AIR POWER

Journal of Air Power and Space Studies

Vol. 8 No. 2, Summer 2013 (April-June)

AIR POWER

CENTRE FOR AIR POWER STUDIES

New Delhi

AIR POWER is published quarterly by the Forum for National Security Studies for the Centre for Air Power Studies, New Delhi.

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ISBN: 81-87966-30-0

AIR POWER Journal is published four times a year and is distributed by
KW Publishers Pvt. Ltd.
4676/21, First Floor, Ansari Road, Daryaganj, New Delhi 110 002
Telefax: 23263498 e-mail: knowledgeworld@vsnl.net

Printed and Published by Air Cmde Jasjit Singh (Retd) on behalf of the Forum for National Security Studies (the Trust running the Centre for Air Power Studies, New Delhi) and Printed by Rajkamal Electric Press, Plot No. 2, Phase IV, HSIIDC, Kundli 131028, Sonepat, Haryana and Published at P-284, Arjan Path, Subroto Park, New Delhi 110 010. Editor: Air Commodore Jasjit Singh (Retd).

RNI REGN No. DELENG/2006/18450

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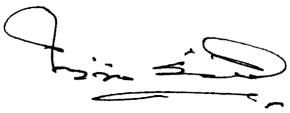
EDITOR'S NOTE

Time is certainly flying; but if key decisions are not taken urgently, the Indian Air Force (IAF) would land up curtailing its flying even more. Already it is experiencing over 24 per cent unplanned reduction in its combat force level, down from the interim authorisation of 39 squadrons. The contract for an MMRCA (Medium Multi-Role Combat Aircraft), even after it has been selected, is yet to be finalised, leave alone signed. Meanwhile, combat aircraft like the MiG-21/27 are finishing their life and more squadrons would get "number-plated" in the near future, reducing the combat force level further. On the other hand, it is reported that the LCA (Light Combat Aircraft as well as Low Cost Aircraft), which was expected to finally reach its IOC (Initial Operational Capability) by the end of this year, would be available only next year onward — 35 years after the IAF decided on the concept of an LCA. If the first lot of LCAs finally do get operational status, it will still be at a performance level lower than what was laid down decades ago, while aircraft performance across the world has been going up dramatically.

One can only hope that the French, not particularly known for their patience, will hold on, unlike their pull-out on the Alpha jet trainer competition leaving a single vendor in the play which factor itself delayed the BAE Hawk deal. In the most optimistic scenario, therefore, it will still take 5-6 years before we can expect the decline in the combat force level to start (leave alone achieve) returning to the authorised level of 39 combat squadrons. Meanwhile, a significant number of Mirage 2000, MiG-29, and even the earlier models of the Sukhoi SU-30MKI would have to be on the ground while undergoing planned upgrades. Look at the Chinese incursion

in Ladakh some weeks ago which was finally resolved through diplomatic processes — talking softly, but without the big stick as Roosevelt used to advise in the conduct of inter-state relations. It appears that with the decline in the IAF combat force, our stick has now become weaker.



IS INDIA'S NUCLEAR DETERRENT CREDIBLE?

SHYAM SARAN

Mr. Chairman, distinguished guests, ladies and gentlemen,

I wish to thank the Subbu Forum Society for Policy Studies, in particular my friend, Cmde Uday Bhaskar and the India Habitat Centre for once again giving me an opportunity to share with you my thoughts on certain issues of contemporary relevance to India's national security. And thank you, Sanjaya, for doing me the honour of presiding over this meeting. I recall well our fighting together in the trenches during the difficult negotiations on the Indo-US civil nuclear agreement. While I have been introduced as the Chairman of India's National Security Advisory Board, I must hasten to add that the views I shall be sharing with you today are entirely my own and do not in any way reflect those of the Board or of the government. These are views that have evolved over a fairly long period of time drawing upon my earlier experience in dealing with disarmament and international security issues at the Conference on Disarmament in Geneva, the two-year stint I had at the Prime Minister's Office in 1991-92, handling issues relating to external affairs, defence and atomic energy and, more recently, my involvement in the Indo-US negotiations on the civil nuclear cooperation agreement, both as Foreign Secretary and later as the Prime Minister's Special Envoy. I believe I

Ambassador **Shyam Saran** is Special Envoy to the Prime Minister and Chairman of the Research and Information System for Developing Countries.

A deliberate choice had been made to defer the acquisition of a nuclear weapon arsenal as long as there was still hope that the world would eventually move towards a complete elimination.

have a fair sense of how our security perceptions have evolved over the years and how different generations of our political leadership have dealt with the security challenges confronting the country. I make this presentation in the hope that there could be a more informed discourse on the role of India's strategic programme in national security, a discourse that is truly rooted in India's own circumstances rather than influenced by external commentaries.

India became a declared nuclear weapon state in May 1998, although it had maintained a capability to assemble nuclear explosive devices and had developed a delivery capability, in terms of aircraft as well as missiles, several years previously. In May 1998, this capability was finally translated into an explicit and declared nuclear weapon status through a series of nuclear tests. This is important to recognise because India did not overnight become a nuclear weapon capable state in May 1998, but until then, a deliberate choice had been made to defer the acquisition of a nuclear weapon arsenal as long as there was still hope that the world would eventually move towards a complete elimination of these weapons of mass destruction. India's leaders recognised the prudence of developing and maintaining national capability and capacity to develop strategic assets if this became necessary, but the preference remained for realising the objective of a nuclear weapon free world. The events of May 1998 reflected the judgement that nuclear disarmament was no longer on the agenda of the nuclear weapon states. On the contrary, their objective was to make permanent the division of the world into nuclear haves and have-nots, which India had rejected since the very dawn on the atomic age.

India's policy towards nuclear weapons evolved over a period of nearly three decades and this evolution was impacted by several significant developments in the country's security environment. The testing of a nuclear weapon by China in 1964 was the first major driver. There is evidence that

both Nehru and Homi Bhabha had not excluded the possibility of India acquiring nuclear weapons even earlier, in case India's security and defence warranted it. India's first plutonium separation plant came up in 1964 itself at Trombay when both Nehru and Bhabha were still in office.The pursuit of strategic capability took time and each subsequent stage would be linked to certain adverse developments in India's security environment. It would be 10 years before India carried out a peaceful nuclear explosion, in 1974, to signal its capability to design and fabricate a nuclear explosive device. In the background was a series of developments which had heightened India's security concerns and led to Prime Minister Indira Gandhi's decision to approve the nuclear test:

Reports began to appear that China had delivered a fully tested nuclear bomb design to Pakistan in 1983.

- The conclusion of the Non-Proliferation Treaty (NPT) in 1968 which sought to prevent the emergence of any new nuclear weapon state, without a concomitant and credible commitment on the part of the existing nuclear weapon states to achieve nuclear disarmament within a reasonable timeframe. India had to stay out of the treaty in order to maintain its nuclear option.
- The NPT was followed by the 1971 Bangladesh War and an unwelcome Sino-US axis targeting India. The appearance of the USS *Enterprise* in the Bay of Bengal heightened India's sense of vulnerability.

The next phase in the acquisition of capabilities is also linked to certain new developments adversely affecting India's security. Reports began to appear that China had delivered a fully tested nuclear bomb design to Pakistan in 1983. (China may have tested a Pakistani weapon at the Lop Nor test site in 1990). Pakistan emerged as a "frontline state" in the war against Soviet forces in Afghanistan in the decade of the 1980s, bringing fresh worries to India's security planners. Its feverish and clandestine pursuit of nuclear weapons capability also heightened threat perceptions in India, particularly when it became clear that the US was not willing to deter Pakistan from the quest, given its equities in the ongoing war.

This also marks the phase when Pakistan's nuclear weapon programme, which was led by its civilian political leaders, Zulfiqar Ali Bhutto and later Ghulam Ishaaq Khan, passed into the hands of its military establishment, thus, acquiring an altogether more sinister dimension. Today, Pakistan is the only nuclear-armed state where it is the military and not the civilian political leadership that is in effective control of the nuclear arsenal. During this period, India's sense of vulnerability increased due to the surge in the violent Khalistan movement, encouraged and supported by Pakistan as also the blowback from the ongoing war in Afghanistan. Despite these developments, Prime Minister Rajiv Gandhi launched a major initiative at the United Nations in 1988 to promote a world free of nuclear weapons through the Action Plan on Nuclear Disarmament. This was a serious effort to promote nuclear disarmament which would enable India to avoid the less preferable alternative of itself becoming a nuclear weapon state in order to safeguard its security and its political independence.

The decade of the Nineties constitutes the next phase in India's nuclear trajectory, leading up to the "break-out" in May 1998. This phase was marked by a serious debate within the political leadership over whether the time had come to go ahead with a declared nuclear weapon status or whether the likely international political and economic fallout made this a costly choice. As the decade of the 1990s unfolded, it became abundantly clear that the choice was being forced on India as a consequence of several serious geo-political developments.

What were the drivers during this phase? One, the US emerged as a hyper-power after the demise of the Soviet Union and this severely narrowed India's strategic space. Two, the nuclear weapon states moved to enforce a permanent status on the Nulcear Non-Proliferation (NPT) in 1995, thereby perpetuating the division between nuclear weapon states and non-nuclear weapon states, with oblique threats to use the UN Security Council to sanction and to penalise those countries which resisted the universalisation of the NPT. This would have put India in state of permanent strategic vulnerability to nuclear threat and blackmail. This may have happened during the India-Pakistan tensions in 1990 though the record is ambiguous

on this score (Yaqub Khan's visit to Delhi in 1990 is said to have been undertaken to convey the threat of nuclear retaliation against India in case the latter moved its conventional military forces to threaten or to attack Pakistan). During 1991-92, one was also witness to a determined attempt by the US to put serious limits on India's civilian space and missile programme by pressuring Russia under President Yeltsin to deny India the cryogenic engine technology that it needed to upgrade its civilian space capabilities. The precipitating factor proved to be the effort in 1996 to push through a discriminatory Comprehensive Test Ban Treaty (CTBT), which would have permanently foreclosed India's options to develop a credible and fully tested nuclear deterrent. These developments meant that India could no longer have any credible assurance of its security in the absence of its own independent nuclear deterrent. It would confront increased vulnerability vis-a-vis its adversaries, its security would have been severely undermined and made its quest for strategic autonomy a mirage. It is against this background that a decision was taken in May 1998 to breach the narrowing nuclear containment ring around the country and assert India's determination to retain its ability to deter threats from states hostile to it and to ensure an environment in which it could pursue its development priorities without disruption. This is clearly articulated in India's Draft Nuclear Doctrine released in August 1999. The official doctrine based mainly on the draft was adopted in January 2003, but its full text has not been shared with the public.

The precipitating factor proved to be the effort in 1996 to push through a discriminatory Comprehensive Test Ban Treaty (CTBT), which would have permanently foreclosed India's options.

It is important to keep this historical perspective in mind because the nuclear tests carried out in May 1998 were not a mere episode driven by current and largely domestic political compulsions (though this may have influenced the precise timing), but rather the logical and perhaps an even inexorable culmination of a decades-long evolution in strategic thinking, influenced by an increasingly complex and hostile security environment.

The shift to a declared nuclear weapon state posture confronts India with new and more complex challenges.

The timing may have also been influenced by geo-political developments. The end of the Cold War and the rise of China brought a sense of strategic opportunity to India. The collapse of the Soviet Union meant that the US was no longer inimical to Indian interests as it had been during the Cold War years, with India seen as being on the wrong side of the fence. China's emergence as a potential adversary to the US made a more rapidly growing India an attractive countervailing power, quite apart from the opportunities it offered to US business and industry. India's swift emergence as an Information Technology (IT) power and the rising affluence and influence of the Indian-American community, reinforced the positive shift in American perceptions about India. Therefore, while fully conscious of the adverse fallout from its decision to undertake a series of nuclear tests and to establish itself as a declared nuclear weapon state, India's leaders may also have calculated that such fallout would be temporary and India's growing strategic relevance would eventually overcome such impediments. This judgement has proved to be true in most respects.

There is no doubt that the shift to a declared nuclear weapon state posture confronts India with new and more complex challenges. These challenges involve the nature and structure of the nuclear weapon arsenal as well as delivery assets. India has articulated a nuclear doctrine that is appropriate to the current geo-political environment, is aligned with its existing and projected levels of technological capabilities and affordability and, most importantly, is reflective of India's domestic realities and its value system. The people of India want their leaders to pursue an independent foreign policy, maintain strategic autonomy and safeguard the security of the country and its citizens by having adequate means to deter threats to national sovereignty and territorial integrity. Sustaining democracy within the country is seen as integrally linked to the ability of the state to deliver on these fundamental aspirations. At various stages of India's contemporary history, the Indian state has pursued different strategies to achieve these

objectives in a nuclearised, asymmetrical and often hostile regional and global environment. It has had to make difficult choices, including embracing a three-decade-long strategic partnership with the Soviet Union from 1960 to 1990, which helped the country to meet the threat from an implacably hostile and belligerent Pakistan and a China that turned into a threatening and often arrogant adversary, post India's humiliating defeat in the 1962 border war. Those who perennially bemoan India's lack of strategic culture such as the recent *Economist* article, seem strangely reluctant to acknowledge the difficult choices that governments of every persuasion in the country have made, whether in seeking strategic partners, maintaining a nuclear option or eventually exercising that option despite the odds confronting us. That mistakes have been made, that sometimes opportunities have been missed or our judgments were misplaced is undeniable. But if having a strategy means the readiness to make reasoned choices, then India has demonstrated an ability to think and act strategically.

It is against this background that I find somewhat puzzling assertions by some respected security analysts, both Indian and foreign, that India's nuclear weapons programme has been driven by notions of prestige or global standing rather than by considerations of national security. For example, typical of comments from US analysts is the remarkable observation that "India now lacks a credible theory of how nuclear weapons might be used than as an instrument of national pride and propaganda".

India does have a credible theory of how its nuclear weapons may be used and that is spelt out in its nuclear doctrine. One may or may not agree with that doctrine but to claim that India does not have a credible theory about the use of nuclear weapons does not accord with facts. Since January 4, 2003, when India adopted its nuclear doctrine formally at a meeting of the Cabinet Committee on Security (CCS), it has moved to put in place, at a measured pace, a triad of land-based, air-delivered and submarine-based nuclear forces and delivery assets to conform to its declared doctrine of no-first use and retaliation only. It has had to create a command and control infrastructure that can survive a first strike and a fully secure communication system that is reliable and hardened against radiation or electronic interference. A

number of redundancies have had to be created to strengthen survivability. India today has a long range ballistic missile capability and is on the road to a submarine-based missile capability. These capabilities will be further improved as time goes on and more resources become available. In all these respects, significant progress has been achieved. To expect that these should have emerged overnight after May1998 is rather naïve. The record since the May 1998 nuclear tests demonstrates quite clearly a sustained and systematic drive to operationalise the various components of the nuclear deterrent in a manner best suited to India's security environment. This is not the record of a state which considers nuclear weapons as "instrument of national pride and propaganda".

There is a similar refrain in Chinese commentaries on India's nuclear weapons programme. Here is a typical Chinese comment:

> Unlike China, which was forced to develop its nuclear option under a clear nuclear threat, India has never been faced with an immediate major military or nuclear threat that would require New Delhi to have a nuclear weapon option to ensure its national survival. The acquisition of nuclear weapons appears to have been almost entirely motivated by politics. India seems to have an explicit strategic goal: to be accepted as a world power. And this goal seems to reflect India's deep-rooted belief that nuclear weapons constitute an effective physical signature of world power status, and even a short-cut to this status.

And this extraordinary assessment of India's quest for security in a nuclearised regional and global environment comes from an analyst of a country which over the years actively and relentlessly contributed to the clandestine nuclear weapon programme of Pakistan, firstly, by providing it with the design of a tested weapon and, later, by assisting it with developing its missile capabilities, both directly and through its North Korean ally. This is a rare case where a nuclear weapon state has actively promoted the acquisition of nuclear weapon capability by a non-nuclear weapon state, though similar allegations have been made about the US and French

assistance to Israel. Chinese assistance to Pakistan's strategic programme continues apace.

Could India ignore the implications of this alliance and the role of Pakistan as a most convenient Chinese proxy to pose a nuclear threat to India? The narrative that I have sketched out does not square with the observation that "India has never been faced with an immediate major military or nuclear threat that would require New Delhi to have a nuclear weapon option to ensure its national survival". And it is rather odd that a representative of a country whose iconic leader Mao Zedong called for "politics in command" can now say that India's nuclear programme has been "almost entirely motivated by politics". Of course, it has been, but not the politics of seeking world power status, as is claimed, but the politics of keeping India and its citizens safe from nuclear threats. We have long been familiar with the Chinese predilection to dismiss India's role in international affairs as that of a pretender too big for its boots, while China's superpower status is, of course, regarded as manifest destiny. One should reject such self-serving assertions.

What is worrying, however, is that this status-seeking argument has been finding an echo among some Indian analysts as well. One analyst recently claimed:

> During its long and unfocused nuclear weapons quest, India came to develop a highly self-absorbed approach. This was because India's dominant objective was political and technological prestige, while for every other nuclear weapon state, it was deterrence.

Such sweeping statements show a lack of familiarity with the history of India's nuclear weapons programme, set against the broader political and security backdrop. They also serve to diminish the very legitimacy of India's nuclear weapons status though this may not be the intention. For if deterrence was not the reason for which India became a nuclear weapon state, but only for "political and technological prestige", then why should it have nuclear weapons in the first place?

It is clear that at least two legs of the triad referred to in our nuclear doctrine are already in place.

If the argument is that India has and does face threats for which a nuclear deterrent is required, but that these have been ignored by successive generations of India's political and security elite, then obviously it must be a mere fortuitous coincidence that we have strayed into a strategic capability. This elite, it is implied, comprehends neither the security threats nor the manner in which this accidental acquisition of nuclear weapons and delivery capabilities, must be operationalised. This does not square with the facts.

The thesis that India's nuclear deterrent is mostly symbolic is, for some, driven by the perception that India's armed forces are not fully part of the strategic decision-making process and that they play second fiddle to the civilian bureaucracy and the scientific establishment. Even if this perception was true, and, in fact, it is not, one cannot accept that the credibility of India's nuclear deterrence demands management by its military. The very nature of nuclear deterrence as practised by a civilian democracy dictates that decisions relating to the nature and scope of the arsenal, its deployment and use, be anchored in the larger architecture of democratic governance. It is the civilian political leadership that must make judgments about domestic political, social and economic priorities as well as the imperatives imposed by a changing regional and global geo-political environment. The military must be enabled to provide its own perspectives and inputs, just as other segments of the state must do. Undoubtedly, the military's inputs and its advice would have to carry weight, especially in operational matters. But to equate exclusive military management of strategic forces, albeit under the political leadership's overall command, as the *sine qua non* of deterrence credibility is neither necessary nor desirable. One should certainly encourage better civil-military relations and coordination. It may also be argued that the military's inputs into strategic planning and execution should be enhanced to make India's nuclear deterrent more effective. But one should not equate shortcomings in these respects with the absence of a credible nuclear deterrent.

If we look at the current status of India's nuclear deterrent and its command and control system, it is clear that at least two legs of the triad referred to in our nuclear doctrine are already in place. These include a modest arsenal, nuclear capable aircraft and missiles in fixed underground silos as well as those which are mounted on mobile rail and road-based platforms. These land-based missiles include both the Agni-II (1,500 km) as well as the Agni-III (2,500 km) missiles. The range and accuracy of further versions for example, the Agni-V (5,000 km) which was tested successfully only recently, will improve with the acquisition of further technological capability and experience. The third leg of the triad which is submarine-based, is admittedly work in progress. We need at least three Arihant class nuclear submarines so that at least one will always be at sea. Submarine-based missiles systems have been developed and tested in the form of the Sagarika but these are still relatively short in range. It is expected that a modest sea-based deterrence will be in place by 2015 or 2016.There is also a major Research and Development (R&D) programme which has been in place since 2005, for the development of a new,longer range and more accurate generation of submarine-based missiles which are likely to be ready for deployment around 2020.

