DIRECTION OF THE NUCLEAR DRAGON

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In August 2012, the Chinese media confirmed the testing of a third generation Intercontinental Ballistic Misile (ICBM) the DF-41. This missile is Multiple Independently Targetable Reentry Vehicle [MIRV (10 warheads)] capable and is expected to carry decoys and counter-measures[1]. It has a minimum and maximum range of 3,000 km and 14,000 km respectively with a Circular Error Probable (CEP) of 100 to 500 m.[2] There was a lot of speculation on the status of the missile as it had not been displayed in any national day parade. However, the recent successful testing has put a stop to these speculations and has raised a number of questions regarding the direction of the Chinese nuclear force.

China has developed the missiles with regard to viewing the US as a threat. Thus, it is quite surprising as to why China would test another land-based, mobile, solid-fuelled ICBM when it already has the DF-31A, which has the range to target almost the entire US mainland. The other question is, would it not have been better to invest the money in the sea leg of its nuclear deterrence? These are obvious questions that need to be answered. There are some important reasons for fielding such a missile. All the reasons are based on enhancing and sustaining a credible deterrence against an improving anti-ballistic missile capability of the United States and to compensate for

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1. Duncan Lennox, ed., *Janes's Strategic Weapons Systems*, issue 55, p. 30.
2. Ibid., p. 31.

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the existing vulnerabilities in the Chinese nuclear deterrence force structure. One has to note that the DF-41 is capable of delivering 10 warheads over a distance of 14,000 km which the other ICBMs lack. This paper attempts to study the vulnerabilities and effectiveness of the Chinese nuclear force structure vis-a-vis the challenges posed by the increasing capability of the United States, to neutralise the Chinese nuclear capability and make their nuclear deterrence ineffective. Based on the study, this paper also attempts to predict the direction of the Chinese nuclear force in the coming decades.

After the fall of the Soviet Union, the United States remains the only major adversary that influences the Chinese nuclear policy. The future course of China's nuclear policy and its nuclear force structure will largely be shaped by Beijing's perspective of US actions. Since 1964, when it tested its first nuclear weapon, China maintains a policy of "minimum and credible deterrence", and as a result, it maintains a small nuclear force structure. The Chinese believe that the foundation of their deterrence rests in the psychological inability of the United States to absorb even a single nuclear strike on its soil. Therefore, possessing the capability to deliver even a few nuclear warheads on the US mainland would ensure effective deterrence.

US BMD EFFORTS AND THE VULNERABILITY OF CHINESE ICBMS

In maintaining a small force structure, there is always a risk of the enemy attempting to wipe out own nuclear force in a first strike, hence, the Chinese lay much emphasis on the survivability of their nuclear arsenal. The Chinese have come a long way in enhancing the survivability of their small nuclear force by making it mobile, storing it underground and inside caves. However, they are concerned about a new threat that degrades their deterrence capability: the US missile defence initiatives which continue to improve technologically and expand spatially. China is estimated to possess

30- 40 ICBMs[3] that have the range to reach the US mainland. In the event of a US first strike, the surviving missiles when launched could be intercepted by the US missile defence systems, degrading the retaliatory capability of China. Nevertheless, the US Ballistic Missile Defence (BMD) technology has not fully matured; various technical analyses of the US BMD systems tell us that it will be ineffective against saturation attacks and those that come with counter-measures and MIRVs. It is well known that the Chinese have the technology to develop and deploy MIRVs and counter-measure to penetrate defences. In the light of this, many scholars believe that China will continue to maintain a minimum deterrence policy and a smaller force structure, while improving only the survivability and effectiveness of its delivery mechanisms. On the other hand, considering the improving US missiles defences, it is possible, that in the future, China will be forced to go for a vertical increase in its nuclear force (warheads and missiles). To explore this possibility, it is essential to study the present US missile defence efforts and the future progress in US missile defence technology, and the possible options for China to counter these efforts.

US MISSILE DEFENCE EFFORTS

The US has begun to forward deploy its missile defence components to protect the US mainland from missile attacks. Recent reports state that the US will deploy the X-band radar in southern Japan as part of its missile defence plans. Japan already has one X-band radar deployed at Shariki base in Tsugaru city, in the far north of the main island of Honshu.[4] The US would also be deploying a floating Sea-Based X-band (SBX) radar in the Pacific (may be in the North Pacific) for mid-course defence against ICBMs. A GBR- Prototype (GBR-P) X-band radar is located at Kawajalein Atoll in the Southern Pacific.[5] An upgraded AN/FPS-115 radar (UHF) is deployed at Beale Air Force Base (AFB), California, and is supported by upgraded

3. Hans M. Kristensen and Robert S. Norris, "Chinese Nuclear Forces," *Bulletin of the Atomic Scientists*, 2011.
4. http://www.deccanherald.com/content/279412/us-station-second-x-band.html
5. "Ground Based Mid-Course Defence (GMD) Segment", in Lennox, ed., n. 1.

