characteristics and laws of training in complex electromagnetic environments and integrated training of missile bases, and is conducting R&D of a new generation of web-based simulated training systems. Significant progress has been made in building the "Informationized Blue Force" and battle laboratories.
>
> The Second Artillery Force places personnel training in a strategic position, and gives it high priority. It is working to implement the Shenjian Project for Personnel Training, and create a three-tiered team of first-rate technical personnel. As a result, a contingent of talented people has taken shape, whose main body is composed of academicians of the Chinese Academy of Engineering, missile specialists, commanding officers, and skilled operators and technicians

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[1] "China establishes Rocket Force and Strategic Support Force", PRC Ministry of National Defense, http://eng.mod.gov.cn/ArmedForces/second.htm

[2] For purposes of clarity, China's missile forces will be referred to as the PLARF as opposed to the SAF throughout the report. With the only exception being in the case of a direct quotation.

[3] U.S.-China Economic and Security Review Commission, *2014 Report to Congress*, "Section 2: China's Military Modernization", November 2014, p. 315.

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[5] U.S.-China Economic and Security Review Commission, *2015 Report to Congress*, "Section 3: China's Offensive Missile Forces", November 2015, p. 340.

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