The National Command Authority is in charge of India's nuclear deterrent. At its apex is the Political Council which is headed by the Prime Minister and includes all the ministerial members of the Cabinet Committee on Security such as the Ministers of Defence, Home and External Affairs. Below the Political Council is the Executive Council which is headed by the National Security Advisor and includes the Chiefs of the three armed forces and the Commander-in-Chief (C-in-C) of India's Strategic Forces Command, a three-star officer, among others. There is an alternate National Command Authority which would take up the functions of nuclear command in case of any contingency when the established hierarchy is rendered dysfunctional. The NCA has access to radiation hardened and fully secured communication systems where, too, redundancies have been put in place as back-up facilities.

Among the nuclear weapon states today, Pakistan is the only country where nuclear assets are under the command and control of the military.

In order to support the NCA, a Strategy Programme Staff has been created in the National Security Council Secretariat to carry out general staff work for the National Command Authority. This unit is charged with looking at the reliability and quality of our weapons and delivery systems, collating intelligence on other nuclear weapon states, particularly those in the category of potential adversaries, and working on a perspective plan for India's nuclear deterrent in accordance with a ten-year cycle. The Strategy Programme Staff has representatives from the three Services, from our science and technology establishment and other experts from related domains, including external affairs. A Strategic Armament Safety Authority has been set up to review and to update storage and transfer procedures for nuclear armaments, including the submarine-based component. It will be responsible for all matters relating to the safety and security of our nuclear and delivery assets at all locations. This will function under the direct authority of the NCA.

The National Command Authority works on a two-person rule for access to armaments and delivery systems.

Regular drills are conducted to examine possible escalatory scenarios, surprise attack scenarios and the efficiency of our response systems under the no first use limitation. Thanks to such repeated and regular drills, the level of confidence in our nuclear deterrent has been strengthened. Specialised units have also been trained and deployed for operation in a nuclearised environment.

These details may be known but I am highlighting them to make the point that while further steps may be required to make our deterrent more robust, it is unhelpful and misleading to peddle the impression that it is dysfunctional, or worse, that it is non-existent.

In much of Western literature, one finds frequent comments about the professional manner in which the Strategic Planning Group, in charge of Pakistan's nuclear assets, is run and how effective and transparent

measures have been put in place to ensure the safety and security of these weapons. What is rarely highlighted is that among the nuclear weapon states today, Pakistan is the only country where nuclear assets are under the command and control of the military and it is the military's perceptions and ambitions which govern the development, deployment and use of these weapons. This is a dangerous situation precisely because the military's perceptions are not fully anchored in a larger national political and economic narrative. The pursuit of a more powerful, more effective and more sophisticated nuclear arsenal, dictated by the Pakistani military, may run in parallel with a steadily deteriorating political, social and economic environment. Would it be possible to island an efficiently managed and sophisticated nuclear arsenal amidst an increasingly dysfunctional polity? There is an air of unreality about the often adulatory remarks about the Pakistani military's stewardship of the country's nuclear assets. There are anxieties about its continuing build-up of nuclear weapons and delivery vehicles but these are conveniently ascribed to the threat perceived from India. More recently, Pakistan's relentless build-up of its nuclear arsenal, its refusal to allow the Conference on Disarmament in Geneva to undertake multilateral negotiations on a Fissile Material Cut-Off Treaty (FMCT) and its threat to deploy theatre nuclear weapons to meet a so-called Indian conventional armed thrust across the border have all been laid at the door of the Indo-US civil nuclear agreement, which it is claimed has upset the "nuclear balance" in South Asia. The votaries of non-proliferation in the West have criticised the agreement as having allowed "exceptionalism" in favour of India, which has encouraged a nuclear arms race between India and Pakistan. Pakistan openly demands that it too be given a nuclear deal like India, otherwise it would continue to produce larger quantities of fissile material and push the nuclear threshold even lower in order to retain the credibility of its nuclear deterrent. The exception provided to India rests on India's universally acknowledged and exceptional record as a responsible nuclear state with an unblemished history in non-proliferation as contrasted with Pakistan's equally exceptional record as a source of serial proliferation

Pakistani motivation is to dissuade India from contemplating conventional punitive retaliation to sub-conventional but highly destructive and disruptive cross-border terrorist strikes.

and in possession of a nuclear programme born in deceit and deception. There is no moral equivalence in this respect between the two countries and this point must be driven home every time Pakistan claims parity. We should not allow such an insidious campaign to affect our proposed membership of the Nuclear Suppliers Groups (NSG) and Missile Technology Control Regime (MTCR).

In dismissing India's nuclear deterrent as driven by pride and prestige, the Pakistani nuclear deterrent is sought to be projected as somehow more understandable, more justified, because unlike India, it is said to be driven by so-called real security threats. The more shrill the articulation of these imaginary threats, the more justified the rapidly growing Pakistani nuclear arsenal is seen to be in the eyes of some motivated analysts. The next link in the argument would be that if only India could be persuaded to discard its pride and false sense of prestige and status, a strategic restraint regime, if not a non-nuclear regime, between the two sides would become possible and the world relieved from having to deal with the "most dangerous part of the world."

Pakistan's nuclear weapons are certainly focussed in large part on the threat from India, real or imagined. In the present case, the Pakistani motivation is to dissuade India from contemplating conventional punitive retaliation to sub-conventional but highly destructive and disruptive cross-border terrorist strikes such as the horrific 26/11 attack on Mumbai. What Pakistan is signalling to India and to the world is that India should not contemplate retaliation even if there is another Mumbai because Pakistan has lowered the threshold of nuclear use to the theatre level. This is nothing short of nuclear blackmail, no different from the irresponsible behaviour one witnesses in North Korea. It deserves equal condemnation by the international community because it is not just a threat to India but to international peace and security. Should the international community

countenance a licence to aid and abet terrorism by a state holding out a threat of nuclear war?

But today, given the evidence available, is it even possible to claim that the so-called Indian threat is the sole motivation which drives Pakistan's nuclear programme?

Let us look at some of the significant shifts that have taken place recently in Pakistan's nuclear posture, taking it from declared "minimum deterrence" to a possible second strike capability.

There is a calculated shift from the earlier generation of enriched uranium nuclear weapons to a newer generation of plutonium weapons.

Plutonium weapons would enable Pakistan to significantly increase the number of weapons in its arsenal, Pakistan is reported to have overtaken India's nuclear weapon inventory and, in a decade, may well surpass those held by Britain, France and China.

Progress has been claimed in the miniaturisation of weapons, enabling their use with cruise missiles and also with a new generation of short range and tactical missiles .This is not yet fully verified but the intent is clear.

Pakistan has steadily pursued the improvement of the range and accuracy of its delivery vehicles, building upon the earlier Chinese models (the Hatf series) and the later North Korean models (the No-dong series). The newer missiles, including the Nasr, are solid-fuelled, which can be launched more speedily than the older liquid fuelled ones.

Pakistan's nuclear programme brings its scientific and technological accomplishments into the limelight. Pakistan repeatedly draws attention to its being the only Islamic country to have a sophisticated nuclear weapons programme. This gives it a special standing in the Islamic world. One should not underestimate the prestige factor in this regard.

These developments are driven by a mindset which seeks parity with, and even overtaking, India, irrespective of the cost this entails. However, they are also driven by the more recent fear that the US may carry out an operation, like the one mounted in May 2011, to kill Osama Bin Laden in Abbotabad, to disable, destroy or confiscate Pakistan's nuclear weapons. The increase in the number of weapons, the planned miniaturisation

of warheads and their wider dispersal, are all designed to deter the US from undertaking such an operation. This aspect has acquired increasing salience in Pakistani calculations. Recent articles which claim that the US has contingency plans to take out Pakistan's nuclear weapons in case of a *jihadi* takeover of its government or if the Pakistan Army itself splits into a pro-*jihadi* and an anti-*jihadi* faction, with the danger that the country's nuclear arsenal is no longer in safe and secure hands, must have heightened the paranoia among Pakistan's military and bureaucratic elite.

Pakistan has, nevertheless, projected its nuclear deterrent as solely targeted at India and its strategic doctrine mimics the binary nuclear equation between the US and the Soviet Union which prevailed during the Cold War. But in a world of multiple nuclear actors, there is pervasive uncertainty about how the nuclear dynamic will play itself out even if a nuclear exchange commenced with only two actors. What may be a zero-sum game with two actors may not be so for a third or a fourth actor. For example, the long history of the Sino-Pakistan nuclear nexus determines that China will be a factor influencing security calculations in New Delhi, Islamabad and Washington. How will a nuclear exchange, often posited between India and Pakistan, impact on China, and would India be prudent not to factor that into its nuclear deterrence calculations? In the context of Japan and South Korea, can the nuclear threat posed by North Korea be delinked from China's strategic posture in the region? How would these calculations affect US nuclear posture? And how would Russian strategists react ?It is because of this complexity that notions of flexible response and counter-force targeting, which appeared to have a certain logic in a binary US-Soviet context, lose their relevance in the multi-dimensional threat scenario which prevails certainly in our region. It is no longer sufficient to analyse the India-Pakistan or India-China nuclear equation only in the bilateral context. Therefore, Pakistan's nuclear behaviour should be a matter of concern not just to India but to the international community. It obviously is for the US though it is usually made out to be a matter for, and related to, Pakistan's relations with India.

It is also this complexity in multiple and interlinked nuclear equations which argues for an early realisation of global nuclear disarmament through

multilateral negotiations and India's championing of this cause is not all contradictory to its maintenance of a robust nuclear deterrent in the meantime.

India's nuclear doctrine categorically affirms India's belief that its security would be enhanced, not diminished, in a world free of nuclear weapons.

The above background must be kept in mind when evaluating India's continued insistence on the central tenet of its nuclear doctrine i.e., that India will not be the first to use nuclear weapons, but that if it is attacked with such weapons, it would engage in nuclear retaliation which will be massive and designed to inflict unacceptable damage on the adversary. As I have pointed out earlier, the label on a nuclear weapon used for attacking India, strategic or tactical, is irrelevant from the Indian perspective. A limited nuclear war is a contradiction in terms. Any nuclear exchange, once initiated, would swiftly and inexorably escalate to the strategic level. Pakistan would be prudent not to assume otherwise as it sometimes appears to do, most recently by developing and perhaps deploying theatre nuclear weapons. It would be far better for Pakistan to finally and irreversibly abandon the long-standing policy of using cross-border terrorism as an instrument of state policy and pursue nuclear and conventional confidence-building measures with India which are already on the bilateral agenda. An agreement on no first use of nuclear weapons would be a notable measure following up on the commitment already made by the two countries to maintain a moratorium on nuclear testing.

As would be apparent, in the case of India, it is the security narrative which is the most significant driver of its strategic nuclear capability though India has consistently followed a cautious and restrained approach. India's nuclear doctrine categorically affirms India's belief that its security would be enhanced, not diminished, in a world free of nuclear weapons. The elements of pride and prestige are secondary as they always are in the complex basket of elements that influence strategic choices which countries make.

In my view, the mostly self-serving and misconceived notions about India's nuclear deterrent that have found currency in the recent past, have

much to do with the failure on the part of both the state as well as India's strategic community to confront and to refute them. The ease with which motivated assessments and speculative judgments, of the kind I have drawn attention to, invade our own thinking, is deeply troubling.

The secrecy which surrounds our nuclear programme, a legacy of the long years of developing and maintaining strategic capabilities, is now counter-productive. There is not enough data or information that flows from the guardians of our strategic assets to enable reasoned judgments and evaluations. There has been significant progress in the modernisation and operationalisation of our strategic assets, but this is rarely and only anecdotally shared with the public. The result is an information vacuum which then gets occupied by either ill-informed or motivated speculations or assessments. To begin with, I would hope that the government makes public its nuclear doctrine and releases data regularly on what steps have been taken and are being taken to put the requirements of the doctrine in place. It is not necessary to share operational details but an overall survey such as an annual Strategic Posture Review, should be shared with the citizens of the country who, after all, pay for the security which the deterrent is supposed to provide to them. An informed and vigorous debate based on accurate and factual information should be welcomed, because only through such debate can concepts be refined, contingencies identified and the most effective responses formulated. In a democracy, this is critical to upholding a broad consensus on dealing with the complex and constantly evolving security challenges our country confronts.

I thank you for your attention.

AIR MAINTENANCE 2025: PROSPECTS AND LIMITATIONS

MANMOHAN BAHADUR

Air maintenance conducted by the Indian Air Force (IAF) has been the lifeline for the Indian Army and the civil administration, especially in the Ladakh sector and the northeast. There is no rail connectivity to the Ladakh valley, while the road infrastructure to the east was indeed very poor till the Seventies and rail connectivity was by metre gauge, with just a solitary bridge at Guwahati. In such an austere environment, air maintenance sorties provided succour to the Army and the civilian population and administration as well. In the north, Chandigarh, and, in earlier days, Jammu and Srinagar, were the launch pads for the air maintenance effort, with Dakotas, Il-14s, Packets and AN-12s providing the airlift. In the east, airfields were few and far between, and the air assets revolved around the venerable Dakotas and Caribous, with communication sorties being the forte of Otters. The acquisition of Mi-4s in the 1960s brought some rotary-wing capability and added to the air logistics effort of the Air Force.

The threat too was of a limited nature -- or was it so? We learnt to our abiding shame in 1962 that in the real world there is perhaps no *bhai-bhai* feeling—it's all a question of keeping one's powder dry at all times. Somebody has also rightfully said that "eternal vigilance is the price of liberty." Did we get better after the debacle? Yes we did, but not to the extent that one would have wanted. The reasons are many and have

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their roots in the political and economic power structure in our country. Additionally, China went through an internal upheaval in the 1960s and 1970s that reduced the imminent threat to our northern borders -- it didn't go away, but it was not live either. So, the urgency lost its own impetus!

Events, however, have moved very fast on the Chinese side since the 1980s. While China's economic progress has been stupendous, its civil and military infrastructure has also improved by leaps and bounds, especially in the Tibetan region adjoining our northern and northeastern borders. We have woken up to the threat a bit late -- but better late than never![1] The road infrastructure and airfields are sought to be improved so that connectivity for the sustenance of our Army and the civil population can be maintained round the year. Still, we are far from our target and it is in this field that the IAF would continue to be called upon to do what it has been doing for the past five decades -- air maintenance.

The aim of this paper is to peep into the future and delve into the prospects and limitation of air maintenance in the eastern part of India, *circa* 2025.

THREAT PERCEPTION

Our past defence strategy had been structured around the ability to wage a full scale war against either China or Pakistan and yet have the ability to dissuade or contain the other.[2] With the changing equations between the countries in the region and China calling Pakistan an "all weather ally," the possibility of a collusive threat from both against India cannot be ruled out.[3] Therefore, we must upgrade our capability to handle two fronts**;** the purported lack of such capability reportedly compelled the Parliamentary Standing Committee on Defence to call the three Service Chiefs before it in

1. Sandeep Unnithan, "Belated Awakening," *India Today* (New Delhi), February 7, 2008.
2. Rajat Pandit, "Two Front-War Remote, but Threat From China Real," *The Times of India* (New Delhi), October 12, 2012.
3. Lt Gen Kamal Davar, "Red Dragon in India's North-West," *Indian Defence Review*, July 18, 2012, available at http://www.indiandefencereview.com/news/red-dragon-in-indias-north-west/, accessed on July 24, 2012. Also see Dr Suhash Kapila, "India's Defense Postures In Ladakh: A Wake-Up Call," *South Asia Analysis Group*, available at http://www.southasiaanalysis.org/%5Cpapers41%5Cpaper4050.html, accessed on July 24, 2012.

April 2012.[4] While our presence in the northern and western borders has got the attention it deserves, the same cannot be said with the same assurance about the eastern front;[5] this is sought to be rectified, with the raising of new Army units and associated firepower, and augmentation of air power assets and infrastructure.[6] The load of air maintenance for the increased workforce would, thus, increase – or would it?

The availability of air assets has been a restricting factor in meeting all the military and civil requirements.

This paper will discuss the prospects and limitations of air maintenance by analysing the past trends in logistics supply from the air carried out the IAF, and discuss the shortfall in the air effort, as demanded by the Indian Army which is the main indenter and recipient. Would the demand for air maintenance go up further, and in what quantum, would be the next question that would be addressed. What about the road infrastructure, the absence of which is the primary cause of air maintenance? This would be appraised, especially the envisaged construction of new road networks and their impact on the air maintenance requirements. The availability of air assets has been a restricting factor in meeting all the military and civil requirements. What would be the impact on air maintenance capability of the increase that is planned in the aerial assets of the IAF? In all this analyses, only unclassified information available in the open domain would be used.

PAST TRENDS IN AIR MAINTENANCE

Air maintenance has been the bread and butter of transport and helicopter operations, especially in eastern India. It has always been so and the reference dates back, not to the 1950s and the 1960s but to World War II when air maintenance of sorts was done by the Americans across the Hump to aid Chiang Kai-shek's Nationalist Kuomintang (KMT) Chinese forces. It is indeed

4. Praveen Swamy, "Parliamentary Panel Summons Military Chiefs," *The Hindu* (New Delhi), April 10, 2012.
5. Unnithan, n. 1.
6. Ajai Shukla, "New Strike Corps for China Border," *Business Standard*, August 24, 2011, available at http://www.business-standard.com/india/news/new-strike-corps-for-china-border/446854/ accessed on July 24, 2012.

an irony that the IAF is doing air maintenance for its troops and civilians from literally the same airfields, made by the Americans, this time as a **counter** to the Chinese build-up across our borders! By the end of World War II, the number of American aircraft in India had grown to 722, and the strength of personnel had swelled from 26,000 to more than 84,000. Accelerated flight activity during the final offensives against Japanese forces in China meant that one transport aircraft took off every three minutes**;** there was no eastern control, or any area air traffic control radar for that matter—and a lot is being made now of one arrival and departure every two minutes from Indira Gandhi International Airport at Delhi! In early 1945, the monthly cargo delivered to China reached 44,000 tonnes, and peaked at 71,000 tonnes in July.[7] The weather and the terrain are as treacherous as ever but what has improved enormously are the living conditions of the personnel as also the connectivity of the northeast to central India by rail and road—the same, however, cannot be said of the road network within the northeastern area to the civil and military outposts situated further on the borders.

The 1962 Indo-China War was a defining moment in our independent history. As per the Official History of the 1962 War, the IAF transport fleet had just 206 aircraft, the majority being Dakotas (95 in number), 51 Packets and just six AN-12s (in the newly formed 44 Squadron at Chandigarh which flew to Leh and Chushul). In the Northern Sector, the air supply and casualty evacuation received a boost when the Mi-4s were inducted in Leh with the arrival of 107 Helicopter Unit. The Army wanted to induct five battalions in the Ladakh Sector but due to shortage of aircraft (and virtually no roads), only four battalions could be flown in. Additionally, the available airlift had to be divided into allotment for maintenance and induction of troops, maintenance for airfields and for construction of roads.[8] So, road building had to share the available effort, a perpetual complaint of the Border Roads Organisation, and a fact even today.

7. See description of Hump operations at http://en.wikipedia.org/wiki/The_Hump, accessed on December 20, 2012.
8. P.B. Sinha and A.A. Athale, *History of the Conflict with China, 1962* (Indian Ministry of Defence, 1992), ch VII, pp. 347-350, available at www.bharat-rakshak.com/LAND-*FORCES/Army/History/1962War/PDF/1962Chapter08.pdf*

In the east too, the situation was no better. Here, the IAF's transport fleet (comprising Dakotas, Caribous and Otters) was supported by some trail blazing flying done by Biju Patnaik's Kalinga Airways which flew basically in support of Assam Rifles. However, the events of October 1962 changed the picture, and the load carrying capability of Kalinga Airways became part and parcel of the total availability.[9] Load distribution was decided in almost exactly the same way as it is being done now, with an annual conference at Air Headquarters (HQ) and quarterly ones at Command HQ.

The airlift capability of the IAF during the 1962 hostilities was only around 400 tonnes per day in both the sectors combined, whereas the requirement was around 600 tonnes.