radars at Flyingdales, UK, and Thule, Greenland.[6] Added to this, the US, along with Japan, has also deployed some Aegis SM-3 equipped ships near Chinese waters. These Aegis systems, with their S-band primary radars and X-band engagement radars, are capable of intercepting ballistic missiles of all ranges with unitary and separating warheads in the terminal phase, except ICBMs. Apart from providing terminal defence against Short Range Ballistic Missiles (SRBMs) and mid-course defence against Medium Range Ballistic Missiles (MRBMs) and Intermediate Range Ballistic Missiles (IRBMs), these systems can detect and track ICBMs and transmit the necessary target details and trajectory information to other systems in the BMD architecture for their mid-course interception of ICBMs. In addition to these sensors, the US has also deployed space-based tracking and surveillance systems which consist of two satellites (technology demonstrators) that scan for targets in the infrared (IR) and visible regions of the spectrum. These space-based sensors can detect missiles in their boost phase, where they emit high intensity short-wave IR radiations and can transmit information to other sensors and fire control systems.

This multiple array of sensors, which are netted together with the Fire Control System (FCS), and at places overlap in coverage, indicates that the detection, tracking and to some extent Decoy-Warhead (DW) discrimination capability of the US is highly advanced, particularly for the crucial mid-course phase. All US radar sensors, except the early warning radars AN/FPS-132 (UHF), Cobra Dane radars (L-band) and SPY-1 radar (S-band) operate in the X-band region which helps in obtaining high resolution target details, enabling the discrimination of decoys and other missile debris from actual warheads. However, the attacker could employ both IR and radar signature counter-measure and, hence, for better DW discrimination, the early warning and tracking systems should include optical sensors as well. The space tracking and surveillance system, which is in the demonstration phase, could be improved and expanded in the future, enabling it to perform better tracking as well as DW discrimination in the optical region, thereby enhancing the effectiveness of the BMD systems. The forward positioning of

6. Ibid.

the ground-based sensors, along with the space-based systems would provide more reaction time for the fire control system. The improvement in the DW discrimination and the early initiation of the interception process will enable the employment of the shoot-look-shoot method which would reduce the number of interceptors required and also lessen the burden for the terminal defence systems respectively.

The other vital area which needs refinement is interception technology. The kinetic kill vehicle of the mid-course interceptor uses a dual band (visual and IR) optical terminal seeker to home in onto the warhead.[7] To increase the accuracy as well as terminal target discrimination efficiency, which would improve the Single Shot Kill Probability (SSKP) of the interceptor, a dual seeker (optical and high frequency imaging radar) might be used in the future. A higher SSKP would further reduce the number of interceptors required. Improvement to the burn-rate performance of the rocket motor, which would increase average speed, and upgrading of control systems with better onboard software and attitude controls could be expected in the future. All these improvements and fine tuning will complicate Chinese efforts to maintain a credible deterrence.

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US BMD VS CHINESE NUCLEAR FORCE

A Chinese ICBM attack on the US mainland could be launched from two directions, one, over the North Pole (circumpolar trajectory) and the other, over the extreme fringes of the Northern Pacific.[8] Along both the directions, the missiles have to pass through the engagement envelope of the interceptors based in Alaska and depending on the target area, over California too. The US BMD sensors (ground-based X-band radars and Aegis ships) in and

7. Ibid.
8. This is due to the geography i.e. the location of the two countries.

around Japan would detect and track any Chinese ICBM launch during the boost phase. It has been reported that AN/SPY-1 radars have tracked ballistic missiles at ranges in excess of 1,000 km[9] and the Terminal High Altitude Area Defence (THAAD) GBR (AN/TPY-2) X-band radar may be used as forward-based sensors to alert the SM-3 systems when a threat missile launch has been detected.[10] However, the altitude (within the boost phase) at which the missile would be detected depends on the distance of the launch point from the radar (due to the Earth's curvature and line of sight issues). If the missile is launched from areas closer to the shore, within the engagement envelope of the Standard Missile- 3 (SM-3), it is possible that the ICBM will be intercepted in the boost phase itself. (To perform boost phase interception, interceptor speed guidance software might require improvement; also the target missile with the presence of booster stages will also present a large target for the X-band radar.) Over the next 10 to 15 years, the military wants to equip Aegis ships with a much larger, faster interceptor that the United States is developing cooperatively with Japan. Estimates suggest that the interceptors speed will be high enough—in principle—to allow it to intercept missiles with intercontinental range.[11] Therefore, there is a high probability that the missiles would be launched from deep inland China and over the North Pole to avoid the Aegis system. Operating it deep inland would also increase the survivability of the missile unit from US air strikes.

To penetrate an effective BMD system, the Chinese missile should employ appropriate counter-measures [decoys with IR and radar counter-measures, Manoeuvrable Reentry Vehicles (MARVs) and MIRVs)]. However, with the gradually increasing capability of the US decoy-warhead discrimination capability, the counter-measures would gradually continue to become less effective. Launching the missiles in a depressed or lofted trajectory to defeat the missile defences is also out of the question as it would reduce the range

9. Lennox, n. 1.
10. Ibid.
11. David Wright and Lisbeth Gronlund, "Technical Flaws in Obama's Missile Defense Plan," *The Bulletin of Atomic Scientists*, September 23, 2009. Available at: http://www.thebulletin.org/web-edition/op-eds/technical-flaws-the-obama-missile-defense-plan

of the missile, making in short of reaching the US mainland.

A submarine could fire its SLBMs in a depressed trajectory, confusing the tracking systems and reducing the reaction time for the BMD system to respond to the threat.

Currently, China has deployed two ICBMs with the range to reach the United States, namely, the silo-based older DF-5A and the solid fuelled and more mobile DF-31A. China recently tested the longer range, road mobile DF-41 with a range of 14,000 km. While the DF- 5A and the DF-31A are reportedly single warhead[12] missiles, the DF-41 will be a MIRVed (10 warheads)[13] missile. At present, there are an estimated 30 to 40 ICBMs which have the range to reach the United States and each being a unitary warhead missile, the total number of warheads remains at 30 to 40. Assuming a SSKP of 0.30 percent for the interceptors based in Alaska and California four interceptors would required for a single warhead. Hence, the total requirement would be of 120 to 160 interceptors. But once the MIRV (10 warheads) capable DF-41 is operational, the number of warheads for this missile force would be a multiple of 10, thus, quadrupling the number of interceptors required. This will get more complicated if the Chinese deploy decoys and counter-measures which would additionally enhance the required interceptor numbers. However, as discussed earlier, the improving sensor capability for decoy-warhead discrimination and the interceptor efficiency might reduce the number of interceptors required, negating the Chinese efforts to some extent.

The other step the Chinese could undertake to counter US efforts would be to strengthen their undersea deterrence. Submarine Launched Ballistic Missiles (SLBMs) are little difficult for missile defence systems to counter compared to land-based missiles. A submarine could fire its SLBMs in a depressed trajectory, confusing the tracking systems and reducing the

12. Though there were some reports of the DF-31A being MIRVed, there is no confirmation yet. *Jane's Strategic System,* issue 55, reports that if DF-31A is MIRVed (3 warheads), its range will reduce to 10,000 km from 14,000 km. The DF-5A, reportedly still remains operational as a single warhead missile.
13. http://www.wantchinatimes.com/news-subclass-cnt.aspx?id=20120822000138&cid=1101

reaction time for the BMD system to respond to the threat. China's SSBN fleet is in a nascent stage with all the nuclear ballistic missile submarines (SSBN)—Xia and Jin—tied up at ports with zero patrols so far due to various technological problems. Once these problems are overcome and the boomers (Jin class) are operationalised, it will ensure better deterrence. Considering that four Jin class SSBNs will be deployed, with each housing 16 JL-2 missiles, it makes a total of 64 missiles and warheads (if armed with a single warhead). The JL-2 can also be MIRVed [three warheads (60, 90 or 120 kt)[14]], multiplying the total number of warheads to 192. Nevertheless, effective Chinese undersea deterrence, given the various problems (technology, crew training and experience), does not appear possible, at least in the near future.

VULNERABILITIES OF CHINA'S SEA-BASED DETERRENCE

China's SSBN Arsenal

China's decision to develop and deploy credible sea-based nuclear deterrence was a natural progression of its nuclear policy. Since China claims, and maintains, a minimum deterrence posture, the primary emphasis is laid on survivability of its nuclear assets from possible enemy strikes. One element of this survivable nuclear force is its underwater nuclear ballistic missile submarine force. Work on building a nuclear ballistic missile began during the Mao era, and on October 12, 1982, the PLA conducted its first successful test of a 1,700-km range SLBM, the JL-1, which carried a 600-kg payload. A year before, China had launched the Xia-class SSBN, derived from the Han-class SSN, with the hull lengthened to accommodate the missile tubes. The Type 092 became operational in 1983, though missile firings conducted in 1984 and 1985 were unsatisfactory due to fire control problems which were not resolved until 1988.[15] Even after two decades since it was deployed, it has not undertaken a single nuclear deterrence patrol. In 2007, it completed a multi-year overhaul but did not sail on a patrol.[16] The Type 092 vessel is