The airlift capability of the IAF during the 1962 hostilities was only around 400 tonnes per day in both the sectors combined, whereas the requirement was around 600 tonnes. After the ceasefire, the Indian government requested the British to carry out a study of the airlift requirements. The British assessed that the annual air-drop requirement for the Northeast Froniter Agency (NEFA) and Ladakh and adjoining areas to be 153,000 tonnes, which included a landing tonnage of 95,000![10] The capability of the IAF was just half the requirement. The overall airlift projection kept increasing with induction of additional troops into the forward areas. The Americans were requested to help with the stocking and positioning of the troops. Twelve C-130 Hercules aircraft of the 322 Air Division operated from Palam, Delhi**;** though they were committed basically to stock up Leh, some sorties were flown to Tezpur and Bagdogra also. This offloaded the IAF transport fleet, which concentrated mainly for operations in the east. The Americans were in India for almost ten months (the last C-130 left Palam on August 17, 1963).[11]

Air maintenance operations settled into a regular pattern thereafter**.** In the north, it was a totally fixed-wing affair, with AN-12s doing the bulk of

9. Ibid., p. 353.
10. Air Mshl Bharat Kumar (Retd) *Unknown and Unsung: Indian Air Force in Sino-Indian War of 1962* (New Delhi: KW Publishers Pvt Ltd, 2013), p. 116.
11. Ibid., p. 352.

Each year, in both sectors combined, fixed-wing aircraft of the IAF airlift and/or drop around 25,000 tonnes for the Army and civil agencies while the rotary-wing aircraft do air maintenance of around 8,000 odd tonnes currently.

the delivery. In the east too, it was predominantly fixed-wing oriented, with the Dakotas and Caribous holding centre-stage and Otters doing yeoman service by providing the link to small Advance Landing Grounds (ALGs). The Mi-4 did its bit but with the arrival of the Mi-8s and later Mi-17s, the thrust shifted to rotary-wing air supply, as it was more accurate and resulted in fewer losses. Opening up of certain hitherto inaccessible areas by road in the east was also a factor in this switchover. Statistics of the air maintenance tasking of the IAF of the past decade available in the open domain show that each year, in both sectors combined, fixed-wing aircraft of the IAF airlift and/or drop around 25,000 tonnes for the Army and civil agencies while the rotary-wing aircraft do air maintenance of around 8,000 odd tonnes currently. The distribution of the air maintenance task requires fixed-wing aircraft to operate from Air Force bases to Dropping Zones (DZs) or advance airfields/ALGs like Thoise and Mechuka to position loads. The helicopters operate from these forward bases/ALGs and several other mounting bases to a very large number of helipads. It's the heli-lift that is critical and this paper would discuss how it would shape up in the future.

Historical data show that the demand from the Army has been rising by the year, leading to a mismatch between its expectations and the load actually delivered. But a point that needs to be kept in mind is that before the start of each financial year, the Air Force conveys to the Ministry of Defence its capability for the coming financial year, in terms of tonnage that can be tasked towards air maintenance in the north and the east. Besides the Army (which is the major client), there is a number of civil agencies like the Border Roads Organisation, Arunachal Pradesh government, Postal Department, Assam Rifles, Indo-Tibetan Border Police/Force, etc, that vie for air support from the IAF**;** however, it is the Ministry of Defence which does the final allocation. This leads to gaps between the air effort demanded

by the Army and the figures allotted, an aspect that has been a source of perpetual conflict at the two Services HQ, decade after decade. Thus, there is a shortfall, as seen by the Army, though the IAF has no control over the allocation. It is important that before solutions are suggested, the expansion plan of the Army is studied (as brought out earlier, only unclassified details available in the open domain would be considered).

Force Accretion Plan: A major force accretion has been planned by the Indian Army, especially in the Eastern Theatre, as has been widely reported in the national press. The *Business Standard* reported on August 24, 2011, that two mountain divisions comprising 35,000 troops were to be raised in the 11th Plan (2007-12) while sanction has also been accorded for a Mountain Strike Corps comprising 40,000 troops to become functional in the 12th Plan (2012-17). The strike corps would have its own complement of mountain artillery, combat engineers, anti-aircraft guns and radio equipment and would be supported by Indian Air Force fighters, operating from newly renovated bases in the northeast.[12]

ANALYSIS OF AIR MAINTENANCE REQUIREMENTS.

- It is logical to assume that the requirement would increase with every passing year while the perception is that it should reduce with time as the road network improves. The increase in air maintenance requirement would primarily come about because there would be an augmentation in the number of posts and/or increase in the strength of troops at the posts**;** increase in scale of rations is also a factor, as is the number of times a soldier can now go on leave. To cater for this, besides the IAF courier flights, there are now five civil couriers per week from Delhi to Leh, two per week to Thoise, four per week to Srinagar and one to Kolkata/ Imphal —and this frequency is likely to increase further.
- The load of air maintenance on the IAF for the Northern Sector is comparatively much larger than for the Eastern Sector. This is because of

12. Shukla, n. 6. See also Josy Joseph, "High Costs Stall Army's Plans on China Border", *The Times of India,* August 26, 2011. Vinay Kumar, "India Evaluating China's Military Exercises in Tibet," *The Hindu* (New Delhi), August 26, 2012, available at http://www.thehindu.com/news/national/article3824862.ece

The high air maintenance demand would continue until the Srinagar-Leh road becomes 'all-weather' with the completion of the Zoji La and Rohtang tunnels.

the relatively greater heights of the Himalayan ranges in the north, larger strength of the Army in Northern Command and closure of mountain passes at Zoji La and Rohtang during winters. A large percentage of the IAF's air maintenance effort, both fixed and rotary-wing, goes towards the requirements of the large Army presence in the XIV Corps area in Ladakh. Operation Meghdoot has been going on continuously since April 1984 and despite the Siachen 'resolution' talks that are reportedly underway (in fits and starts), the path to a disengagement that would see Indian troops coming down from the glacier, does not appear to be on the horizon.[13] Thus, the high air maintenance demand would continue until the Srinagar-Leh road becomes 'all-weather' with the completion of the Zoji La and Rohtang tunnels—this aspect is covered in detail later in this paper. Once this happens, a large amount of fixed-wing flying hours would be released for utilisation in the Eastern Sector.

- To meet the rotary-wing shortfall, the option of outsourcing to civil helicopter operators has been thought of and Requests for Proposals (RFPs) floated. After prolonged attempts at this novel idea, the project should hopefully fructify. This would, to a very large extent, meet the additional requirements of the Army. However, the process would need to be expedited to keep pace with the expansion/accretion plans of the Army, especially for the Eastern Theatre.
- Transients to Leh and Thoise comprise a large percentage of the fixed-wing load. This could probably be diverted to increased frequency of civil chartered aircraft in the coming years, thereby releasing a large number of fixed-wing aircraft for use elsewhere.
- With the improvement of infrastructure and depending on the change in threat / force levels from China, the deployment pattern may change in the future to increase the troops holding defences on the higher

13. "India, Pakistan Begin Siachen Talks", *The Times of India*, June 11, 2012. Also available at http://articles.timesofindia.indiatimes.com/2012-06-11/india/32173851_1_siachen-talks-siachen-issue-defence-secretary

reaches close to the Line of Actual Control (LAC). The requirement of air maintenance would increase in that case.

- Air effort for Humanitarian Assistance and Disaster Relief (HADR) will always be an inescapable requirement and will form a major responsibility of air maintenance assets of the nation. HADR requirements place a heavy burden on the air assets of the IAF, especially on the rotary-wing fleet. Floods are an annual occurrence in the east and the past few years have seen new weather phenomena causing different catastrophes, e.g. the devastating mudslides of 2010 in Leh following a cloudburst and the frequent landslides that have been occurring in the recent past in Himachal Pradesh. Another aspect that needs to be kept in view is the increasing role of India in regional affairs -- considering our size and economic clout, India would be expected to play a leading role in HADR requirements in South and Southeast Asia.

ROAD COMMUNICATIONS

If air maintenance requirements are to be reduced, then expansion of the road network is a must. Road communications for meeting the operational requirements of the Army are being developed as part of a major effort by the Border Roads Organisation (BRO). The following issues come to the fore:

- The bulk of requirement of air maintenance in the Northern Sector is due to the mountain passes getting blocked by snow during winters. Completion of work on the tunnels at Zoji La and Rohtang would cut down the requirement to a very large extent.[14] In the interim, the period of roads being kept open is being increased by innovative employment of resources by the BRO. Each extra day that the road is kept open reduces the requirement drastically. Last year, Zoji La was opened a month earlier and the Srinagar to Leh road was kept open for an extra month.
- There is a detailed plan that has been approved for road development in all the major sectors. The bulk of the projects are scheduled to be

14. "Work on Rs 5,500-cr Zojila Tunnel in J&K to Begin by 2013," *Indian Express* (New Delhi) October 9, 2012.

completed by 2016-18, as per the BRO. So, if the IAF can help the BRO make roads faster, the requirement for air maintenance would also reduce accordingly -- but, at present, it is a chicken and egg story. The BRO requires air effort to transport its heavy machinery but if helicopters are pulled out for its tasks, the Army will cry foul due to decrease in its allotment. The loss of an Mi-26 last year was a colossal one to this road building effort, as bulldozers are required by the BRO and they can be lifted only by the heavy lift Mi-26.[15]

- The flip side to the development of roads, as one argument goes, is that presently, the deployment of troops on the LAC is thin because the roads are not developed in the sector and, hence, of operations by an attacker also cannot progress fast. Once the road network develops, the threat of its use by an attacker to push its operations towards depth areas will require us to hold the forward locations with greater strength resulting in increased air maintenance requirements; but, this is an argument that does not hold water and has to be planned for.
- Even if the road network develops, it is only practical to assume that the roads will get blocked by snow in certain areas in the peak of winters, the durations depending on the fierceness of nature. Thus, dependence on air maintenance by the Air Force for items of rations and equipment and casualty evacuations for certain areas and/or posts, would, in any case, be inevitable.

NORTHEAST PROJECT

About Rs 2,000 crore have been released by the government for the development of ALGs as part of the Prime Minister's northeast development project. There is an inter-ministerial empowered committee under the Vice Chief of the Air Staff for speedy modernisation of assets in the area,[16] especially the ALGs/helipads like Mechuka, Ziro, Tawang, Tuting, Passighat,

15. See http://www.bharat-rakshak.com/IAF/Aircraft/Specs/571-Mil-Mi-26.html?showall=1, accessed on November 6, 2012.
16. "Airfield Development in Northeast not Country Specific: Vice-Air Chief," *The Arunachal Times*, October 14, 2010, available at http://www.arunachaltimes.in/archives/oct09%2015.html accessed on November 6, 2012.

Along and Walong.[17] This is making progress, but as brought out earlier, it is the last mile connectivity to the forward posts that requires precious helicopter hours during air maintenance. So, roads leading to each and every post in the border areas are an imperative, if dependence on air maintenance is to be reduced. The northeast project, thus, will have only minimal effect in reducing the air maintenance requirement for the rotary-wing fleet, as road construction is not a part of its charter. However, there would be some accretion in the capability as modern air assets (like the C-130s and Avro replacement aircraft), which can utilise these refurbished ALGs and small airstrips, get inducted into the Air Force in the coming years.

It will be the C-17s that will make a dramatic difference to the air maintenance capability of the IAF.

FUTURE INDUCTIONS OF AIR MAINTENANCE ASSETS.

The Indian Air Force transport fleet is being modernised extensively as part of its Long-Term Perspective Plan. Besides the C-130 Special Operations aircraft that have already arrived, the induction of ten C-17 Very Heavy Transport Aircraft (VHETACs) from the USA, with more likely to follow,[18] will be the major accretions in the coming decade. Additionally, the AN-32 fleet is being given an extended lease of life through an upgradation being done in Ukraine that will equip the aircraft with modern avionics and extra payload capability.[19] Given their specialised role, the C-130s will not be used for routine air maintenance tasks but will certainly be called upon for emergent HADR situations when they arise, as was done during the 2011 Sikkim earthquake relief activation.[20] It will be the C-17s that will make a dramatic difference to the air maintenance capability of the IAF.

The C-17, with a 70-tonne payload capability at sea level, demonstrated its exceptional performance during the flight evaluation conducted by the

17. For details, see Rajat Pandit, "IAF Slams Chinese Objections to Airstrips in Ladakh, Arunachal," *The Times of India* (New Delhi), October 15, 2009.
18. See en.wikipedia.org/wiki/Boeing_C-17_Globemaster_III accessed on November 18, 2012.
19. www.youtube.com/watch?v+pKrxdF-6CCU
20. "C-130J Aircraft Used for the First Time in Quake-hit Sikkim," *Hindustan Times* (New Delhi), September 24, 2011.

IAF; in the height of summers in June 2010, it took off with 30 tonnes of load from Leh airfield (10,300 ft above mean sea level).[21] This prodigious payload capability will dramatically enhance the IAF's ability to meet Army requirements for the Leh Sector and release IL-76s and many AN-32s for operations elsewhere, especially in the east where the altitudes of operational areas are lower. The C-17 also showed its short field landing capability when, during the evaluation phase after take-off from Leh with the 30-tonne load, it landed at the 3,000-ft Gaggal airfield in Dharamsala in Himachal Pradesh![22] The valleys in the Eastern Sector are narrow and heavily wooded. The good short take-off and landing capabilities of the C-17 and C-130 would be a boon for forward area operations, and construction of short ALGs, and/or upgradation of existing ones will greatly meet the expectations of the military and civil authorities in the east. However, the criticality is still of the availability of rotary-wing airlift capability.

The IAF's rotary-wing fleet has been augmented with six new Helicopter Units equipped with Mi-17 V-5 helicopters.[23] With more powerful engines, the V-5s are expected to bring a quantum enhancement in air maintenance execution statistics. The old Mi-8s too are going to be replaced with this medium lift helicopter as part of a 59-helicopter follow-on contract,[24] greatly adding to the overall capability to meet or reduce the deficit between the demand and execution of air maintenance. The 197-recce and surveillance helicopter acquisition programme seems to have a hit a roadblock for the last six years or so. While flight trials have been completed twice and the final report submitted to the ministry, accusations of misdoings have lead to delay in its acceptance. The selected helicopter is supposed to replace the Chetak/Cheetah in many units of the Air Force[25] and as and when the report gets accepted and the selected aircraft are inducted, the airlift

21. Ajai Shukla, http://ajaishukla.blogspot.in/search?q=C+17 accessed on November 18, 2012.
22. See n. 18.
23. "Latest Mi-17 V5 Choppers Formally Inducted into IAF," *Indian Express* (New Delhi), February 17, 2012.
24. "IAF to Procure 59 Mi-17 Choppers from Russia, *"The Times of India* (New Delhi), September 9, 2010.
25. http://articles.timesofindia.indiatimes.com/2012-10-28/india/34780187_1_agustawestland-eurocopter-light-utility-helicopters, accessed on March 28, 2013.

capability would get an additional boost.[26] The national and international press has also reported that the Boeing Company has won the contract for 15 Chinook helicopters for the heavy lift helicopter programme of the IAF.[27] The Chinooks will bring in an acutely needed capability of lifting heavy and odd size loads to the forward areas. One agency that will greatly benefit from this uniqueness of the Chinook would be the BRO, which requires bulldozers and similar heavy pieces of machinery in remote and inaccessible areas as primary implements for road building. With its exceptional manoeuvrability and ability to turn around in narrow valleys, the Chinooks would be able to position urgently needed heavy construction material in the hills of the northeast. This, in turn, will enable the BRO to expedite its road making projects that have been inordinately delayed, leading to reduction in air maintenance requirements.

One agency that will greatly benefit from this uniqueness of the Chinook would be the BRO, which requires bulldozers and similar heavy pieces of machinery in remote and inaccessible areas.

What lies further ahead? The 13-tonne Indian multi-role helicopter will equip a few more Helicopter Units, as and when it gets developed by Hindustan Aeronautics Limited (HAL). Similarly, there is a Light Utility Helicopter (LUH) project which is to provide the leftover numbers after the recce and surveillance helicopter deal is signed.[28] On the fixed-wing aircraft side, there would be another squadron of C-130s, the medium transport aircraft from HAL (as and when developed along with the Russians),[29] more C-17s and modern aircraft as replacement for the vintage Avro –

26. https://www.defenseindustrydaily.com/eurocopter-bell-battling-for-500600m-indian-army-contract-0725/ accessed on March 28, 2013.
27. "Boeing Bags $ 1.5bn IAF Chopper Deal," *The Times of India* (New Delhi) October 30, 2012. Also available at http://articles.timesofindia.indiatimes.com/2012-10-30/india/34818074_1_lowest-bidder-heavy-lift-helicopters-chopper Also see Paul Fiddian, "Boeing CH-47D Chinooks for Indian Air Force," *Armed Forces International*, posted at www.armedforces-int.com/news/boeing-ch-47d-chinooks-for-indian-air-force.html, accessed on November 19, 2012.
28. http://www.indianaviationnews.com/indian-aviation-archievenews.asp?id=15&NID=1006&PID=31
29. http://www.defenseindustrydaily.com/hal-and-irkuts-joint-tactical-transport-project-02931/

The transport and helicopter fleet of the Indian Air Force has been doing an extraordinary job since independence.

these acquisitions are still many years away but will significantly enhance the air maintenance capacity of the IAF on their induction. But something closer on the horizon, and already being talked about, is the V-22 Osprey tilt rotor—there are news reports to the effect that Boeing has already made presentations to the IAF on this revolutionary machine that is proving its worth in Iraq and Afghanistan. Boeing confirmed that it was "invited in-country to provide more information" on the V-22, but that it has not received "an official, written [request for information] from India …...we've made presentations at a number of Heli-Power conferences and also presented to the Air Force Chief of Staff" a Boeing representative said.[30] If inducted, the V-22 would bring about a paradigm shift in the way air maintenance and HADR would be executed; it would be a game changer, to put it mildly. With its Vertical Take-off and Landing (VTOL) and high forward speed characteristics, larger and heavier supplies could be delivered from logistic heads in well connected areas in the rear, right to the front lines (obviously within its height and temperature operating envelope). An offshoot would be the casualty evacuation capability directly to better equipped areas in the rear. Surely, there would be limitations too due its high downwash, but the payload capability that would accrue would justify construction of specific landing areas for its operations.

CONCLUSION

The transport and helicopter fleet of the Indian Air Force has been doing an extraordinary job since independence. Flying in the two sectors—the Northern and Eastern—is as different as chalk is from cheese, but through sheer professionalism and dedication to the cause, the air and ground crews have met the air maintenance targets laid down by the government. The even more creditable part is that the tasks have been achieved decade

30. Greg Waldron, "India Sizes up V 22 Osprey," *Flightglobal*, available at http://www.flightglobal.com/news/articles/india-sizes-up-v-22-osprey-367058/ accessed on November 22, 2012.

after decade despite diversions due other national requirements of HADR, internal security and urgent civil requests that come in periodically like national and state elections. Even after the road network expands and gets developed fully in the border areas, air maintenance will never really cease since forward posts of the Army and civilian areas would require assistance when cut off due to natural calamities and disaster situations. The aircrew and ground crew of the IAF can take legitimate pride in a job that has been done well – and there is no doubt that it would continue to be the same in the coming decades.

The Chinese have erected a memorial at Kunming as a tribute to all aircrew (predominantly American) who died in the Hump operations of World War II, carried out from airfields in eastern India. The transport and helicopter personnel of the IAF, however, get their satisfaction when the Service personnel and civilians whom they support, smile back at them in appreciation of their selfless devotion to the cause of air maintenance!

PLA LOGISTICS REFORMS

J.V. SINGH

Historically, logistics has suffered from continued resource shortages since the inception of the People's Liberation Army (PLA). As a result, logistics and combat sustainability have been a weak link in the PLA's prosecution of operations primarily because the logistics system had short lines of supply and lacked rapid mobilisation and strategic transport capabilities. Based on its study of logistics requirements in modern conflicts, starting with the 1973 Arab-Israeli War, and its own performance in the Korean War (1951) and the 1979 "Defensive Counterattack" into Vietnam, the PLA had included logistics reform as a basic component of its comprehensive modernisation programme which began three decades ago. The need for greater integration of advanced weaponry and high technology equipment into PLA forces was highlighted after the 1991 Gulf War and an examination of subsequent foreign military campaigns in the 1990s. Reorganisations and policy directives in 1998 added greater bureaucratic weight to logistics functions within the PLA, encouraging further reform.

The General Logistics Department (GLD) is the logistics headquarters of the PLA and directs the logistics supplies including production, supply, transportation, housing, pay, and medical services on behalf of the Central Military Commission (CMC). It is one of the general departments along with the General Staff Headquarters, the General Political Department, and the General Armaments Department. The department manages and commands

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The GLD ranks the third among the four general headquarters in the PLA's protocol order.

the logistics system within the PLA, and also directly provides certain logistics support functions. The GLD was first established in 1949 as the People's Revolution Military Commission General Logistics Department, and was renamed the PLA General Logistics Department in 1954.[1] The GLD ranks the third among the four general headquarters in the PLA's protocol order. Important departments include the Headquarters Department, Political Department, Finance Department, Material and Fuel Department, Infrastructure Construction and Barracks Department, Military Transportations Department, Health Department and Audit Agency.

Before the establishment of the GLD, much of the logistics support for the PLA came from the civilian populace, and it was organised most often by Commissars. Although the GLD controls a few depot-level maintenance facilities, primarily for heavy vehicles, maintenance is primarily the province of the owning formation, or PLA unit. Extensive repair operations, particularly for aircraft and naval vessels, apparently involve the manufacturers in the case of shipbuilding; the manufacturers control the primary shipbuilding and repair facilities. PLA logistical resources in the 1980s and 1990s were far fewer than those of Western or Soviet forces, making the PLA heavily dependent upon the militia and civilians. In 1985, the General Logistics Department was reorganised, its staff cut by 50 percent, and some of its facilities turned over to the civilian sector.

GUIDELINES FOR PLA LOGISTICS TRANSFORMATION

China's military recognises the importance of logistics on the battlefield, and it is taking steps to maximise its logistics capabilities and undergoing a complete logistics transformation. The PLA has been slowly improving its logistics concepts since the mid-1990s. In 1991, Jiang Zemin, included logistics support as one of the five major requirements to build up the PLA. He pointed out that there would be no high combat effectiveness without

1. Dennis J. Blasko, "Chinese Military Logistics: The GLD System", *China Brief,* vol 4, issue 19, April 11, 2004, p. 3.

a strong logistics supply. In 1999, he signed the "PLA Joint Logistics Regulations", considered a landmark in transformation of the PLA logistics system.[2]

In 2002, Hu Jintao, issued an order to transform the PLA logistics, hastening logistics modernisation.

In 2002, Hu Jintao, issued an order to transform the PLA logistics, hastening logistics modernisation. His order to transform the PLA logistics was inspired by several military events. The first was the PLA's lack of success during the Sino-Vietnamese War in 1979. During this conflict, the PLA never established dominance over the ill-equipped and smaller Vietnamese military. Hu blamed the PLA's Korean War-era logistics support plan for the failure of this operation. In the 1990s, Hu and other top officials cited Operation Desert Storm as a logistics model to emulate.[3] They were impressed by how the US defeated the Iraqi military in a matter of days with higher levels of technology and weaponry.

GLD Director Gen Wang Ke announced the logistics reform programme at a "Forum on the Features and Rules of Logistics" in November 1998, and it was officially enacted at the expanded meeting of the CMC in December 1998 covering the undermentioned aspects:

- Integration of logistics for the three Services.
- Standardisation of supply work to include centralised procurement.
- Conversion of officer perquisites into cash allowances for housing, insurance, etc.
- Outsourcing of support functions.
- Inculcating more professionalism and scientific inputs in logistics management.
- Improving mobile logistics support for units away from their bases.

By 2000, the PLA formed Joint Logistics Departments (JLDs) in all

2. Lonnie Henley, "PLA Logistics and Doctrine Reform, 1999-2009," in Susan M. Puska, ed., *People's Liberation Army After Next* (Carlisle, PA: Strategic Studies Institute, US Army War College, 2000), p. 77.
3. David A. Payne, "Army Logistician: Chinese Logistics Modernisation", vol 140, issue 4, July-August 2008, p. 1.

seven Military Region (MR) Headquarters. In addition, joint logistics staff officers, who understand the needs of all the Services, are being trained and assigned to headquarters staffs. Accordingly, the PLA Air Force and Navy transferred responsibility for many depots, supply bases, hospitals, maintenance and repair units to the control of the MR in which they are located. The JLDs, and their subordinate logistics sub-departments, provide support functions common to all the Services, while supplies and support unique to a single Service are provided through that Service's own separate department. Also, PLA reserve units, too, have undergone reforms wherein, a reserve logistics support brigade has been established by each MR. Hence, it is evident that despite a relatively late initiation, the CMC has been able to achieve integration of the PLA's defence logistics system.

The PLA's logistics doctrine in the year 2000 still depended heavily on the "people's war" concept and not on military assets. A portion of this doctrine stipulated that an individual must carry his own support and sustainment packages while fighting the enemy on the front lines. Based on a series of steps taken by the GLD, the PLA gradually began to shift from supporting itself to purchasing subsistence from civilian markets. The GLD began implementing privatisation measures to reduce the size of the standing army. Functions like managing barracks and building maintenance shifted from PLA units to civilian companies. The GLD and PLA are linking civilian and military logistics to provide what Jiang Zemin had called "precision logistics."[4] This term is still used today in an effort to encourage PLA leaders to continue the transformation of Chinese logistics.

DRIVERS FOR LOGISTICS TRANSFORMATION

Few logistics improvements were implemented by the PLA from the end of World War II to the Sino-Vietnamese War. Historically, the PLA relied heavily on small loads that gave it an advantage in terms of mobility, as was evident during the Chinese Revolution and the Korean War. A review of PLA operations since the Vietnam War (1979) reveals that logistics and

4. *People's Daily* online, "Precision Logistics; Focus of PLA Logistics Changes", accessed on March 5, 2013.

combat sustainability have been a weak link in the PLA's prosecution of operations. The main driver for change in Chinese logistics was the need to keep pace with US military transformation.

To make up for the lack of progress, Hu Jintao and Jiang Zemin both focussed on information technology improvements. They made it clear to the PLA and its subordinate units that the Chinese military needed to focus on achieving parity with the US military. They knew that if this transformation was implemented correctly, it would permit a precise logistics flow to PLA units. Some of the issues which have impacted the reorganisation and modernisation of the PLA logistics system are as follows:

- Integrated logistics support to sustain future wars.
- Additional requirements to support mobile warfare, amphibious and airborne operations.
- Logistics system to support projection of power missions and protect land and sea lanes of communications for unhindered flow of energy and commerce.
- Technical knowhow to enhance strategic/tactical mobility and lethality of firepower.
- Need for a lighter and modularised logistics system which would be compatible with the operations conducted by the Rapid Reaction Forces (RRFs).

BUILDING MODERN LOGISTICS

PLA logistics has suffered from the axiom "do more with less" since the 1930s. After 1949, the GLD took charge of the logistics modernisation process. The PLA received new combat uniforms and protective equipment, and manoeuvre units were given field feeding assets. Contracted civilian companies have been employed and improvements to the PLA's procurement process have also been successful. During the summer of 2004, the PLA and civilians in northeast China held a successful training event that focussed on implementing the transformation of field feeding and the procurement of supplies through civilian sources. The overall success of that event has led to the employment of a supply chain management system and an increased

The GLD issued what it referred to as "the Four Great Transformations" which were described as ushering in a new era of logistics transformation and strategic conceptualisation.

reliance on civilian support.

Four Great Transformations: Six years after inaugurating the integrated logistics system in year 2000, and two years after the PLA's limited response to the Indian Ocean tsunami, the GLD issued what it referred to as "the Four Great Transformations" which were described as ushering in a new era of logistics transformation and strategic conceptualisation.[5] According to this concept, PLA logistics must possess the ability to ensure operational capabilities in multi-dimensional space, including on land, at sea, in the air, in space and electronically, and other military operational capabilities, including reacting to crises, maintaining peace, containing wars and winning wars.

Specifically, the four great transformations are described as:

- From autonomous to the three armed Services joint logistics.
- From self-guarantee to socialised (i.e., integrated with the civil) guarantee.
- Informatisation constructs new logistics platforms.
- Scientification transforms traditional logistics management. As military Operations Other Than War (MOOTW) capabilities have become increasingly important to the PLA, so too have logistical capabilities designed to support and enable MOOTW.

In November 2010, CMC member and GLD Director Liao Xilong asked the PLA to basically accomplish the task of building modern logistics in an all-round way. He called on the PLA to improve strategic projection capabilities by improving coordination of national traffic and transportation systems, establishing a military logistics information system based on the national logistics system, and improving civil support resources. In addition, Hu Jintao issued "Important Expositions on Development of PLA Logistics," as fundamental guidance for the development of PLA logistics.

5. "Modernising PLA Logistics", *China Brief*, vol. 5, issue 25, December 6, 2005, p. 9.

Hu brought out that China's national interests are gradually going beyond the traditional sphere of territorial land, sea, and air space, and keep expanding and extending to the ocean, space, and electromagnetic domains. The PLA, therefore, should develop modern logistics with strong comprehensive support capabilities that not only provide support for winning local wars under informatised conditions, but also can provide support for the units in safeguarding the security of maritime, space, and strategic routes, and in safeguarding national interests in other areas. At the beginning of 2011, the GLD issued the "Framework for the Overall Advancement of Comprehensively Building Modern Logistics Experimental Goals and Tasks," which was intended as a baseline for future improvement in the PLA's logistical system.[6]

Improving Procurement: The PLA in 2009 attempted to accelerate the pace of reform in military procurement, and set up a three-tier logistics procurement management system organised by major units, logistics departments, and troop units. The PLA also attempted to establish a standardised set of rules and regulations for procurement in order to improve efficiency. Procurement has been computerised in order to evaluate bids, improve transparency and efficiency, and prevent black-box operations, a likely reference to corruption. In response to the recent storm in the PLA over the sacking of Lt Gen Gu Junshan on charges of corruption, the four general departments have collectively issued a set of 17 policy instructions on February 26, 2013, approved by CMC Chairman Xi Jinping, stipulating strict guidelines to be followed, specifically in cases of procurement, infrastructure, conferences and delegation visits to check corruption.

From mid-2008 to mid-2009, the GLD organised a reform experiment in regional joint procurement for military goods and material in 13 cities, reportedly procuring goods valued at Yuan 1.4 billion and saving 18 percent. Separately, but in the same spirit, in 2010, the PLA experimented with allowing international bidding to provide medical and health equipment for 100-plus military hospitals, an endeavour the PLA claimed attracted 13 bids from Chinese and foreign business, saving roughly Yuan 10 million.

6. Available at www.cdsndu.org/en/zgjs/jfjgk/jfjgk3.html, accessed on March 5, 2013.

The PLA is increasing scientific research on logistics equipment and making greater investments in R&D.

Logistics Training: The PLA has a multi-dimensional system for logistics training with over 20 institutes. The Logistics Command Academy is conducting training at theatre and operational levels since 2000. The PLA is sending large numbers of logistics staff officers for training in various reputed institutes abroad to achieve indigenisation, technological innovations and modernisation of production facilities. Logistics training exercises are also being conducted at all levels for all-weather high-altitude support.

Logistics Research and Develoment (R&D): The PLA is increasing scientific research on logistics equipment and making greater investments in R&D. In April 2004, more than 340 manufacturers from 26 countries took part in the fourth Beijing International Exhibition on military logistical equipment and technology. Military delegations from 16 countries were invited to attend the exhibition as well as the international symposium on the development strategy of military logistical equipment and technology. These exhibitions and military exchange programmes contribute much in military diplomacy. China has realised that development of indigenous production capabilities of high technology equipment and technological innovations is an inescapable necessity to sustain the war effort in the future.

In addition, the PLA organises and provides logistical support for key national and international events with meticulous precision. Some of the examples include the National Day Parade, naval escort operations in the Gulf of Aden and the waters off Somalia, joint exercises with foreign military forces, security work for the Shanghai World Expo and 2008 Beijing Olympics. China provides strong and reliable logistical support for rescue and relief operations following disasters, such as the Yushu earthquake and the Zhouqu mudrock slide. These activities enhance the capabilities and confidence of the PLA logistics system.

Battlefield Logistics: In the new combined arms mechanised corps, the logistics brigade is held at the corps level and logistics support is supplied directly to the brigades and battle groups using a pull system. Besides military

operations, the new logistics brigade tasks involve providing logistics support for military operations other than war. To repair vehicles in the field, the PLA has developed two vehicles to provide repair facilities for armoured vehicles in the forward battle area. To cut costs while improving the provisioning of supplies in the field and in base areas, the PLA now uses computerised outsourcing and procurement to buy equipment. PLA battlefield medical services have also been modernised. The PLA is investing in its battlefield health services with the addition of armoured tracked ambulances. In the field, new mobile kitchen vehicles have been introduced. To enable sustained operations in the field without the need for resupply, the PLA in 2005 introduced pre-packaged field rations. Specific cold-weather ration packs are now available and come in self-heating, tinned, soft packaging.

PLAAF LOGISTICS AND MAINTENANCE

The PLAAF's Logistics Department's basic mission is to provide supplies for construction, operations, training, and daily life. The Logistics Department has 18 subordinate departments, bureaus, divisions, and offices that are responsible for individual aspects of the overall logistics system. The PLAAF's Equipment and Technical Department is responsible for determining how much and what types of equipment should be procured; for general management of equipment; for aircraft and engine maintenance, repair and procurement; for aviation maintenance/repair research; and for aircraft ground-support equipment. The PLA's GLD conducted extensive analysis of logistics operations during the 1991 Gulf War and has tried to implement those portions that meet Chinese capabilities and requirements.

As the PLA Air Force moves toward becoming a leaner force with rapid deployment capabilities, it is in the process of trying to diversify its logistics patterns in several areas, including emergency resupply, prepositioning of supplies at key airfields and cooperation among frontline and rear area airfields.[7] The overall concept of supply guarantees includes the following tenets.

7. Kenneth W. Allen, PLA "Air Force Logistics and Maintenance: What has Changed". Available at www.rand.org/pubs/conf_proceedings/CF145/CF145.chap6.pdf.

- **Emergency Guarantees:** In order to fulfil combat tasks, the PLAAF has established an emergency mobile supply system. As a result, airfields can receive emergency logistics support if their own logistics guarantee systems are knocked out. Moreover, emergency guarantees can be extended to such areas as setting up temporary airfields, repairing damaged key airfields as well as damaged aircraft take-off and landing facilities within a short time, and guaranteeing field oil supply and emergency air transport.
- **Partial Guarantees in Advance**: To fight a high-tech air battle, the air force has to supply key combat goods and materials to the frontline and backbone airfields in advance. Since transport lines are often vulnerable to enemy attack, all essential equipment needs prepositioning in advance, in order to gain the logistics initiative and save time.
- **Guarantee to Key Airfields:** All types of aircraft are involved in a modern air battle, and various types of aircraft are to be assigned to, or temporarily landed at, key airfields. The logistics department should the supply necessary personnel, technology, goods and materials, instruments, and equipment to key airfields that undertake to maintain various types of combat aircraft to ensure maintenance and combat effectiveness.
- **Independent Guarantees to Different Areas.** The air force should divide a combat zone into independent guarantee areas in the light of its jurisdictional and topographical characteristics and supply routes; clearly define responsibilities, tasks, and requirements for independent guarantee areas; properly strengthen the logistics force of independent guarantee areas; and organise guarantee operations on the basis of independent guarantee areas under normal circumstances.
- **Guarantees Among Departments.** To ensure effective guarantees to the frontline and second-line airfields, airfields located in the hinterland should cooperate with the front-line and second-line airfields. The front-line and second-line airfields and airfields located in the hinterland should help each other by establishing either permanent or temporary relations of mutual guarantee and support.
- **Overall Cooperation Guarantees.** To provide logistics guarantees to a high-tech air battle, the logistics departments of all arms and services

should closely cooperate with one another and with the localities concerned in providing combined logistics guarantees.

The Lanzhou Military Region Air Force (MRAF) logistics department and subordinate unit personnel tested some of these new concepts during two 1995 joint high-tech ground and air attack exercises. The exercises involved three categories and six types of combat aircraft, including attack planes, large transport planes, armed helicopters, and transport helicopters. During the exercises, Lanzhou MRAF aviation units made efforts to turn the airfield and support stations from those that provided logistics support for only one category of combat planes in the past into those that provide support for all categories and all types of combat planes.

In April 2011, the Lanzhou MR hosted a live military exercise, code-named 'Joint Logistics Mission' 2011.The purpose of the exercise was to comprehensively examine the emergency support capabilities of the logistics units in the context of informatisation, specifically focussing on command and planning, manoeuvre and deployment, and support. The exercise involved the establishment of a joint logistics sub-department under the MR, which centralised command and control for logistical elements. According to a published review of the exercise, the Lanzhou MR had benefitted from previous exercises by building an integrated command information system for logistics, a safety protection system, and a comprehensive logistics database, and achieved interconnectivity among different information resources.

Similarly, the Chengdu MRAF has increased investment to speed up the modernisation of the logistics support system of air force stations in Tibet. This includes Petroleum, Oil and Lubricants (POL) and ammunition reserve bases, their supportive warehouses and logistics support systems. Further, modern logistics command systems have been connected with the operational logistics command offices by system networks; and logistics support for airports has been improved. They have also succeeded in developing air transport, forming a three-dimensional air, land, and rail, multi-directional transport system equipped with various types of aircraft

The Theatre Joint Logistics Department (TJLD) of the Military Area Command (MAC) is responsible for joint logistical support for all 'in-theatre' units of the three Services.

that have increased the transport capacity more than seven-fold.

LOGISTICS REFORMS: FOCUS AREAS

Some of the main focus areas of PLA logistics system reforms are as follows;

Unified Joint Logistics: The PLA created its first-ever "Unified Theatre Logistics Command System" in Nanjing MR in 1995. The Theatre Joint Logistics Department (TJLD) of the Military Area Command (MAC) is responsible for joint logistical support for all 'in-theatre' units of the three Services. Jinan MR has set up a joint oil distribution network to overcome supply shortfalls. Nanjing MR has established a joint military-civilian vehicle spare parts and maintenance operations system. Efforts are on to create a corps of joint logisticians, who would be trained to think about joint logistics support, rather than Service specific operations.

Mobilisation: China has established a system of National Defence Mobilisation Committees (NDMCs) extending from Beijing to the county level. The NDMC system is the focal point for the integration of militia and civilian logistics assets to support active duty and reserve PLA operations and joins together the government, Communist Party and military leaders at all levels to oversee the functions of mobilisation. Along with local PLA Headquarters, the NDMCs organise civilian personnel, trucks, ships, and other material required to support PLA operations.

Strategic and Tactical Mobility: A modest fleet of transport aircraft and naval transport vessels has been acquired to boost strategic mobility. The PLA is purchasing heavy lift assets from Russia to move its Heavy Brigade Combat Teams (HBCTs) and supplies from the Mainland to outlying provinces/remote parts of the world. The Chinese defence industry is also building cargo planes and ships that will replace foreign-purchased ships and aircraft by 2015. The PLA would have the lift capability for supporting three corps level operations simultaneously.

Amphibious Operations: The PLA Navy's amphibious lift capacity is estimated to be about one infantry division i.e. 10,000-12,000 personnel and equipment. The airlift capability is limited to about 11,000 parachutists in a single lift, depending on the quantity of equipment required to be lifted at the same time. The PLA plans to incorporate civilian ships, aircraft and crews for its war-time transportation requirements.

Emergency Support Units: Quick reaction logistical support units are vital to support frontline Rapid Reaction Forces (RRF). Senior PLA leaders have outlined the requirement of emergency logistics teams for deployment in the field. A network of small-scale emergency support units and depots has been established in all MRs over the past few years. The PLA Navy (PLAN) and PLAAF have established emergency support units to support prolonged operations from detached forward bases. Reserve logistical support units have been set-up in recent years.

Joint Battle Zone Logistics Support: The PLA is anticipating that vast quantities of material in future wars would necessitate restructuring of its battlefield logistics system. The new structure would integrate fragmented logistics units of the PLA Army, Navy and Air Force to provide regional joint support, under the joint battle zone logistics support concept, wherein the MR logistics departments and branches will be responsible for the unified supply of materials and general services to units within the battle zones.[8] The reforms are focussed to provide unified leadership, planning, management of logistics resources and services to support joint operations.

Forward Stockpiling: The PLA's strategic war materials reserve system is concentrated inland and is being reorganised and relocated to coastal / forward regions.

Outsourcing: A major element of logistics reform is outsourcing or contracting with local civilian entities to provide services previously performed by members or units of the PLA. The GLD and PLA are linking civilian and military logistics to provide, what Jiang Zemin called precision logistics. The PLA is testing such outsourcing activities in various operational exercises.