14. Lennox, n. 1.
15. http://www.fas.org/nuke/guide/china/slbm/type_92.htm
16. http://www.fas.org/blog/ssp/2009/02/patrols.php

said to suffer from major design problems, particularly with the nuclear propulsion system. The Xia class is slow, noisy and its reactor is unreliable.[17]

A new design (Type 094) has been planned since the late 1980s. The new design was based on the Type 093 (Shang class) nuclear-powered attack submarine, utilising the same power plant.[18] This new design represents an improvement over the older Type 092 submarine. There were speculations that the development of the Type 094 class was assisted by the Russian Rubin Design Bureau. However, this information was not confirmed.[19] This submarine is to be equipped with 16 JL-2 SLBM, which has a range of 8,000 km with an improved CEP compared to its predecessor, the JL-1. This improved system gives China the ability to launch nuclear strikes from a longer distance. However, though there were some reports on the successful test-firing of the JL-2 missile, till date it has not been confirmed, and even if it was test-fired, the launch platform is not known.

EMPLOYMENT CONSTRAINTS AND VULNERABILITY

The current Chinese nuclear submarine force comprises the Xia class and Jin class (yet to become operational) submarines. The main asset of any submarine, particularly a nuclear submarine, is its stealth, and that is the reason why nuclear submarines do not operate in groups; also, they operate at very low speeds, mostly four to five knots[20]. Though the Jin class submarine incorporates a lot of improvements over its predecessor in terms of stealth and other aspects, it still does not match or even come close to its US counterparts. A 2009 report from the US Navy's Office of Naval Intelligence indicates that the Type 094 is louder than the Russian Delta III-class submarine developed in the 1970s. This means that the new Type 094 boats are more detectable than the Russian technology, nearly 40 years old.[21] China is reportedly working on another SSBN design, namely, the Tang

17. http://www.military-today.com/navy/xia_class.htm
18. http://www.globalsecurity.org/wmd/world/china/type_94.htm
19. http://www.military-today.com/navy/jin_class.htm
20. Capt P. Ashokan, " Nuclear Submarine For the Indian Navy –Roles and Concepts", *College of Naval Warfare (CNW) Journal*, Annual Issue, 2008, p. 109.
21. Thomas M. Skypek, "China's Sea-Based Nuclear Deterrent in 2020: Four Alternative Futures for China's SSBN Fleet."

According to the US Department of Defence (DoD), the PLA has only limited capacity to communicate with submarines at sea.

class, but it is unlikely to become operational in the near future. Hence, the Chinese might not press their SSBNs into long range nuclear deterrence patrols. Moreover, the US Navy, throughout the Cold War period, had the practice of finding and trailing the Soviet boomers. The mission of these Anti-Submarine Warfare (ASW) forces was to detect, trail and, if needed, sink them. Therefore, it can be assumed that the Chinese will not risk sending their SSBNs on long range patrols, instead, as discussed by James. R. Holmes and Yoshihara in their book *Red Star over the Pacific*, the Chinese might adopt the Soviet Union's bastion strategy, where the boomers would be operating under the protective cover of land-based and sea-based defences. They further argue that authoritarian regimes—particularly those driven by ideologies like Communism, which prize military officers' loyalty to the regime and go to extraordinary lengths to enforce it—are ill-disposed to permit naval commanders this degree of control over strategic assets.[22] According to the US Department of Defence (DoD), the PLA has only limited capacity to communicate with submarines at sea, and the PLA Navy has no experience in managing an SSBN fleet that performs strategic patrols with live nuclear warheads mated to missiles.[23] Already, the Chinese have made an impressive advance in enhancing their anti-access and area denial strategy, so the possibility of them adopting this 'bastion strategy' is quite high. However, the Chinese undersea deterrence force still suffers from serious vulnerabilities even within the bastion. Firstly, as discussed above, it radiates more noise and, hence, might be easily detected by an enemy ASW force. Secondly, the range of the missile deployed in this boat restricts the freedom of operation even within protective shore-based defences. The JL-2 has a range of 8,000 km, and with this range, the submarine has to operate beyond the first island chain and away from the protective envelop of land-based

22. Toshi Yoshihara and James R. Holmes, *Red Star Over The Pacific*, ch 6, p. 131.
23. US DoD, Annual Report to Congress, Military and Security Developments Involving the People's Republic of China 2010. Available at: http://www.defense.gov/pubs/pdfs/2010_cmpr_final.pdf

defences to target the US mainland. Otherwise, operating within the first island chain, the submarine can target Alaska and hit the extreme eastern fringes of the US mainland from the Sea of Japan and, operating from the northeastern areas of the South China Sea, Bohai Sea and Yellow Sea, they can target Alaska.[24] Hence, the range constraint of the missile restricts the submarines to certain geographical areas even within the protective bastion. During times of crisis, the adversary could concentrate some of his ASW forces in these areas. Thirdly, the number of Jin class SSBNs China deploys will also determine the effectiveness of its underwater deterrence.