8. Maj Gen S.B. Asthana, "Transformation of PLA Logistics System: An Analysis", *Journal of the United Service Institution of India*, vol. CXLI, no. 586, October-December 2011.

Centralisation and Automation: The market mechanism system is being introduced to improve efficiency and save on costs. The military supplies are being centralised, automated and reorganised to improve the warehousing, distribution and procurement system during peace and in war-time periods. The effort is to make logistics management more professional and scientific; and to improve mobile logistics support for units away from their bases.

Integrated Procurement: The PLA has been carrying out mock emergency procurement drills to test its new computerised procurement system with local suppliers in northeast China. The success of the exercise demonstrated that the system was viable and indicated the way for future integrated army-civilian emergency procurement systems. The PLA is also developing comprehensive capabilities of automatic identification that deal with logistics information e.g. bar code readers and Radio Frequency Identification (RFID) equipment.

Integrated Command Platform: The Integrated Command Platform of field logistics connects the three Services in one network. In early May 2012, a special support coordination exercise was organised by the JLD under the Nanjing MAC. In the exercise, commanders of the three Services were reporting and submitting demands, generating support plans, regulating and controlling material flows, and simultaneously commanding support actions in different areas through the command platform, showing the integration capacity of information systems.[9]

CONCEPT OF JOINT LOGISTICS

At both the national and local levels, the separate Services of the PLA have maintained separate logistical infrastructures since they were created in the 1950s. As an important step to reform the PLA's logistics system, the GLD introduced the joint logistics concept, which aims to overhaul the existing logistics system of the PLA by bringing together logistics resources in different Service branches to improve the overall efficiency. In 2000, the logistics departments of the seven MRs were reorganised into Joint Logistics

9. Available at http://www.china-defense-mashup.com/pla-joint-logistics-sub-department-builds-integrated-command-platform.html, accessed on March 5, 2013.

Department (JLDs) to manage the logistics resources across all service branches within the MR. Under the joint logistics scheme, Military Region Air Forces (MRAFs) and naval fleets transferred their general logistics support elements common to all services such as hospital, fuel, and motor and vehicle maintenance to the MR JLD, while only keeping specialised logistics support elements unique to their own Service branch.

The PLA has extended the Revolution in Military Affairs (RMA) to logistics as well and established a three-tier logistics system based on joint logistics at the GLD.

The PLA has extended the Revolution in Military Affairs (RMA) to logistics as well and established a three-tier logistics system based on joint logistics at the GLD, war zone and region level logistics departments. The key change is a shift from 'Service specific' to 'integrated' logistics. Integrated logistics implies the integration of military Services' logistics, civil-military compatibility, and the combination of war-time and peace-time functions to support mobilisation. The plan is to develop combat logistics capability to enable sustained operations well beyond China's borders.

In 2003, a further reform was initiated to bring in the 'great joint logistics', wherein the army-dominant military region JLD will be further reorganised into the Theatre Joint Logistic Department (TJLD), a joint logistics headquarters staffed by personnel from all three Service branches. Joint logistics staff officers, who understand the needs of all the Services, will be assigned to the TJLD. The difference between 'general' and 'specialised' logistics will no longer exist. The PLAAF and PLAN will transfer the remaining specialised logistic support elements to the control of the TJLD, thus, further simplifying the logistics support to the PLA in joint Service operations.

Integrated Support System: Based on the joint logistics systems of MACs the PLA explored the integration of support systems in 2003 and officially launched the overall joint logistics system in the Jinan Theatre in 2007. The PLA steadily promoted an integrated support system by integrating

support forces, support units and support elements as well as developing strategic, battle and tactical logistical support capabilities in a coordinated way, all of which facilitate the combination of support strength of the three PLA Services as a firm whole.

Information-based Support Means: Over the past decade, the construction of the logistics database centre of the PLA has moved forward in an all-round way with three information systems for the rear warehouse, combat reserve management and logistics equipment management established, and their sub-systems under construction. A large support system, which is based on a unified platform, covers logistics organs, support entities and support-receiving troop units, stretches over competent military and civilian logistics departments, and integrates all elements in material support, has gradually taken shape.

Privatisation: The PLA and GLD are making progress toward privatising procurement, transportation, and building construction and maintenance. Over the past decade, the outsourcing of the PLA logistics support has extended from non-combat troop units to combat ones stationed in large and medium cities, from organs at the group army level and above to small, remote and scattered military units.

PLA'S CURRENT LOGISTICS CAPABILITIES

China has significantly improved its domestic and external logistical capabilities. Logistical systems have been modernised, logistical processes have been rationalised, and decision-making has been streamlined. PLA logisticians have demonstrated an improved ability to improvise, and the Chinese logistics benefits tremendously from the utilisation of civilian resources. In addition, strategic and tactical mobility for operations beyond China's borders is consistently increasing with induction and integration of civil transportation resources. The PLA is purchasing heavy lift assets from Russia for moving formations and heavy assets to outlying provinces, including Fuzhou which can be used as a platform to invade Taiwan. By 2012, the Chinese defence industry will replace foreign purchased ships and aircraft.

Although, China does not have a blue water navy as yet and has limited amphibious capability, a large number of ocean going transport ships and airliners can be interfaced to enhance rapid sealift/airlift capability. High priority has been accorded for sustained logistics support for RRFs operations on China's periphery and beyond. Land-based transportation capability is increasing at a fast pace due to rapid development of road, rail and air transportation infrastructure. Socialised support network, civil infrastructure and resources have been integrated to make the military logistics system efficient, responsive and cost-effective.

High priority has been accorded for sustained logistics support for RRFs operations on China's periphery and beyond.

With China's main strategic focus towards the South and East China Seas, the PLA aims to achieve logistics capability to intervene militarily to protect its energy supplies and to have an effective deterrence capability to safeguard national interests. It would take some time for China to be able to support a decisive large-scale war well beyond its borders. However, the PLA has been quite successful in developing a modest modern conventional force projection capability in its periphery. China's ability to deploy a small force over great distances quickly and sustain that force for a long period of time, was demonstrated by its operations in the Gulf of Aden and the Libya evacuation. The following factors have strengthened the logistics system:

- Unified command and control of logistics resources.
- Focussed leadership, determined to push through the reforms.
- A sizeable budget for modernisation.
- A policy of combing around the world to acquire military knowhow and equipment.
- A well developed industry for production of military hardware, oriented towards export.
- The will and ability to mobilise civil resources during an emergency.
- Focus, determination and ability to fast track infrastructure development.
- Improvement in availability of resources in border areas in recent times.

By creating the GLD and well defined, fast paced reforms under a focussed leadership, the PLA has come a long way to improve the effectiveness of its logistics system. While the reforms may be sufficient to support local campaigns, within or just beyond China's borders, they have not been focussed on extending expeditionary capabilities across oceans. Inefficiencies and a lack of power projection capabilities hamper external logistics. PLA units still lack high-mobility transportation assets for power projection missions. Although the PLA's logistics system has improved, it still has a long way to go and new systems and procedures are yet to be war-tested. Insufficiently resilient infrastructure and a lack of prepositioned resources have in the past hampered logistics from supporting responses to domestic security challenges. The synergy between the joint systems is also suspect due to some resistance from the ground forces towards integration.

LOGISTICS SUPPORT FOR TIBET AUTONOMOUS REGION (TAR)

The People's Republic of China (PRC) has been carrying out extensive infrastructure development in the TAR and Xinjiang to enable it to support the logistics supply, transportation, stocking and distribution systems, POL pipeline, telecommunications and industrial base, besides giving a boost to the economy of the TAR. Such extensive development of logistics infrastructure in the TAR indicates the impetus being made available to the PLA's logistics capability which, in turn, will enhance its operational capability in the TAR.[10] The 1,142-km Qinghai-Tibet Railway (QTR) line from Golmud in Qinghai province to Lhasa in Tibet became fully operational on July 1, 2006. In addition, China has also unveiled plans to extend the Chinese National Rail Network to the border with India. China has developed a network of internal highways and subsidiary/feeder roads in the TAR to connect strategically significant border areas with India, Nepal, Bhutan and Pakistan by means of motorable roads. It has developed 58,000 km of road network in Tibet, including five major highways and a number of subsidiary roads.

10. N. C. Vij, "Strategic Posture of China in Tibet Autonomous Region and Its Implication: Is India Prepared", Occasional Paper (New Delhi: Vivekananda India Foundation, Imprint Services, October 2012), p. 6.

Recent extension of the QTR to Xigaze at a cost of $1.98 billion by 2014, and extension of the 435-km-long Lhasa-Nyingchi railway to the southeast will boost logistics supply to the areas opposite Arunachal Pradesh of India. This will be part of the $20.8 billion, 1,900-km-long Sichuan-Lhasa railway which will be completed by 2018. There are reports of construction of dual runways in the TAR which will enable simultaneous use by fighter and transport aircraft enabling transportation of supplies, armaments and equipment by air.

The logistics support for air operations in the inhospitable plateau area is a key subject for the PLA Air Force to expand and deepen military struggle preparations.

In addition, construction of new airfields and the upgradation of Advance Landing Grounds (ALGs) and helipads in and around the TAR coupled with acquisition of new transport aircraft is likely to enhance China's strategic airlift capability. The construction/upgradation of airfields/ALGs closer to the borders enhances the PLAAF aircraft's striking range and provides the PLAAF the ability to strike/engage targets in India on a broad front and in depth.

The logistics support for air operations in the inhospitable plateau area is a key subject for the PLA Air Force to expand and deepen military struggle preparations. In the past three years, the logistics department under the Chengdu MAC has paid great attention to building a logistics system for plateau flight operations, and made important breakthroughs in weather forecast, material collecting, POL supply and medical support.

In POL support, the problem of rapid decline in the quality of POL on the plateau has been solved, by using the Qinghai-Tibet Railway, the time for the transportation of explosive devices has been reduced by 90 percent compared with the past, and in medical support, the hypoxia special training method has enabled the attendance rate of aircrew on the plateau to rise significantly. The logistics department of the Chengdu MAC has also developed a logistics support information system for aviation stations, which integrates such functions as support information collection, transmission, processing, and distribution, and makes logistics organisation and command more rapid and efficient.

The PLA, as well as most defence forces in the world, have shifted emphasis from Service specific to joint logistics systems and have economised their logistics investments and efforts.

PLA'S LOGISTICS CAPABILITY AND INDIA

China faces no major constraints in inducting forces required for conventional operations. It can use the three highways, railways and air transportation for moving forces up to major townships near the Indian borders. No additional acclimatisation period is required because the induction of Chinese forces in TAR has been spread over a long time. Lack of deployment space and capacities for maintenance of tracks along likely places of deployment restricts the overall force levels needed for launching operations speedily. Application of forces along the Indo-Chinese borders will continue to be restrained by terrain, extreme climate and limited campaigning period. Application of RRFs along the Indian borders would require ground-based logistics support suited for mountain warfare. Air operations will continue to be affected by problems related to high altitude factors, although the PLA is trying to mitigate this by air-to-air refuelling capabilities and other measures.

The PLA, as well as most defence forces in the world, have shifted emphasis from Service specific to joint logistics systems and have economised their logistics investments and efforts. In the Indian armed forces, the bulk of the logistics continues to be Service specific. We need a "Defence Logistics Agency" for higher direction, control and coordination of logistics effort within the three Services Headquarters to provide an interface with other logistics agencies in the country. It should project the logistics perspective plan and forge close cooperation between defence R&D and defence production, and the public and private sectors. In effect, there can be no worthwhile RMA without a worthwhile Revolution in Military Logistics (RML). The RML intends to transform the logistics system to ensure that the right material reaches the right place at the right time, for the best value.

While, the Indian armed forces are also undergoing logistics reforms, some of the areas which need emphasis are as follows:

- **Mobilisation:** There is a need to establish National Defence Mobilisation Committees at the grassroots level for involving the civil sector, population and reservists for speedy mobilisation. Due to advances in Information Technology (IT) in India, cyber mobilisation platforms can also be adopted.
- **Theatre Logistics Command System:** We need to have have a 'theatre-based' logistics system for establishing a 'grid pattern' logistics infrastructure, which could support all elements of the defence forces, including the paramilitary forces.
- **Indigenisation and Defence Production:** To ensure that national interests are not compromised, we need to be self-reliant in defence production. Defence production should be export oriented to enhance our surge capabilities to cater for fast-paced, short duration wars.
- **Defence-Industry Partnership:** The Confederation of Indian Industries (CII) could be a forum for closer interaction and synergy between the industry and defence logistics. It would ensure close cooperation between development and production in the defence, public and private sectors. We need to adopt the 'partnership' approach with the industry.
- **Absorption of Technology:** We should increase the pace of absorption of state-of-the-art technology, IT and scientific management techniques for better cost-effectiveness. There is a need to improve the R&D capabilities for defence technology, especially by involving the private sector also.
- **Logistics Training:** We need more formalised institutes for logistics training to nurture logisticians as specialists.

Infrastructure Development in Border Areas: India should formulate a broad framework for infrastructure development, especially in border areas and pursue it vigorously in conjunction with the civil agencies. The pace of infrastructure development in border areas has been very slow due to various reasons. We need to ensure that the current asymmetry between India and China, in terms of infrastructure development in the border areas, is reduced.

CONCLUSION

The PLA seems to know where it wants to go with its logistics system. Generally, strategic and doctrinal revisions in recent years all point to a

rather straightforward path ahead for PLA logistics. There is a clear interest in improving civil-military and inter-Service logistical integration, including logistical command and control as well as shared resources. The PLA is also committed to expanding the use of information system-of-systems in order to improve logistical efficiency and speed. There is also a great deal of emphasis on improving multi-dimensional capabilities in the land, sea, air, space, and electronic domains. Most important is the general realisation that a military being assigned an increasingly diverse set of tasks and missions requires a logistical system that is flexible, distributed, and nimble, both domestically and internationally. Ultimately, logistics is at the heart of any military's power. The PLA has finally acknowledged that logistics is the key force multiplier and should never again be the "poor cousin."

The GLD has embarked on a major modernisation campaign to bring logistics in the PLA up to the expected level of a modern military force. Considering logistics as an important tool, the PLA has fast tracked its logistics reforms. The measures undertaken by it will enable China to sustain independent operations beyond its borders and enhance its power projection capabilities. Infrastructure development along the India-China borders, coupled with other strategic and operational parameters, will improve the PLA soldier's quality of life, morale and capability to wage war. Realistic analyses of China's logistic capabilities along our borders should compel the Indian armed forces to pursue their logistics and infrastructure development plans vigorously to ensure that we do not lag behind them. The Indian Railways' plan to bring Arunachal Pradesh on the rail map is a welcome step in this direction.

In the near future, the PLA will be able to conduct sustained independent operations outside China's borders, something it has never been able to do before now, finally acknowledging that logistics is the force multiplier. However, despite these accomplishments, the PLA's logistical capabilities continue to be limited in size and sophistication. Foremost among them is the PLA's total reliance on a stable and accessible external environment.

EXAMINING CHINA'S SPACE STRATEGY

MANPREET SETHI

That China will emerge as a great power in this century (unless there is a domestic upheaval of sorts or an international conflict that disturbs the country's focus on growth and development) is now a well accepted fact. Its sustained high economic growth has allowed the country to spend liberally on its hard power attributes. At the same time, comfortable foreign exchange coffers have enabled it to provide generous assistance, particularly of the military kind, to countries it perceives as being of economic or strategic value in its rise, and to complicate the calculations of its existing and potential rivals.

It has also been evident for a fairly long time that China is well aware that it cannot claim great power status without establishing a high profile presence in outer space. Three White Papers on Space Activities, in 2000, 2006 and 2011, have systematically mapped the expanding scope of China's activities in space. The first paper listed "exploration, applications and promotion of economic development" as the three broad aims of China's space efforts. The latest version expands the horizon of China's ambition further with plans to "launch space laboratories, manned spaceships and space freighters, make breakthroughs in, and master, space station key technologies, including astronauts' medium stay, regenerative life support and propellant refueling, conduct space applications to a certain extent and

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Beijing has concluded that it has to stake its own claim in outer space to deny American ambitions of 'space control' and 'space dominance'.

make technological preparations for the construction of space stations." These pronouncements reflect an ambitious approach anchored in a growing confidence coming from the country's impressive track record of translating plans into achievements from the 1970s onwards.

Over the last five decades, as China's own capability of exploiting space has steadily grown, and as it has keenly observed how the US used it for military objectives during its wars in the Gulf and Afghanistan, Beijing has concluded that it has to stake its own claim in outer space to deny American ambitions of 'space control' and 'space dominance' – its freedom to attack and freedom from attack.[1] While Beijing has not publicly articulated any similar concepts and nor can it hope to match the US, its achievements, nevertheless, have been built in a manner to sufficiently project deterrence. In fact, it is a travesty of sorts that China's space programme appears to be coming into its own at a time when the USA is perceived to be pulling back on its space budget. Of course, this is only relative considering the magnitude and range of space capability that the US has already built in outer space. But perceptions on 'rise' and 'decline' have a role to play in international relations.

It is against this background that their paper examines China's space strategy. What specific role does China ascribe to its space programme for its national security? What are the major characteristics of its space strategy? To what extent would China be willing to follow the 'existing rules of the road' or constructively participate in the formulation of new ones that support peaceful exploitation of outer space? Would an enhancement of its offensive and defensive capability tempt China to indulge in disruptive behaviour with military intent? These are some of the issues that need to be analysed, especially by India, given that the country has yet unresolved territorial disputes with China. As both nations 'rise', the possibilities of

1. As articulated in Counterspace Operations, Air Force Doctrine Document 2-2.1, August 2, 2004, available at http://www.dtic.mil/doctrine/jel/service_pubs/afdd2_2_1.pdf

their engagement – in conflict or in peace — will also increase. The paper concludes with some implications of China's increasing engagement in outer space for India's national security.

CHINA'S 'LONG MARCH'[2] INTO OUTER SPACE

Officially, China has never acknowledged the launch of a single military satellite, admitting at most that its space assets might have a dual role. However, there is no reason to believe that China was ever oblivious to the military uses of outer space given that Mao Zedong and Zhou Enlai, both proponents of equipping China with military might, were the political drivers of the space programme till they died in 1976. Thereafter, Deng Xiaoping did endeavour to prioritise efforts towards practical civilian application of satellite technology in keeping with his strategy of four modernisations in which the military occupied the last place. Indeed, the 1980s and 1990s were marked by some remarkable achievements—launch of scientific satellites, success of the recoverable satellite programme, introduction of microbiology experiments, launch of communication satellites (Dongfanghong-2A and DFH-3 series) and meteorological satellites (Feng Yun series), as well as the first flight of the Shenzhou, the prototype manned spacecraft. By 2000, a total of about 47 Chinese spacecraft had been launched.

In the new millennium, the speed of China's space activity shifted into higher gear. In the decade 2000-10, 70 satellites, some Chinese and some for other countries, were sent into orbit for performing a range of functions – some primarily civilian like telecommunications, weather forecasting, scientific Research and Development (R&D), space mapping, disaster relief, maritime observation and remote sensing; and other more military like intelligence, surveillance and reconnaissance, navigation and military communications.

Obviously, China's space capability has travelled a long way from the day in April 1970 when its first man-made satellite, the Dongfanghong-1 (the

2. Long March is the name designated to one family of Chinese launchers that are used to send its spacecraft into orbit. Four versions of this launcher have been used and Long March 5 is presently under development. Long March is symbolic of the time in 1932 when Mao Zedong had led the Communist Army over 8,000 km to the north of the country in order to escape the Nationalist government.

A few of the notable achievements in China's space programme over the last five years have made the world sit up and take note.

east is red) was launched.[3] Slowly and steadily, and moving at a pace, and toward milestones, it set for itself, China has enhanced its civilian, military and commercial exploitation of outer space. In fact, in the year 2010, China equalled the number of American launches of 15 satellites.[4] And, in 2011, it surpassed the USA by reaching the figure of 18 launches in one year.