According to *Jane's Underwater Warfare Systems*, four boats have been laid down[25] and with four boats, approximately two submarines can be on patrol at any given time. Therefore, in quantitative terms, the US would require to deploy less ASW resources for these two boats. Even if the submarines are operating within the protective bastion of land-based defences, the underwater ASW component of the US Navy, which is known to be quite advanced in terms of stealth and other aspects, is certain to restrict the freedom of operation of the Chinese boomers. Above all, it is unlikely that China's Central Military Commission (CMC), which controls the country's nuclear arsenal, would hand over custody of nuclear warheads to the navy during peace-time, which means that China would not deploy a fully functional sea-based deterrent like that of the United Kingdom or the United States. In a crisis, the SSBNs would have to be first outfitted with warheads and then deployed, and this being the case, the Chinese SSBN fleet would have no experience with operating an SSBN during a realistic military operation.[26]

Another factor affecting the Chinese deterrence in a major way would be the vulnerability of shore-based defence. The core elements of the Chinese shore-based defences are their anti-ship capability and air defence systems. The key components of their anti-ship capability are air-launched anti-ship cruise missiles and land-based cruise missiles and, possibly in the future, anti-ship ballistic missiles. The effectiveness of these arrays of anti-ship

24. The reach of the missile was measured with the help of the google earth ruler tool.
25. Skypek, n. 2.
26. Kristensen n. 3.

missiles is based on the ability of the surveillance systems to detect, track, locate and cue target information to missile units or platforms. In a possible conflict, the surveillance systems along with air bases, from where attack sorties could be launched, would be one of the primary targets of the US forces. Surface forces might find it difficult to enter the zone protected by land-based defences; hence, the underwater forces might deliver the initial blows on these targets along with US stealth aircraft. With the end of the Cold War most of the US Navy's SSBNs have been converted to SSGNs equipped with Tomahawk cruise missiles for the land attack role. Almost all of the US Navy's SSN fleet has also been optimised for the land attack role and equipped with Tomahawk cruise missiles, which have a range of over 1,800 km.[27] The long range of the missiles enables the submarine to operate outside the Chinese bastion (immediately out of the first island chain to the east of Japan and from the northern Philippine Sea[28]) to strike the shore-based defences, and the stealth of the submarines permits them to penetrate the defended waters, considering the relative weakness of the Chinese ASW capability. "China has very limited ASW capabilities and appears not to be making major investments to improve them," explains Owen Cote, Jr. , an analyst at the Massachusetts Institute of Technology. "The ASW capabilities it does have appear focused on coastal defense, and on the threat posed by the diesel submarines of potential regional adversaries as opposed to American nuclear attack submarines (SSNs)."[29] The PLAN has deployed a large number of diesel-electric and nuclear powered attack submarines primarily for coastal defence. But the submarine crew suffer from lack of operational experience which is evident from the number of patrols the total submarine force has undertaken, which is just 55, from 1981 to 2007.[30] Recently, there were reports of increased Chinese submarine patrols.[31] After the year 2000, which saw the highest number of submarine patrols (6 patrols) since 1981, the year 2007 witnessed the same number of

27. Jane's Fighting Ships.
28. Range measurements done by using google earth application.
29. http://thediplomat.com/flashpoints-blog/2011/11/28/china%E2%80%99s-u-s-sub-hunter/
30. www,fas.org/blog/ssp/2008/01/Chinese_submarine_patrols_rebo.php
31. www,wired.com/dangerroom/2011/12/china-submarine/

submarine patrols. The 12 patrols conducted in 2008 constitute the highest number of patrols ever for the Chinese submarine fleet.[32] This might have imparted some operational experience, however little, to the submarine crew. On the other hand, the flurry of undersea activity gives US forces more opportunities to tail and examine Chinese submarines.[33] These factors further question the ability of the Chinese attack submarine forces to restrict US submarine operations inside the first island chain. However, a study done by Andrew S. Erickson, Lyle J. Goldstein, and William S. Murray , of the US Naval War College on the Chinese mine warfare capability indicates that the US submarine force will not have unrestricted freedom to operate inside the protected waters of China.[34]

As per the US Air Force's (USAF's) anti-anti-access concept, the Global Strike Task Force (GSTF), the anti-access nodes (missile launch units, air bases, radar stations, SAM sites and command centres) will be destroyed by their precision strike stealth aircraft, the B-2, F-22 and possibly, the JSF. The B-2 will be able to perform deep ingress into the enemy territory to take out long range weapon launch points. But, given the various drawbacks the USAF faces at present, like long range sorties (during the initial days of the conflict) which will reduce the number of sorties per day and reduce on-station time of an aircraft, resulting in reduced targets struck per day (reduced intensity), it is going to give the Chinese significant time gaps to deliver considerable attrition on the American assets within their bastion. Nevertheless, it is just a matter of time before the US forces achieve their initial objectives, thereby shattering the protective zone the Chinese have established. With the fortress effectively brought down, the Chinese boomers will be vulnerable to US ASW forces (underwater, surface and air elements). Hence, the present state of underwater nuclear deterrence assets does not give the Chinese a highly credible third leg of deterrence against the US.