A few of the notable achievements in China's space programme over the last five years that have made the world sit up and take note need to be mentioned. The most significant of these took place on January 11, 2007, when China demonstrated its anti-satellite prowess by shooting down its own satellite at an altitude of about 800 km. Later the same year, China launched its first lunar probe, the Chang'e, which brought back scientific data and a map of the Moon to successfully establish China's credentials in deep space exploration. In 2008, with the successful launch of the Shenzhou-7, which took three men on a three-day mission to outer space, China became the third country to have an astronaut perform a space walk. In 2010, China demonstrated a successful Ballistic Missile Defence (BMD) intercept and also launched a second lunar probe, the Chang'e-2. In September 2011, China placed Tiangong 1[5], an experimental space laboratory into orbit. Two successful dockings with this spacecraft have since been conducted. The first of these was of the Shenzhou-8, an unmanned capsule, in November the same year itself. But more recently, in June this year, taking a step further in its human space flight and orbital space station programme, China launched the Shenzhou-9 carrying three astronauts (one of them being a woman) to dock with the orbiting laboratory. The crew successfully returned to Earth on June 29 after spending three days in space. With this feat, China has been able to establish

3. James Clay Moltz, "The Chinese Space Program" in *Asia's Space Race: National Motivations, Regional Rivalries and International Risks* (New York: Columbia University Press, 2012), pp. 70-109. For the history of China's space programme, see chapter 3.
4. Jeff Foust, "Space Challenges for 2011", *Space Review*, January 3, 2011.
5. The Tiangong-1 weighs less than 10 metric tonnes compared to the International Space Station's 400 metric tonnes.

that it can manoeuvre a space capsule to rendezvous with, and attach itself to, a port on the station in order to transfer people and material to sustain a space station. Three more Shenzhou missions by 2014 are expected to help the country in mastering manoeuvring and long-duration life support systems, thereby laying the foundation for a future space station, which is scheduled to become operational by 2020.

Since 1992, when the Standing Committee of the Politburo approved the manned space flight programme, the construction of a space station has been the long-term objective of the country and it is likely to be realised within a decade from now. Interestingly, this will also be about the time that the International Space Station, a joint endeavour of the USA, Russia, Japan, Europe and Canada would have lived its life and be ready to be de-orbited in 2020. In the next decade then, China might be the only country with a permanent human presence in low earth orbit.

What would be the significance of this? US defence analysts are divided on whether the Chinese human space flight programme is driven by military objectives. Some such as former National Aeronautics and Space Administration (NASA) administrator Michael Griffin, and senior Carnegie scholar Ashley Tellis believe it is so. There are reports that the Shenzhou missions have been "equipped with either electronic intelligence or image intelligence gathering devices."[6] In fact, Tellis describes the entire space enterprise as being "centered on the primacy of military considerations which suffuse even the scientific, domestic, and commercial elements of the space effort".[7] Larry Wortzel too believes that there is a distinct military game plan behind this and that the "PLA is serious about space warfare".[8]

On the other hand, scholars like Gregory Kulacki of the Union of Concerned Scientists do not perceive China's manned missions as a threatening development. Echoing the same thought, Joan Johnson-Freese too argues that China has a "soft power approach to space relying on prestige,

6. "China in Space: The Possibilities and Risks", http:///www.sinodaily.com, November 28, 2005, accessed on February 6, 2012.
7. Ashley Tellis, "China's Space Capabilities and their Impact on US National Security", Testimony before the US-China Economic and Security Review Commission, May 20, 2008 , p. 3. available at http://www.ceip.org
8. As cited in Moltz, n. 3, p. 71.

international cooperation and commerce plus *modest military hedging*".[9] The truth, as always, may lie somewhere in between.

A Chinese space station would certainly have tremendous symbolic value for power projection and establishing deterrence. Achieving the feat would reflect favourably on the scientific, technological and industrial/manufacturing capability of the country. It would build China's reputation as a committed space-faring nation with a robust space infrastructure on the ground as well as showcase its ability to use space for military applications. In fact, the dual-use utility of such a project was clearly highlighted in the 2006 version of China's White Paper on National Defence[10]:

> Major scientific and technological projects, such as manned space flights and the lunar probe project, are being carried out *to spur the leapfrogging development of high-tech enterprises combining military and civilian needs and to bring about overall improvements in defense-related science and technology*… As a result, a fairly mature scientific and technological infrastructure is taking shape, which is well configured, multi-functional, efficient and based on close cooperation between the military and civilian sectors.

Therefore, China perceives great value in these projects and will persist in its efforts towards setting up a space station and the exploration of the Moon. In fact, China has announced plans of mapping "every inch" of the surface of the Moon to enable eventual exploitation of Helium 3 from lunar rocks. Meanwhile, as an added bonus, the success of these plans would do wonders for the Party's self-confidence and allow China to participate in any future international space negotiations from a position of strength.

OUTER SPACE IN CHINA'S NATIONAL SECURITY

China has been candid enough to admit that acquisition and expansion of Comprehensive National Power (CNP) is its foremost objective. The attributes of CNP include economic growth and development, preservation

9. Ibid., p. 71.
10. *China's National Defense in 2006*, Information Office of the State Council of the People's Republic of China. Emphasis added.

of internal stability, and adequate military capability to deter/meet threats from the external environment. China realises that the achievement of each of these objectives can be furthered through its engagement in outer space. Therefore, the value of outer space for China's national security in both the tangible and intangible dimensions is critical. Four of these can be identified.

For 'Recovering Greatness' and Legitimising Party Rule

The pursuit of certain capabilities has come to be associated with showcasing the scientific and technological prowess and prestige of a country. Nuclear technology and outer space exploration and exploitation constitute two such examples. For a country like China, which is acutely image conscious, these are of special relevance for power projection abroad, as well as for maintaining the domestic stature and legitimacy of the regime at home.

A hint of this motivation was evident in 1958 itself when approval was first granted for the construction of a Chinese earth satellite. Mao wholeheartedly backed the proposal with the "only rider that a Chinese satellite should be large and not the size of the small American satellites then being put into orbit"[11]. This was thought necessary for "impressing foreign powers" by making it visible. It was equally to be a showpiece for the domestic population and was fitted with a tape recorder that played revolutionary tunes. The Chinese media hailed the event more for its "politico-revolutionary portentousness" than for its scientific import.[12]

From then to the most recent achievement of the docking of the Shenzhou-9, China has retained what Richard Fisher, Vice President of the International Assessment Strategy Centre and a keen China watcher, had once described as the "political" purpose of the Chinese space programme. Its successes have been interpreted as necessary to allow "the Communist Party-led government in Beijing to prove to the Chinese people that it can produce a major technological success that can lift the glory of China and give

11. Brian Harvey, *China's Space Program: From Conception to Manned Sapceflight* (UK: Praxis Publishing, 2004), p.27. Mao was apparently impressed with the Soviet Sputnik which weighed a whopping 1.5 ton compared to the Vanguard 1 of the US at a mere 1.5 kg
12. Ibid., p. 50. Harvey writes, "The satellite's main role appears to have been to broadcast 'the east is red'", p. 59.

China witnessed the relevance of space technologies for modern warfare during the first Gulf War in the early 1990s.

them reason to be proud of the achievements of the Communist Party".[13] Indeed, China's achievements in space "provide symbolic gains that enable China's rulers to justify their continued rule".[14]

For Socio-Economic and Development Benefits

There is no doubt that like India, China too seeks to use its space activities for improving the socio-economic conditions of the country. Deng Xiaoping was particularly keen on this and since the 1980s, China has used its satellites for agricultural purposes such as land resources survey, crop mapping, meteorological monitoring, remote sensing for better land use, water resources management and other economic activities. Satellite-based communications and broadcasting have also been of special relevance given the vast landmass of the country.

Besides the direct benefits, there have been several collateral spin-offs of the space programme, including by way of increased employment opportunities in the space and ancillary industries.[15] The country has gained in the development of computers, transistors, modern electronics, precision engineering, metallurgy, materials science, welding skills, etc. This has generally raised the quality consciousness and appreciation of technical education. In turn, economic growth and development have implications for internal stability too and the Chinese leadership is more than conscious of this. China has also used space enabled services for discharging law and order functions and for disaster relief.

For Enhancing Military Capabilities

China witnessed the relevance of space technologies for modern warfare during the first Gulf War in the early 1990s. The lessons were further

13. "China in Space: The Possibilities and Risks", http:///www.sinodaily.com, 28 Nov 2005, accessed on 6 Feb 2012.
14. Tellis, n.7
15. While conducting a peer review of this article, it was pointed out by Prof Srikanth Kondapalli, a renowned China expert in India, that the stock value of satellite companies has risen manifold in the last few years.

reinforced in 1995-96 during the Taiwan crisis when China had to put up with the deployment of two US carrier groups in the region. Beijing found to its great discomfiture that it had no means of locating or tracking, leave alone threatening, the American naval assets. Obviously, that served as a major wake-up call and China quickly realised that if it had to deny American forces the ability to interfere with its plans for reunification with Taiwan in the future, then it had to enhance its military capability in space. It is entirely to the credit of the Chinese leadership that the necessary adjustments at the budgetary and organisational levels were accordingly quickly made.

Amongst the military relevant space capabilities that China has consciously built up is that of Intelligence, Surveillance and Reconnaissance (ISR).

Within a decade from 1991, the country was ready with its first White Paper on the subject and it clearly reflected some of the lessons that China had assimilated through the 1990s. One capability of the US military that had impressed China was its network-centricity. Little wonder then that by the mid-2000s, China was looking to build capability to fight a "high-tech war under informationized conditions", China's term for networked forces that could conduct military operations through better connectivity enabled by information gathering, sharing and exploitation of space-based assets.

Amongst the military relevant space capabilities that China has consciously built up is that of Intelligence, Surveillance and Reconnaissance (ISR). A rapid launch of a constellation of satellites has enabled the country to fulfill its objective of 'informationising' its operations. The Yaogan family of spacecraft (officially billed as satellites for crop monitoring) form the core of Chinese military space operations: 13 of these have been in orbit since 2006. They are believed to be of four military designs, including satellites with electro-optical digital imaging cameras, another one with Synthetic Aperture Radar (SAR) imaging, a third with signal intercept and a fourth with electronic eavesdropping capability. A fifth one is also planned for formation flight and has ocean surveillance sensors.[16]

16. Craig Covault, "China's Military Space Surge", *Aerospace America*, March 2011, p. 34.

According to one assessment, "Next to China, only the United States possesses more capable tactical support systems in space for tactical operations".[17] This is hardly surprising given that since 2001, China has launched 32 reconnaissance satellites that could be used for tactical support. Even if American estimates do not yet credit China with "continuous, real-time tactical coverage", there is little doubt that China has certainly acquired "*frequent and dependable coverage of stationary targets* and at least a *basic ability to identify, track and target vessels at sea*".[18] This has been helpful in supporting China's anti-access/denial capabilities. The recent demonstration of the 1500 km+ range DF-21D new Anti-Ship Ballistic Missile (ASBM), as well as mobile Anti-Ballistic Missile (ABM) capability are only possible through the support provided from its assets in space. The imaging satellites have been described as a "force multiplier in the service of long-range cruise missiles, standoff precision attacks, stealth technology, damage assessment, joint combat operations as well as overall battlefield awareness."[19] According to one estimate, it is evident that the "PLA is developing a tightly integrated information loop dedicated to supporting data fusion for missile targeting, damage assessment and overall battlefield awareness with space-based reconnaissance at the centre."[20]

In view of this, China's White Paper on National Defence, 2011, is able to claim that "significant progress has been made in building information systems for reconnaissance and intelligence, command and control, and battlefield environment awareness." It also lists improvements in operational command systems as well as integrated support capabilities with services such as command and control, ISR, communications, surveying and mapping, navigation, meteorological and hydrological support all being part of the battlefield support capability to conduct defensive and offensive operations.

Another capability of military relevance that China has focussed on is the development of small satellites. These could be microsatellites (less

17. Eric Hagt and Matthew Durnin, "Space, China's Tactical Frontier", *Journal of Strategic Studies*, vol 34, no.5, October 2011, p. 734.
18. Ibid., p. 748. Emphasis added.
19. Ibid., p. 748.
20. Ibid., p. 752.

than 100 kg) and nanosatellites (less than 10 kg) or even picosatellites (less than 1 kg). These provide the facility of quick launch in order to urgently respond to any degradation – inadvertent or deliberate -- in its satellites. According to an estimate, China has already launched 40 satellites weighing less than 500 kg for purposes ranging from defence, civil and academic.[21] Smaller satellites also provide the advantage of being used for "coorbital spacecraft formations like triangles or echelons that can detect ships and calculate location, speed and direction of travel." For instance, the Yaogan-9 positioned three satellites in a triangular formation, which indicates the deployment of a dedicated naval ocean surveillance satellite system to support its ASBM through surveillance and cueing help. More recently, a further launch of the three-satellite Yaogan-11 constellation is believed to provide the all-weather, day-night capability to China for tracking carrier strike groups.

China has also exhibited the ability to conduct complex orbital manoeuvres.

China has also exhibited the ability to conduct complex orbital manoeuvres. A recent example of this was the adjustment in orbits of satellites carried out by the Xi'an satellite control centre to avoid collision with space debris. In 2010 too, there were reports that several Shijian satellites had conducted "highly sophisticated proximity maneuvers, perhaps even making physical contact".[22] The military significance of these manoeuvres is to be able to adjust the satellite's trajectory to revisit a point on Earth more frequently. While this can obviously not compare with the level of broad scale, persistent surveillance that the US system can manage, it nevertheless demonstrates China's ingenuity to manage with less.

Unlike the case in the US where the focus has been on building larger, more sophisticated, built-to-specification systems for military satellites, which are obviously expensive and have longer R&D lives, China has demonstrated a tendency to enhance cost-effectiveness by using common and smaller platforms for civilian and military systems.

21. Covault, n. 16, p. 35.
22. Brian Weeden, "Dancing in the Dark: The Orbital Rendezvous of SJ-12 and SJ-06F", *Space Review*, August 30, 2010, http://www.thespacereview.com/article/1689/1>.

China's White Paper on Space Activities, 2011, lists bilateral space cooperation agreements with no less than 11 nations today.

While the buses are evolutionary in design and capability, this has allowed the Chinese space industry to reap the benefits of standardisation, modular design and serial production. For example, the DFH-3/3A platforms are known to have been used for roughly 20 satellites ranging from military and civilian communication satellites, to the Beidou navigation satellites, to the Chang'e lunar exploration spacecraft, to the Tianlian data relay systems.[23] Such an approach has aided China in reducing R&D timelines for individual satellites. Use of mature technologies with incremental innovation has enabled serial production and mating of well developed platforms with a range of payloads. By following such an approach, "China may not need to develop superior heavy spacecraft technologies, but end up with military space capabilities greater than the sum of its parts".[24] Meanwhile, it has also provided the added benefit of making it more difficult for the outside world to know the exact number or nature of the military satellites.

In any case, China evinces an asymmetric advantage in space given the high dependence of the US on its space assets for its economic and military operations. China will build its future military capability keeping this American vulnerability in mind.

For Forging Bilateral Relations

China's White Paper on Space Activities, 2011, lists bilateral space cooperation agreements with no less than 11 nations today. This is a quantum change from the situation in the 1990s when China's space programme was isolated and largely friendless. Though the first Chinese efforts in space were made with the help of the USSR, the relationship had soured by 1959-60. Thereafter, the country's space programme grew out of indigenous efforts

23. Hagt and Durnin, n.17, p. 755.
24. Covault, n. 16, p. 36.

and Zhou Enlai, at the launch of the first satellite in 1970, ensured that the press statement carried a sentence saying, "We did this through our own unaided efforts".

In the 1970s, China tried to make use of the diplomatic opening with Washington to seek an advanced communication satellite, forge a close relationship with NASA on possible hosting of Chinese scientific payloads on future US space shuttles, as well as an agreement seeking US assistance in developing a civil communications and broadcast system for China through the purchase of an American satellite launched by NASA but operated by China. Not all of these fructified, especially after the espionage allegations by the Cox Committee in the late 1990s. It was only recently, in November 2009, that a joint statement issued on the occasion of the visit of President Obama to Beijing mentioned "expanding discussions on space science cooperation and starting a dialogue on human space flight and space exploration".

Meanwhile, for its own technology development, China has engaged with Brazil, France, Russia, Ukraine and the UK for collaborative missions or actual joint development of spacecraft. China's first imaging satellite of military significance was the China-Brazil Earth Resources Satellite (CBERS-1) in 1999. Operated along with Brazil, it provided medium resolution imagery for military planners. But, more importantly, it laid the foundation for the subsequent Ziyuan–2A satellite which transmitted military relevant imagery to ground stations.[25]

China's indigenous achievements in space launch and satellite construction are perceived as an important "instrument to boost its soft power status"[26]. Not surprisingly, therefore, there are separate sections on international exchanges and cooperation in the three Chinese White Papers on Space Activities. Realising the commercial and strategic opportunity offered by this sector, China has concentrated on building an impressive infrastructure for undertaking satellite launches. It has carried out 33 commercial satellite launches for international customers and placed 39

25. Hagt and Durnin, n.17, p. 736.
26. Ajey Lele and Gunjan Singh, "China's White Papers on Space: An Analysis", *IDSA Issue Brief*, January 20, 2012.

satellites in orbit. Interestingly, China and India also signed a Memorandum of Understanding on Space Science and Technology in 2006 but nothing concrete has emerged yet out of this.

For a large part of the developing world, however, China has become a key provider of technology and training. Pakistan has been an important client of China. In fact, Pakistan became the second customer of China's launch facilities when it contracted its first small satellite, the Badr, to be launched into low earth orbit aboard a Long March 2E booster in July 1990 at a cost of US $395,000. Since then, China has also launched satellites for Sweden, Australia and some other Western nations. On at least four occasions in the 1990s, Chinese launches also suffered failures. But these spurred China to become more quality conscious and it has constantly striven to promote itself as a cheap and reliable service provider for commercial space launches. In 2011, China undertook three commercial launches. In August, it launched a Chinese made communications satellite for Pakistan; in October, it launched a French made communications satellite for Eutelsat; and before the year was out, it had launched another Chinese made communications satellite for Nigeria.

Besides establishing commercial relations, China has also sought to occupy the place of a mentor in space for many smaller countries in Asia. Since 1992, Beijing led the initiative on Asia-Pacific Multilateral Cooperation in Space Technology and Applications (AP-MCSTA). Placing itself as a regional leader in the group, China held meetings for exchange of information with Thailand, Pakistan, South Korea, Bahrain, and Iran. But in 2005, this was turned into a more formal, paid membership body called the Asia-Pacific Space Cooperation Organisation (APSCO). With its headquarters in Beijing, it comprises Bangladesh, Indonesia, Iran, Mongolia, Pakistan, Peru and Thailand and was formally inaugurated in December 2008. Training of foreign scientists at Chinese institutes and donation of ground stations to member countries to receive information from Chinese satellites are some of the activities that the organisation has undertaken. More recently, with Sri Lanka, China has concluded an agreement to build

and launch a communications satellite by 2015.[27] The ground station would be in Kandy and Sri Lankans would get on the job training from Chinese engineers for its operation.

China has shown competence in building large and small satellites, has an impressive family of launchers and variants, and is able to put a range of payloads into several types of orbits.

MAJOR CHARACTERISTICS OF CHINA'S SPACE STRATEGY

Clarity of Thought and Objectives

An examination of the history of the Chinese space programme reveals a fair amount of clarity on the rationale and importance that China has accorded to this project. Of course, there were inter-departmental issues and discussions within the Party on what aspects of the capability to focus on, but the commanding role of Mao and Zhou Enlai kept the programme focussed. Since 2000, the White Papers clearly indicate a steadfast commitment to vision and clarity in objectives. The Party leadership has wholeheartedly backed, even pushed and directed, the scientific establishment towards its goals, including through streamlining efforts at developing China's aerospace engineering potential. For instance, in 2011, the Chinese Academy of Engineering and China Aerospace Science and Technology Corporation jointly founded a research institute to study and provide consultative services on aerospace engineering development strategies and national special aerospace programmes. The institute would also collaborate with the private sector, colleges and other research institutes.

Comprehensive in Approach

The range of space activities being undertaken in China span the entire spectrum from R&D in deep space exploration to the development of the necessary infrastructure for design and manufacture of satellites, launch

27. Shirajiv Sirimane, "Lanka to Own Communication Satellite by 2015", *Ceylon Daily News*, August 10, 2012.

capability, telemetry, tracking and control networks, as well as the ability to place all kinds of payloads to conduct activities such as communications, meteorological, navigation, remote sensing, reconnaissance, and electronic intelligence. China has shown competence in building large and small satellites, has an impressive family of launchers and variants, and is able to put a range of payloads into several types of orbits. The country has also focussed on a manned space programme and the construction of a space station.