32. Hans M. Kristensen, "Chinese Submarine Patrols Doubled in 2008," FAS Strategic Security Blog. Available at: http://www.fas.org/blog/ssp/2009/02/patrols.php
33. David Axe, "China's Noisy Subs Get Busier --- And Easier to Track," Available at: http://www.wired.com/dangerroom/2011/12/china-submarines/
34. Andrew S. Erickson, Lyle J. Goldstein, and William S. Murray, *Chinese Mine Warfare: A PLA Navy Assassin's Mace Capability"*, ----------

CHINESE LAND-BASED ICBMs

The Chinese land-based ICBMs remain the pivot of their nuclear deterrence against the United States. Last year (2012—from July to August) saw four test launches of their nuclear capable ballistic missiles among which are three land-based ICBMs (the DF-5, DF-31A and DF-41), all capable of targeting the US mainland, and one SLBM (the JL-2).[35] This shows the emphasis the Chinese place on their land-based missiles as their other arms of nuclear deterrence are in a nascent stage. Over the years, China has continued to prioritise the survivability of the nuclear deterrence force. Presently, China fields two ICBMs capable of targeting the US mainland, namely, the DF-5A and DF-31A. It is often reported that the DF-31 has the range to strike the US west coast, with a range of 8,000 km. However, this assumption is made from calculating the range from the Chinese northeastern land border areas. In a real war situation, these missiles would not be deployed in these areas owing to the possibility of being targeted by the US systems (aircraft and Aegis BMD systems) deployed in and around Japan. The above mentioned areas are within range of the US aircraft (with a single mid-air refuel considering required tactical manoeuvring)) deployed in Japan. As discussed above, launching the missiles from here would make them prone to detection by the sensors and Aegis systems based in Japan and possibly intercepted. Even if interception fails at this level, the sensors will alert and pass on the target and trajectory details to the BMD Fire Control System located on the US mainland.

China still retains the older, single warhead and liquid fuelled DF-5A missiles. This could be because, firstly, China might have felt the need to maximise the number of warheads that the Second Artillery can deliver.[36] Secondly, liquid fuelled DF-5A missiles have more thrust than solid fuelled missiles and, hence, can be loaded with multiple warheads if China chooses to do so,[37] though with considerable reduction in range but complicating the missile defence efforts of the US. Third, possibly to push up the low numbers of total ICBMs deployed at present. With the increasing surveillance

35. http://www.wsws.org/articles/2012/sep2012/chin-s12.shtml
36. Paul J. Bolt and Albert S. Willner, ed., *China's Nuclear Future*, ch. 4, pp- 86.
37. Ibid.

capability of the United States, China is concerned about the vulnerability of its silo-based missiles like the DF-5A, which need to be pulled out of a cave and launched from pre-prepared above-ground launch sites. These liquid-fuelled missiles usually take up to two hours preparation for launch. In addition, unlike the US and Russia, China does not have a reliable early warning system and its missiles are not in a launch-on-warning posture.[38]

The other ICBM, the DF-31A, is a solid fuelled, road-mobile [carried on a Transporter Erector Launcher (TEL)], single warhead missile with a range of 13,000 km. The mobility of this missile makes it harder to target and gives it considerable survivability. However, there are some operational constraints and uncertainty in maximising the gain obtained by the mobility of this missile. Firstly, Chinese nuclear warheads are not reportedly mated to their missiles.[39] To utilise the mobility of the missile, the warhead should be mated to the missile, but this increases the possibility of unauthorised and accidental launch as the warhead would be in the control of the local unit commander. Secondly, if these missiles are dispersed over a wider area, it complicates command and control. The other option is to restrict the deployment to certain areas closer to the warhead storage sites, which would, to a great extent, negate the mobility advantage of the missile and also, possibly, give out the warhead storage area. The mobile DF-31A also requires an array of support vehicles for launching operations. Hence, the DF-31A has to move with all these support vehicles occupying a large footprint, which makes them relatively easy to detect with imaging satellites.

To overcome these shortages, Hui Zhang, Senior Research Associate, Project on Managing the Atom, Belfer Centre for Science and International Affairs, argues that the Chinese might resort to a new method, which he terms "Tunnel Launched Ballistic Missile (TLBM)".[40] In March 2008, China's state-run CCTV network broke the news about a 5,000-km-long network of hardened tunnels built to house the Chinese Second Artillery

38. http://www.powerandpolicy.com/2012/01/31/chinas-underground-great-wall-subterranean-ballistic-missile/
39. n. 26.
40. http://www.powerandpolicy.com/2012/01/31/chinas-underground-great-wall-subterranean-ballistic-missile/

China has established an integrated air defence network which consists of advance Russian SAM systems like the S-300 series, S-400s and its Chinese derivatives like the HQ-9.