The development of the end-to-end capability endows China's space programme with a comprehensiveness that does not exist in many space-faring nations. In fact, while the number of countries having a presence in space has increased considerably over the recent decades, very few have the entire range of capability or even plans to build it all.

Control of the Army over the Space Programme

On October 8, 1956, the Central Committee of the Communist Party of China (CPC), chaired by Mao Zedong, established the Fifth Research Academy of the Ministry of National Defence to develop the space programme. But it was during the Cultural Revolution, when the space programme was under threat, that Zhou Enlai persuaded the Central Committee to bring it under military control. There the programme has remained ever since as a military directed programme in which the "military develops and operates its satellites and runs its infrastructure, including China's launch sites and satellite operations center".[28] In fact, the PLA's General Staff Department (GSD) undertakes the tasking of reconnaissance satellites. Command centres for all satellites are controlled by the People's Liberation Army's (PLA's) General Armaments Department which theoretically makes all Chinese satellites available for military application, as and when deemed necessary. This is in complete contrast to the situation in India where the space programme is distinctly and predominantly civilian, and the military, in fact, has a very limited role and influence on the overall roadmap for space plans.

28. Kevin Pollpeter, *Building for the Future: China's Progress in Space Technology During the Tenth 5-Year Plan and the US Response* (Carlisle Barracks, PA: Strategic Studies Institute, 2008), pp. 44-45. Cited by Tellis, n.7.

Commercial Focus

In 1985, China first publicly expressed a desire to commercially exploit its space capability by offering its launchers to the West. With the reprioritisation of government spending by Deng Xiaoping, the space agencies felt the need to generate additional income by offering the services of the Long March launchers to Western communication companies. After passing through a phase of American commercial and military restrictions as well as imposition of trade quotas that did not allow China to launch more than a specific number of satellites in a year and not to offer prices less than 15 percent below Western rates, China's commercial missions successfully took off in the 1990s.

Since then, China has exploited a lucrative market in commercial space launches, providing this facility to many countries in the region and beyond. In fact, to enable this, the space organisation of the country was restructured in the mid-2000s, with the China National Space Administration emerging as the civilian front for international cooperation and liaison between the military and the Chinese defence industry. Three launch sites equipped with spacecraft testing, preparation, launch and in-flight tracking and safety control provide cost-effective services in this field because of its unique strategy of using common platforms.

Emphasis on Counter-Space Capabilities

The conduct of the Anti-Satellite (ASAT) test in January 2007 was the most overt action of China in the field of building capabilities that would seek to deny/degrade adversaries space assets. Given that the USA has identified space as "critical national infrastructure" in its National Security Space Strategy prepared by the Department of Defence and issued in January 2011, the US Administrations have categorically stated the objective of seeking "space control". In contrast, China's trajectory of capability development tends to veer towards attempts not at acquiring space control itself but to deny it to others. This amounts to focussing on developing tracking capabilities in order to identify and track US satellites for any hostile measures that may be planned in the future, as well as building hard and

soft kill options to destroy/deactivate the satellites. Dazzling, blinding or destruction of satellites using strong laser beams, disabling satellite control facilities through cyber warfare techniques, anti-satellite kinetic attacks, and development of 'space landmines"[29] or parasitic nano or microsatellites to interfere in a satellite's functioning are some of the measures that China is known to be working on. The same was elaborated upon by former US Director of National Intelligence, Adm Dennis Blair in his testimony to the Congress in 2009 when he stated that "China continues to pursue a long-term program to develop a capability to disrupt and damage critical foreign space systems. Counter-space systems, including anti-satellite weapons, also rank among the country's highest military priorities".[30] China is also developing small high energy lasers or high power microwave systems for incorporating self-defence for satellites. Development of such counter-space capabilities provides for effective deterrence since it is widely perceived that in case of a US-China military crisis, possibly over Taiwan, the US would be far more dependent on space for the conduct of its military operations than China.

Participation in Regulating Space Activities

In its White Paper on National Defence issued in March 2011, China's opening statement expresses the view that "seeking mutual benefit and engaging in win-win cooperation are the only ways for humankind to achieve common development and prosperity". However, the fact that China well understands the limits of cooperation to regulate activities in outer space is also clear from its own development of capabilities that would enable it to stand up in its own defence. Along with Russia, China had tabled a draft treaty on Prevention of Placement of Weapons in Outer Space and the Threat of Use of Force against Outer Space Objects at the Conference on Disarmament in the late 1990s, and again in 2008, after the demonstration of its ASAT capability. The signal was clear. Not only was China willing to negotiate from a position of strength but was also keen

29. For more on this concept, see G.S. Sachdeva, *Outer Space: Security and Legal Challenges* (New Delhi: Knowledge World, 2010), pp, 187-205.
30. As cited in Covault, n. 16.

to halt more countries from acquiring/demonstrating the same capability. However, there have been few takers for the treaty from among the space-faring nations.

In the coming years, it is likely that China would be willing to participate in the creation of an equal opportunity space governance regime since it is well aware of its own vulnerabilities, and, more importantly, since it has already shown its strength in the field. China has articulated the need for a code under a multilateral framework that includes discussion among all space-faring powers. But it has also made it clear that it won't agree to any arbitrary or ad hoc arrangements.

CONCLUSION

That China has a coherent and ambitious space policy is fairly clear. It has been steadily increasing its presence in this domain and reaping the benefits for its economic growth, social development, military enhancement and projection of international profile. Unlike the space programmes of the US and USSR that were drafted with a clear military orientation and civilian benefits emerged as spinoffs, China has categorically maintained a dual use thrust. China is well aware of the twin benefits and it today has the financial resources to pursue both aspects with equal enthusiasm. In fact, this approach is clearly outlined in the White Paper on National Defence 2011, which states that China strives to "optimize those research and production systems for weaponry and equipment which cater to both military and civilian needs and sustain military potential in civilian capabilities."

China has retained developmental goals such as building of communication infrastructure, better land and maritime management, early warning system for disaster relief, etc. as key objectives. Yet, after witnessing the phenomenal use of space by the US for its military operations and owing to a reassessment of its own security environment after the Taiwan crisis, China began to focus on building dedicated military capabilities in space. However, this task has been undertaken with the understanding of the rise in vulnerabilities that accompanies increased dependence on space assets. Perhaps, it is for this reason that there is a greater focus on

construction of a space station or a Moon mission or other such high profile or other industrial/commercial ventures. These perform the critical task of raising the international profile of China as a 'modern and technologically advanced' nation and serve the purpose of perception management for effective deterrence without really making China as vulnerable as it perceives the US to be.

Implications for India

Space systems enhance all forms of deterrence. For conventional deterrence, they make it possible to fight non-contact, non-linear, asymmetrical wars. At the same time, they can degrade the adversary's nuclear deterrence by striking against his Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) or nuclear assets. Above all, as space systems affect not just military but other aspects of a nation's life, the damage has wide ranging repercussions.

China's presence in outer space is progressively increasing. Since most of the Chinese space assets have a dual role, there are serious implications of this expanding Chinese footprint on India's national security. Some of the more specific repercussions are highlighted in the following points.

- China's earth observation satellites are equipped with sophisticated, all-weather, day and night imaging capabilities which makes India transparent. This has implications for the choices that India must make for ensuring the survivability of conventional and nuclear assets. Given its own transparency to US ISR capabilities, China has focussed on building mobility into its systems. China's strategic modernisation has focussed on increasing its complement of mobile, solid fuelled missiles, as well as building a mobile BMD capability. India too will have to follow a similar trajectory while enhancing its own military reconnaissance and surveillance capabilities to have a deeper visual reach into the Chinese territory for ensuring real-time intelligence.
- Use of space-based systems for navigation would be particularly helpful in increasing the accuracies of Chinese conventional and nuclear missiles. This has implications for the targeting philosophy of China. For instance,

more accurate nuclear missiles allow China to shift from purely counter-value to counter-force options. This could alter China's approach to nuclear deterrence by tempting it towards first use of nuclear weapons and then imposing intra-war deterrence by suggesting more counter-value strikes. The DF-21D has been demonstrated as being usable against manoeuvrable targets largely because of the navigational guidance possible from space. As the Beidou regional navigation system assumes full operation, China's capability in this sphere will only increase.

- Space enabled communications allow China's military to realise its vision of informationisation. Better networked forces at both the strategic and tactical levels will provide for optimum battlefield management and resource mobilisation in the conduct of military operations.
- Space assets also enhance the BMD capability of China. The efficacy of the BMD is critically dependent on early warning and this is best provided from space. An improved C4ISR can make all the difference for the success of an interception. This will have implications for India's deterrence, including for the number of nuclear weapons.
- China's demonstration of ASAT capability poses a direct threat to Indian space assets. By overtly performing the feat, China has managed to project deterrence, which places psychological pressure on diverse Indian activities.
- China's expertise in launching small satellites with variegated payloads offers it the advantage of using these for offensive and defensive purposes. Quick launches could be useful in plugging gaps created by a deliberate or inadvertent loss of a spacecraft, while these could also be manoeuvred into the path of another satellite of the adversary to act as a 'space mine'.
- Every official Chinese pronouncement on space weapons condemns them. However, it is certain that Beijing closely follows the American debate and developments on the space weapons/systems such as space-based kinetic kill vehicles, space-based lasers, hypervelocity rod bundles, space-based radio frequency energy weapons, space manoeuvre vehicles, etc that are often mentioned in US reports. For instance, the President of China Arms Control and Disarmament Association had stated in

China's increased confidence in space capabilities allows Beijing to exhibit assertive behaviour in other domains.

2005 that China was aware of the "approaching bugling (*sic*) of war. The space military technology is advancing rapidly. New military and combat concepts and theories like 'control of space' and 'occupation of space' are emerging. Research and development programs of space weapons are in implementation."[31] Given the opacity of the Chinese political system, it is unlikely that China's efforts in developing its own systems of the kind will be visible till such time as the USA reveals its intentions. But once that happens, China will be able to quickly respond with a demonstration of its own capability. This would obviously have implications for the nature of its deterrence relationship with India.

- China's increased confidence in space capabilities allows Beijing to exhibit assertive behaviour in other domains. There is certainly a link between China's growing capability in space and other strategic systems and its behaviour in inter-state relations. One example of this is visible in China's relations with Iran and Pakistan, in the case of both of which, it is unwilling to change course despite widespread allegations that it is abetting proliferation. The same assertiveness would likely emerge in China's future approach in several multilateral fora. US Secretary of Defence Leon Panetta, during his visit to Asia in June 2012, specifically mentioned the need for China to follow existing international rules and norms in the interest of international security. But a China that is more strategically capable would be more interested in making rules for others to follow rather than succumbing tamely to earlier or others' formulations.
- At a more political level, China's use of its 'soft power' in space arising from its expanding infrastructure, growing cadre of scientists and engineers and active outreach efforts, as evident in bilateral agreement and in APSCO denies India a leadership role in regional space cooperation. While India has not expressed any such desire in the past,

31. Li Daoyu, "Prevention of the Weaponization of, and an Arms Race in, Outer Space: An Urgent Task with No Time to Delay", statement at UNIDIR conference, Geneva, March 21, 2005.

the geo-political and commercial benefits of this for a country that has plans for an ambitious space programme in the coming decades cannot be dismissed lightly.

As far as China's activities in outer space are concerned, a silver lining may be found in the fact that its increasing dependence on space also increases its vulnerabilities and could contribute to self-deterrence. Therefore, China may be more willing to constructively participate in the creation of some 'rules of the road' or code of conduct in outer space than is normally assumed. While it is true that China contributed massively to the creation of space debris through its ASAT in 2007 despite its commitment to space debris mitigation at the UN, its own satellites are not immune to the shards in orbit.

As the stakes of the country in outer space increase, China may be willing to protect its national interests through more collective efforts. In the interests of its own national security, India too should push for universal acceptance of norms of behaviour. The introduction of space weapons would not only be detrimental to the security of space-based assets but also complicate terrestrial security by evoking asymmetric responses. As a Chinese Ambassador pointed out, "With lethal weapons flying overhead in orbit and disrupting global strategic stability, why should people eliminate WMD or missiles on the ground? This cannot but do harm to global peace, security and stability, hence, be detrimental to the fundamental interests of all states".[32]

While India can wholeheartedly agree with this statement, it must closely monitor and analyse China's increasing capabilities to effectively exploit outer space. Simultaneously, India must have a clear-headed strategy to fortify its own capabilities to exploit space and to defend its freedom of action in and from space.

32. Hu Xiaodi, remarks at a panel discussion on "A Treaty to Prohibit Weapons and War in Space?", as cited in Hui Zhang, "Chinese Perspectives on Space Weapons", in *Russian and Chinese Responses to US Military Plans in Space* (Report by the American Academy of Arts and Sciences, March 2008), p. 43.

CHINA'S READJUSTMENT STRATEGY

VISHAL NIGAM

FIVE-YEAR PLAN

The Great Recession of 2008, as a consequence of the subprime mortgage and euro zone crisis, adversely impacted the external demand upon which China had long relied. The timing of the economic crisis coincided with the internal drafting of the 12th Five-Year Plan (2010-15) – which by this time had moved up to the National Development Reforms Commission (NDRC) for due consideration. The planners perceived that the crisis brewing up was likely to have long lasting aftershocks in the developed world which, in turn, could also have far-reaching implications for the Chinese economy. Most importantly, many countries adversely affected by recession were major markets for China's exports, accounting for more than 30 percent share of its Gross Domestic Product (GDP).[1] Therefore, under the prevailing circumstances, the leadership of China effectively readjusted policy directives in the 12th Five-Year Plan (FYP) to steer the economy clear of the emerging global crisis.

Development plans are considered key indicators of the direction and changes of a country's development strategy. Therefore, the convergence of policy directives in the 12th Plan was targeted towards correcting the prevailing unsustainable levels of economic growth. China had to rethink

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1. Aileen Wang and Nick Edwards, "China 2012 FDI Inflows Slow, Stay on Track for $100 Billion", November 19, 2012, http://www.reuters.com/article/2012/11/20/us-china-economy-fdi-idUSBRE8AJ06C20121120, accessed on March 5, 2013.

some of its core values by compromising on the external demand and shifting focus towards the internal demand. The National People's Congress (NPC) ratified the 12th Five-Year Plan (2011-15) in the midst of the prevailing global crisis by following due diligence at every stage in the consultative process (Table 1).

Table 1: Guidelines for Drafting Five-Year Plan (FYP)

NATIONAL PEOPLE'S CONGRESS		Ratifies national level FYP
STATE COUNCIL		Provides guidance for key themes within national FYPs
NATIONAL DEVELOPMENT REFORMS COMMISSION (NDRC)		Constructs and oversees national FYPs
MINISTRIES		Constructs industry and issues specific FYPs
LOCAL GOVERNMENT		Constructs local and regional FYPs

Source: China's 12th FYP, APCO Worldwide December10, 2010

GREAT LEAP INTO MODERNISATION

The Chinese economy in the first three decades after the civil war was autarkic, centred on Mao's preposterous belief that any kind of contact with foreigners would not only corrupt the political structure but also pollute its cultural ethos. As a result, during the early years, the government prohibited foreign investment and restricted foreign trade. However, in the post-Mao era, the Chinese government, realising that it was economically lagging behind much of the rest of the world, began to rethink on its future economic posture. In 1978, Deng visited Matsushita's television division in Ibaraki, Osaka prefecture, and told Konosuke Matsushita (founder of Panasonic); "*They say you are the God of management, could you help with China's modernization"?* Subsequently, on May 22, 1987, Matsushita and China signed an agreement to establish a joint venture to set up a TV cathode-ray tube plant at a time when the rest of the world was hesitant to

enter into any type of a contract with China[2].

China's tryst with liberalisation began in 1979 when it enacted the law on joint ventures and in 1980, set up Special Economic Zones (SEZs) in Shenzhen, Zhuhai, Shantou and Xiamen. In 1984, it opened up fourteen cities to trade; in 1986, it passed a law on foreign capital enterprise, ended the preferential tax treatment in 1995 and, consequently, announced tariff reduction on 5,000 items. China was gradually preparing itself to being accepted in the World Trade Organisation (WTO) by amending its legal code to conform with the WTO stipulations on issues ranging from trade to rules governing tariffs and anti-dumping regulations[3]. Hence, the carefully crafted economic policy scripted by Deng followed a step by step process of liberalisation which got China gradual entry into the world of foreign trade and investment by intrinsically becoming an active strand in the global supply chain.

The economic model formulated by Deng was unique because, on the one hand, the economy was being driven by free market principles, and, on the other, one party continued to maintain absolute monopoly and political authority. China was following a model unparalleled in history but based on the principle of regional decentralisation which provided flexibility and space to the regions to experiment upfront with economic reforms. The strategy of empowering regions and prefectures in decision-making could well have been the inflection point in propelling the economic transformation to an unprecedented scale, never before witnessed by the world. The process was engineered with a strong underlying caveat that China was not prepared to tamper with the political process and, therefore, averse to the idea of political liberalisation.[4]

The incentives to invest in China were compelling. The 1980s started to witness swarms of foreign companies waiting to invest in South Asia because of the latent market potential and availability of scarce resources. China

2. http://panasonic.net/history/corporate/chronicle/1987-01.html, accessed on January 29,2013.
3. http://www.ln.edu.hk/mkt/staff/gcui/Lecture7.pdf accessed on January 29,2013
4. Yukong Huang, "In China, Most Politics is Local", *International Herald Tribune*, *The Global Edition of New York Times*, January 30,2013.

The last two Plans were clearly directed at promoting development by increasing allocation on Research and Development (R&D).

was a huge reservoir for the factors of production. With the onset of economic liberalisation in China and the economic slowdown of the 1980s in the West, China, by default, became a preferred destination for businesses which wanted to persist with their only aim being profit maximisation. The investments ranged from manufacturing to export processing and licensed agreements in both the military and civil sectors. By the turn of the decade in this century, direct investments surged and foreign investments consisting of more than 600,000 joint ventures valued in excess of $1 trillion had become the mainstay of China's economic turnaround. China, along with the US, accounted for almost two-third of total global growth. Rapid economic growth further propelled the purchasing power and to put the argument in the correct perspective, the level of development that the West achieved in five decades during the period of industrialisation, China could achieve in less than a decade. In its calibrated development plan, China was continuously building infrastructure by investing trillions of dollars on highways, seaports, airports, dams, power plants, communication networks, high speed railways and infrastructure for achieving its strategic goals as well as developing other industries.[5]

ENGINEERING A NEW ECONOMIC REVOLUTION

China was attempting to restructure the economy through its 12th Plan by boosting domestic consumption, developing the service sector, shifting to a higher value added manufacturing and by, finally, setting the tone for carrying out deep-rooted reforms in the country. In its evolutionary industrial strategy, there has been a conscious effort to shift away from imitation to innovation by either embracing technology through fair means or, if required, even through subterfuge. In its stratagem, transfer of technology was not used as a tool to enhance production but to move up in

5. John D. Daniel, Lee H. Radebaugh, Daniel P. Sullivan, Prashant Salwan, *International Business Environment and Operations* (Pearson, 12th edition,2009).

the innovation ladder. Hence, the provisions in the last two Plans were clearly directed at promoting development by increasing allocation on Research and Development (R&D) and ameliorating the quality of manufactured goods which would ultimately enhance their competiveness in the global arena. China has also targeted increased spending on R&D from the current level of 1.75 percent to 2.2 percent of GDP by the end of this Plan and aims to further hike it to 2.5 percent by 2017; comparable with any Organisation for Economic Cooperation and Development (OECD) country[6]. The larger strategy for the first two decades of this century has been to promote scientific and technological development in carefully selected fields which would ultimately enhance their innovation capabilities. The new revolution in the 21st century is expected to flow out from the prescriptions of the 12th FYP and not necessarily from the barrel of the gun – as China continues to embark to the next level, as the world's leading economic and military power.

The previous revolution initiated by Deng spread over three decades, culminating in China moving up from a low income to a middle income economy but at a much faster pace compared to a similar transition by the West and America during the period of the industrial revolution. The transition also witnessed a shift to large scale privatisation in some non-critical sectors. The ongoing revolution, however, is expected to energise the national innovation system by setting goals for development of science and technology which would automatically act as a stimulus for China's development strategy in the coming years. Enhancing R&D intensity, and increasing the number of researchers, publications, patents and R&D laboratories would be the simple methodology followed to achieve the set goals. In the ongoing plan for economic development, while, on the one hand, the earlier manufacturing model which promoted exports was being replaced by the service sector model to enhance domestic consumption, on the other, the government was trying to incentivise and retain the high-tech manufacturing which would help promote Chinese companies to compete globally.