Corps' increasingly modern force of nuclear-tipped ballistic missiles. Tunnelling evidently commenced in 1995. Located in, or rather under, the mountainous districts of Hebei province, in northern China, the facility is reportedly hundreds of metres deep.[41] This great underground wall of China is not only used for warhead storage but also as a launch base[42] and to transport nuclear missiles. The missiles, personnel and related equipment can be transported by rail and trucks within the network of tunnels to various locations. All the activities for launch preparation can be done in the tunnels without detection. Some of the tunnels could also be for logistical support or command and control facilities.[43] Thus, China has moved its land-based missiles to underground basing to ensure a limited and reliable second-strike nuclear force after absorbing a first nuclear strike.[44]

The US conventional precision strike capability is well known, but the Chinese case offers new challenges. The USAF also possesses special munitions to destroy Hardened and Deeply Buried Targets (HDBT). As part of the anti-access capability, China has established an integrated air defence network which consists of advance Russian SAM systems like the S-300 series, S-400s and its Chinese derivatives like the HQ-9. To destroy the Chinese ICBM silos and Underground Facilities (UGF), the USAF needs precise target location and should be capable of penetrating the well defended Chinese air space. According to Carlo Kopp, only the F-22 and B-2 have enough stealth performance to penetrate this intense air defence environment. Nevertheless, the sortie generation rates will be low owing to three reasons which are interlinked. One, the limited number of B-2s (16 B-2s[45]) and the F-22 deployed; two, the B-2 stealth

41. http://thediplomat.com/flashpoints-blog/2011/08/20/chinas-underground-great-wall/
42. no. 16.
43. Ibid.
44. Ibid.
45. http://www.northropgrumman.com/analysis-center/paper/assets/The_2018_Bomber_the_case_for_a.pdf

bombers are designed to attack at night.[46] And, the F-22s can carry very limited munitions, and considering the limited sortie rates it can generate operating from long distance, it clearly falls short of the kind of intense and heavy bombing required for such operations. And three, the possible unavailability of air bases around China as they might be vulnerable to Chinese missile and air strikes, the missions need to be flown from long distances with mid-air refuelling. Particularly, such missions require high sortie rates. Dr. Robert Farley, an Associate Professor for the Patterson School of Diplomacy and International Commerce at the University of Kentucky, in his interview to *The Diplomat*'s Editor Harry Kazianis, opines that "a high-low mix of F-22s, F-35s and generation 4.5 fighters (such as the F-15 Silent Eagle) might make sense for the USAF, with the former contributing quality for cracking open difficult anti-access environments and the latter contributing the quantity necessary to have decisive effect in (newly) permissive environments. There are some missions that only an F-22 or an F-35 will be capable of conducting; there are many more (even in high-intensity peer competitor combat) that less capable legacy aircraft can capably address."[47] Nonetheless, in a nuclear crisis situation, a disarming operation would require quick results and, hence, the above concept is not suitable for these sorts of operations. Targeting platforms need to be on the hostile battle area for longer durations, particularly for hunting down mobile missiles. Mobile missiles are opportunity targets, meaning, they will allow only a small strike window even if detected. The targeting platforms have to reach striking distance before the window closes i.e. the capability to strike targets in near real-time.

The United States is working on a new bomber specifically for such anti-access environments. The project has been named the Next Generation Long Range Strike System (NGLRS) which is expected to be ready by 2018.

46. http://www.airforce-magazine.com/MagazineArchive/Pages/2006/October%20 2006/10062018.aspx
47. http://thediplomat.com/author-spotlight/2012/10/25/meet-the-diplomat-writers-31/?utm_source=The+Diplomat+List&utm_campaign=db693395e4-Diplomat+Brief+2012+vol19&utm_medium=email

Northrop Grumman, in its publication, has described the capabilities of this new system. These are:

- The NGLRS will operate over the increased distances, thus, mitigating the decline of air base availability.
- The NGLRS will ease access into any air space, in the face of adversaries adopting an anti-access/area denial strategy.
- The NGLRS will provide increased capacity, operating over extended ranges and within these environments, to deliver ordnance and effects, alone or as part of a "wolf pack" of netted manned/unmanned weapon systems that swarm over hostile targets.

In addition, the 2018 bomber will bring other needed capabilities:

- It will operate at a higher sortie tempo demanded in conventional theatre operations.
- It will be integrated into a netted Command and Control, Intelligence, Surveillance and Reconnaissance (C2ISR) enterprise, allowing it to receive and send targeting data from space assets, other airborne systems, surface and even sub-surface platforms. It will offer an open architecture for rapid upgrades and modifications. As such, it will be distinguished from previous bomber aircraft by its ability to conduct netted cyber operations that range from monitoring, intercepting and attacking enemy information nodes to augmenting the theatre commander's capacity to deliver highly survivable lethal effects.
- It will also provide a critical capability for the nation's leadership. An adequate NGLRS inventory will be able to hold at risk any hostile leadership, infrastructure, forces, or resources in a timely fashion with the required precision, and command and control.[48]

However, technology has its limits and the Chinese will use camouflaging to conceal their mobile missiles from US surveillance sensors. Moreover, in case China decides to deploy mobile missiles

48. http://www.northropgrumman.com/analysis-center/paper/assets/The_2018_Bomber_the_case_for_a.pdf

mated to their warheads, it would take a few minutes for launching their solid fuelled, mobile missiles.

DIRECTION OF CHINESE NUCLEAR FORCE

Since 1949, when the People's Republic of China (PRC) was founded, its primary strategic objective was to deter the United States from interfering in what it considers its domestic affairs. And it considered nuclear capability as the primary instrument in ensuring deterrence. Till date, the main pillar of that deterrence calculation are its nuclear missile force operated by the Second Artillery Corps. Development of nuclear missiles is one area which was not affected even during the Cultural Revolution. China deployed its first ICBM, the DF-5, which has a range of 13,000 km, capable of targeting the US mainland, in 1980. Nevertheless, the effectiveness of the deterrence was always in doubt considering the superior US nuclear and conventional capability to disarm China. So, China continued its efforts towards strengthening its nuclear deterrence by improving the survivability of its nuclear assets. At the same time, the US capability too advanced to offset the Chinese efforts which continued to plague the Chinese confidence on their deterrence capability. The Chinese keep trying to checkmate the US, but fortunately or unfortunately, this equation remains unsolved as both sides try to outsmart the other by adding on new systems to undo the advancement made by the other. In this unending balancing act which has entered the 21st century, when Communist China seems to be in a better position to challenge the US dominance, the nuclear equation between the two remains a key issue. The function remains the same while the variables in the equation keep changing and evolving.

Three important variables were studied in this paper: China's undersea deterrence, improving US BMD capability and its impacts on China's nuclear capability, and the efficiency of Chinese land-based ICBMs. From the study, it is quite evident that the Chinese nuclear deterrence force is not completely effective and remains vulnerable to hostile forces. While the Chinese undersea deterrence platforms are yet to become truly operational to

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add any meaningful deterrence value, their land-based ICBM force remains the only section that offers some real nuclear deterrence capability. The various efforts undertaken by China to enhance the survivability of its ICBM force since the first ICBM was deployed in 1980 has ensured a certain degree of effectiveness against a disarming nuclear or a conventional strike by the US. However, the US resolutely continues its efforts to neutralise the Chinese nuclear deterrence capability. The US is suffering from severe resource constraints in fielding advanced capability at a faster phase, as a result of which the Chinese are gaining an edge with their steadfast pursuit in improving their deterrence force. This dynamic equation is bound to continue till the time the political disputes are settled between the two, though the possibility for a settlement seems near to impossible at present.

The US efforts to improve and expand their BMD system and their superiority in naval capability to neutralise the Chinese undersea deterrence would degrade Chinese nuclear retaliatory capability, thereby making their nuclear deterrence less effective. This would force Beijing to initiate efforts to go for a qualitative and quantitative improvement of its nuclear force by increasing and improving the nuclear force structure by deploying more ballistic missiles with MIRV and MARV capability and penetration aids. Given their drawbacks and technological backwardness in their undersea deterrence force, it is logical to say that the Chinese will give more emphasis to their land-based ICBM force, which is comparatively more advanced than their naval deterrence platforms. While the primary emphasis would be for the land-based ICBM force, the Chinese will also strive to improve their undersea deterrence platforms because once the drawbacks are overcome and the systems are deployed, it will give the Chinese leaders a more survivable and reliable deterrence force. The current emphasis on the land-based deterrence component is evident from the recent testing of the MIRV capable DF-41. This missile offers sufficient range to target any

part of the US mainland and is also MIRV capable, which will be more effective in penetrating the missile defence shield being deployed by the US. At, present the land-based DF-5A, mobile DF-31A and DF-41, once they are deployed, form the core of the Chinese nuclear deterrence against the United States and will continue to do so for a few more years, at least a decade or so, until advanced and highly survivable Chinese boomers are deployed. Nevertheless, the minimum deterrence doctrine might not change due to various reasons, with the aim remaining the same, i.e. to operate the necessary force capable of delivering at least a few warheads on the enemy mainland.