6. Joseph Casey and Katherine Koleski, "U.S. Economic and Security Review Commission, Backgrounder: China's 12th Five Year Plan", June 24, 2011.

While opportunities and challenges in the coming decade are expected to be distinct, the future too will, therefore, demand a development strategy – separate from the past. In a fast growing economy, strategies need to not only be adaptive but also flexible to enable governments to carry out mid-course correction in accordance with the changing dynamics. China was aware that if it did not shift away from policies directed towards unsustainable high growth rate, then it could well be sitting on a potential socio-economic time bomb. Therefore, a shift towards economic rebalancing and moving to a more balanced growth structure was not only inevitable but also the most likely course for China to follow in the coming decade. The likely policy prescriptions include a lower growth rate at 7 percent, minimal government intervention, a larger role for the private sector to set up upgraded and high technology industries and an improvement in the overall indigenous innovation capability by both private enterprises and the state.

China is carrying out calibrated reforms in the 12th Plan by focussing on equitable income distribution, enhancing overall social well-being through better education opportunities and health care so that large numbers of domestic citizens also benefit from the economic growth. It is enhancing domestic consumption by using technology to raise agricultural productivity; amending tax policies that would increase rural purchasing power; building infrastructure, including roads, railway lines, ports and airports; constructing apartments for the weaker section of the society; and targeting to increase the rate of urbanisation beyond 50 percent by revising the *hukou* system (residency permits).

It is also fascinating to see the emergence of groups of people in a typically authoritarian state who are able to freely network through blogs on social networking sites. While micro blogs (Weibo) were becoming a vibrant medium of freedom of expression for a large number of thinkers and activists which is otherwise not available to the citizens in a controlled system, the Renrou search engine has also become a medium for netizens to vent their views. Renrou was emerging as the most fearsome and potent non-state controlled artillery being used not only to gather information but also to expose influential individuals to the glare of public scrutiny.

China, particularly after the 'Jasmine Revolution,' had become extremely wary and cautious of the consequences of social instability which, in its opinion, could adversely impact the Party's control.

In the 12th Plan, China revisited its three-decade-old economic strategy – but this time signalling a shift away from its traditional export-led model.

Therefore, China was left with little choice other than carrying out adequate course corrections in its future development strategy by deliberately adapting to more egalitarian policy measures aimed to arrest social unrest which otherwise had the potential to snowball into a people's revolution – not the best result expected in an authoritarian state where instability was most feared. The policy-makers gradually started abolishing agricultural taxes, subsidised health care, and implemented measures to make basic education more accessible – sending a loud signal of the government's intent to reduce disparity by following a more balanced growth structure where the common man could benefit as much from the country's ongoing economic prosperity. In its policy initiatives, there has been a deliberate shift away from *'growth at any cost'* towards a more balanced and sustainable pattern, controlling inflation and keeping the economy in sync with the reality of the existing global economic environment.

READJUSTMENT STRATEGY

Since the dawn of the new millennium, reforms have been critical for China's success. While the experiments with reforms started in the 1980s, they appear to have taken shape with China's ability to diverge from the laid down path and execute policy readjustments since the 11th Plan. The 12th FYP actually picked up from where the previous plan (11th FYP) left off in terms of broad policy guidelines. The emphasis, however, had now shifted from what used to be 'hard production' to 'quality production' with a greater role envisioned for private sector and foreign investments. Initiatives were also undertaken to reduce bureaucratic regulations and state intervention which largely pointed towards maturing of the state administrative machinery.

In the 12th Plan, China revisited its three-decade-old economic strategy – but this time signalling a shift away from its traditional export-led model (exports in China consist of 30 percent of the GDP) to one that would now be driven by the consumers themselves. The government was forced to infuse a $640 billion stimulus package for development of the domestic market since the Western markets had dried up, resulting in the lay-off of millions of workers in China's manufacturing sector.[7] The 12th Plan largely promoted two key aspects — the government's focus on inclusive and balanced growth and enhancing indigenous innovation capability through large public and private investment in research and development which would enable China to take a great leap forward from "Made in China" to "Created in China" – both expected by the end of this decade.

In its transition from a simple manufacturing and export driven economy to a nation hoping to rely on the high-end technology manufacturing and service sectors, China was open to adopting measures which would encourage not only the flow of foreign investments but also foreign technology, vital for scientific development. It was ready to make readjustments in policies to attract foreign investments by easing regulations and lowering taxes. The policy formulations initiated in the 12th Plan resulted in China becoming the world's largest recipient of Foreign Direct Investment (FDI), according to the half yearly estimates of the Global Investment Trends Monitor. In the first six months of 2012, China attracted FDI amounting to $59.1billion, while FDI flow into the US amounted to $57.4 billion.[8] The amount by the year end had swelled to over $100 billion despite the slowing down of the economy and many favourable factors of production having become unfavourable.

In the past, large global trade and foreign exchange imbalances have irked many countries. China has been blamed for blatantly manipulating the Renminbi (RMB), thus, leading to tensions between China and its

7. "Reforms Critical to China's Decade of Success", Xinhua, October 30,2012, http://english.peopledaily.com.cn/90785/7995964.html, accessed on October 30, 2012.
8. Tom Gregor, "Commentary: China's Top Spot For Global FDI", *People's Daily*, October 25,2012, http://english.peopledaily.com.cn/90778/7991215.html, accessed on October 31, 2012.

major trading partner – America. The American anxiety of the relative standing of the US and Chinese economies was reflected in the heated rhetoric over China as a currency manipulator in the 2012 US Presidential debate. The anxiety is not limited to China deliberately undervaluing the RMB but extends largely to the dollar losing space to the RMB as a potential reserve currency in the future. While international use of the RMB has not yet expanded to transactions beyond those with China, the country has started allowing companies to settle payments for imports and exports outside Mainland China in RMB since 2009. China has 18 bilateral currency swap agreements with countries, including India, Japan, Russia, Brazil and Chile, which permit the Central Banks of these countries to access the RMB outside China. The Public Bank of China (PBOC) allowed almost 60,000 firms worldwide to transact in RMB and almost 7 percent of merchandise trade in 2011 was settled in RMB, a rise from 2 percent in 2010.[9] The RMB's international use and credibility have grown manifold and since June 2012, all Mainland firms were being permitted to invoice and settle their foreign trade transactions in RMB. FDI transactions by Chinese firms abroad and by foreign firms in China are also increasingly being carried out in RMB and such transactions effectively reduce the need for a currency to hedge against the dollar's volatility –implying broadly that the dollar is losing space in favour of another currency.[10]

Therefore, as China steps up in the international pecking order by the measure of its Comprehensive National Power, it would be natural for China to promote the RMB as a global reserve currency. The RMB moved into the trading band in 2005, enjoying swaps with over a dozen countries. Further internationalisation would mean that the RMB would not only become one of the top global trading currencies but also an investment currency to supplant the US dollar as the dominant currency in the foreign exchange market. China expects to excessively benefit from the RMB's hegemony in

9. Victor Shih and Susan Shirk, "To Renminbi or not to Renminbi? Why China's Currency isn't Taking over the World", *Foreign Policy* October 18,2012, http://www.foreignpolicy.com/articles/2012/10/18/to_renminbi_or_not_to_renminbi, accessed on October 31, 2012.
10. ibid.

By 2015, China is expected to invest 8 percent of the GDP in the development of key Strategic Emerging Industries (SEI) which include sectors like new materials, aerospace, displays, high end software and clean and alternate energy.

the world's financial systems, anticipating that other countries will orbit around it. Correcting the abysmal proportion of consumption to GDP would be one of the many drivers for shifting to a consumption model and hedging to internalise its future development strategy. A shift away from the export model would further reduce China's requirement to carry out excessive currency manipulation against a sharp depreciation of the dollar. It is, therefore, anticipated that China will only gradually strengthen rather than deliberately weaken the RMB –which appreciated by almost 3-5 percent in 2012.[11]

China's fifth generation leadership appears flexible to policy readjustments and consumers could well become protagonists in China's future development strategy. There are also possibilities that circumstances could guide Beijing into accepting the orthodox market-based system, starkly different from the socialist market economic system proposed by Deng. Tax breaks, subsidised electricity and land, financing targeted industries for development of future civil and military technologies, and encouraging investments will eventually become the future drivers for growth and economic development. The central, state and private sectors together are also expected to invest in excess of $2 trillion to achieve the set goals.[12]

By 2015, China is expected to invest 8 percent of the GDP in the development of key Strategic Emerging Industries (SEI) which include sectors like new materials, aerospace, displays, high end software and clean and alternate energy (Table2).

11. David Walker, "Yuan to Appreciate by a Modest 3% in 2012", June 13, 2012, http://www.investmenteurope.net/investment-europe/news/2184014/yuan-appreciate-modest-2012-allianz-gis-lam, accessed on November 6, 2012.
12. APCO Worldwide, "China's 2011 National People's Congress (NPC): Fine-Tuning the Economy With an Eye on Social Stability," March 2011, www.apcoworldwide.com/content/PDFs/**npc**_briefing_**2011**.pdf

Table 2: Strategic Emerging Industries

NEW MATERIALS	High performance composites Advanced structural materials New function materials Generic-based materials
HIGH END EQUIPMENT MANUFACTURING	Aerospace and space industries Rail and transportation Ocean engineering Smart assembly
BIOTECHNOLOGY	Innovative pharmaceuticals
NEXT GENERATION INFORMATION TECHNOLOGY	New displays Integrated circuits High end software and servers Digitisation of creative industries Next-generation core equipment Smart devices Next-generation mobile communication Convergence of telecom/ cable TV/ Internet network
ALTERNATIVE ENERGY	Nuclear power Solar power Wind power Smart power grids Biomass power
GREEN ENERGY VEHICLES	Electric hybrid cars Pure electric cars Fuel cell cars
CLEAN ENERGY TECHNOLOGY	

Source: Backgrounder China's 12th FYP

The 12th Plan highlights a shift in priorities favouring consumption by increasing investments in the service sector and the rate of urbanisation. China has lifted millions of citizens out of poverty and, inclusive growth, along with solving issues of widening income disparity, will continue as focus areas in the 12th Plan. The transition from an economy dependent

on hard manufacturing to consumption and higher quality growth model is expected to be gradual. Enhancing R&D to 2.2 percent as a proportion of the GDP by the end of this Plan will also be another key priority (Table 3).

Table 3: Economic Indicators of 11th and 12th FYPs

TARGET	11TH FYP (TARGET)	11th FYP (ACTUAL)	12TH FYP (BY 2015)
Average GDP growth	7.5%	***11.2%***	7%
Service sector as percentage of GDP	43.3%	***43%***	47%
Urbanisation	47%	***47.5%***	51.5%
R&D as percentage of GDP	2%	***1.75%***	2.2%
Strategic industry as percentage of GDP	-	-	8%

Source: Backgrounder, China's 12th FYP.

In the previous three decades, China successfully created an integrated global production system, unprecedented in scale and complexity. However, future directions must not only deal with challenges unfolding in the struggling developed countries but also in China as a result of increasing production and labour cost. The transition from "Made in China" to "Created in China" requires increase in allocation on R&D and the effects are already visible as highlighted by the Chinese Academy of Sciences (CAS) and Chinese Academy of Engineering (CAE) in 2011. The successful rendezvous of the Tiangong-1 and Shenzhou-8; invention of high speed laser equipment; integration of China's breeder reactor with the grid; launching of the first manned deep sea submersible to a depth in excess of 5,000 m; construction of the first deep water drilling platform; increasing yield of China's super rice through advancements in agriculture technology; and developments in missile and aviation technology are examples of only a few advancements made in science and technology in recent years.

DISRUPTIVE MILITARY MODERNISATION

Alongside its economic progress, Beijing is also on the cusp of becoming the world's largest collector of military arsenal. Its order of battle consists of modern jets, frigates, submarines, a range of missile systems, radar network and space-based systems. It also boasts of a robust infrastructure consisting of road and railway networks across the Tibetan plateau, high altitude airfields and over 11 million km of optic fibre cables to strengthen its command and control system. The rapid pace of military modernisation has extensively benefitted from globalisation of the arms industry and China's deliberate strategy of becoming an intrinsic part of the global chain of suppliers and buyers. Beijing is not embarrassed to acquire military hardware surreptitiously if it is not available through legal means. While China enjoys official military ties with more than 150 countries, some of which are vital sources of defence technology, it is also in alliances with other countries, not publicised because of political sensitivities, but wherein are also sources of defence technology.

One such country with which China continues to maintain a formal cooperative relationship is the state of Israel which has been a vital source of defence technology guiding China's military modernisation.

One such country with which China continues to maintain a formal cooperative relationship is the state of Israel which has been a vital source of defence technology guiding China's military modernisation. Though China and Israel established official diplomatic relations only in 1992, they have enjoyed a symbiotic relationship rooted in an informal alliance spanning almost four decades. The bilateral trade grew from $54 million in 1992 to an excess of $8 billion by the end of 2011. China is also an Israeli target export country in the field of telecommunications, agro-technology, security, environment and infrastructure and Israel is opening "Einstein Centres" in many Chinese cities to showcase its

companies.[13]

The foundation of the China-Israel nexus has been, therefore, rooted in a win-win business model. While Israel was looking for a potential market to maximise profits for its civil and military industries, China was in search of a partner with expertise in Russian and American advanced weapon systems – in that context, China could not have found a better partner than Israel. China was aware that Israel over the years had not only gathered experience in countering the Soviet weapon systems but had also developed capabilities to integrate these weapons into its own arsenal. It is an open secret that Israel provided China enough technology to drive the latter's military modernisation through the 1990s. Some of these capabilities include those in the fields of communication, radar, electronic warfare systems, optical instruments (night vision instruments), missiles (Patriot anti-missile technology, Gabriel sea skimming anti-ship missiles and Raphael Python-3 Air-to-Air Missiles (AAMs), laser guided armour piercing warheads, anti-tank missiles, fighter aircraft technology (J-10 considered to be a derivative of the Lavi) and Unmanned Aerial Vehicles (UAVs)(Harpy anti-radar drones). It is also believed that Israeli technicians helped the Chinese improve the guidance system of the DF-3A, which were later sold to Saudi Arabia. However, it is speculated that if the aborted Phalcon deal had fructified, it would have signalled a high point in the Sino-Israeli military cooperation. Also, Israel, pledging closure on future weapon sales to China has made the Israel-China nexus less transparent; however, the volumes of Israeli arms sales to China continue to surge, only to be surpassed by, Russia.[14]

Today, a battle zone is not limited to a region but extends across regions and further into space and, therefore, most conventional battlefields are transforming into a seamless global battle zone. The arms industry too is being driven by globalisation where, like all the other industries, defence

13 Alex Pevzner, "TIP Announces Breakthrough China Program" and Cnaan Liphshiz "China Marks 17 Years with Israel,", http://www.theisraelproject.org/site/apps/nlnet/content3.aspx?c=asIOI5NJKeK0F&b=7676985&ct=11138743#.UQoUQB2deBU and http://www.haaretz.com/china-marks-17-years-with-israel-1.7201, accessed on January 31, 2013.

14. Dallas Boyd, "Advanced Technology Acquisition Strategies of The People's Republic of China", report by ASCO, September 2010

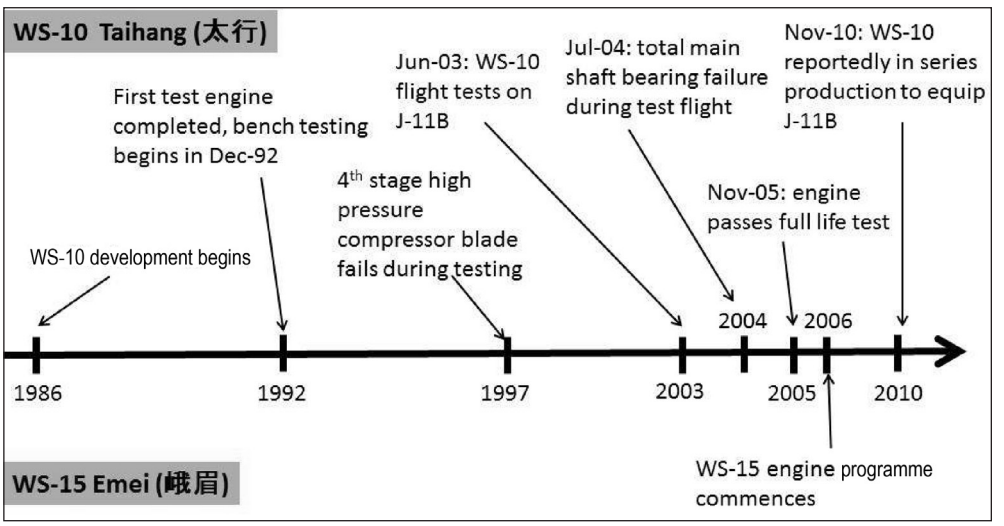
industries are also in search of favourable factors of production for profit maximisation. China, in that context, has evolved as a preferable destination for major primes because of cheap labour, good infrastructure and latent market potential due to the increasing pace of military modernisation. The irresistible market potential is complementing Beijing's drive to achieve rapid industrial development and military modernisation. China is openly embracing Western methodology, blatantly absorbing technology from any country willing to share it and if not, even ready to adopt illicit methods to bring the technology home. China's surreptitious acquisition of technology has been the cornerstone of its development strategy. It has become a collector of export restricted defence systems and sensitive commercial technology used to step-up its capabilities to match the Russian weapon systems and also play catch-up with the American weapon technology. In this effort, China's Military Intelligence Department (MID) under the PLA (People's Liberation Army) has played a pivotal role in assisting Beijing to acquire technology in the denial regime. In the MID, one arm is actively devoted in collection and analysis of data from open sources and the second arm is engaged in carrying out industrial cyber espionage.

As a result, China, over the years, has been able to successfully design nuclear missiles, send taikonauts into space and manufacture aerial platforms; however despite many years of R&D, it is yet to design and develop a low bypass turbo fan jet engine for its home grown fighters. Nevertheless, China's long-term priority continues to be to develop a high performance power plant for the J-10, J-11, J-20 and J-31; and in the interim, the Chinese are also utilising their resources to design engines for the ARJ-21 and C919 single aisle passenger aircraft. The demand for these engines is expected to rise and could be worth $100 billion over the next two decades. In the meantime, Beijing is contemplating increasing investments on research to $50 billion for the underfunded development project for the low bypass turbo fan engine.[15] Eventually, an increase in allocation on R&D to 2.5 percent as a proportion of GDP and flow of

15. Gabe Collins and Andrew Erickson, "Jet Engine Development in China: Indigeneous High Performance Turbofans are a Final Step Toward Fully Independent Fighter Production, *China SignPost*, June 27, 2011.

technology from China's expanding range of commercial aviation joint ventures will boost the development of the aero-engine programme. The development programme for the WS-10 (Taihang) which commenced in 1986 has significantly benefitted from increased investment on R&D, and, when complete, will replace the Russian AL31F. The timeline for China's WS-10 and WS-15 is shown in Fig 1.

Fig 1: Development and Production Timeline of WS-10 & WS-15



Source: Global Times

CHINA IN POST-MAO ERA

China is on the cusp of disruptive transformation in the 21st century, markedly distinct from its earlier *avatar* in the 1990s. China is readjusting its development strategy by reducing state ownership and controlled prices in favour of market forces; realigning infrastructure to emphasise on quality rather than mass production; encouraging foreign private investment by lowering trade barriers; focussing on enhancing domestic consumption instead of exports and, developing the less developed western regions to improve the lives of Chinese citizens across an extended spectrum. A recent survey of Chinese manufacturing activity show signs of economic recovery

as a result of improved global trade and stimulus provided by the government in 2012. The Purchasing Managers' Index (PMI) published by the Hongkong and Shanghai Bank Corporation (HSBC) has recorded the fifth consecutive improvement.[16] The PMI in January rose to 51.9 from 51.5 in December 2012, the highest level in two years, a good start for China in 2013. Qu Hongbin, chief China economist for HSBC, has said that while export growth is likely to remain tepid, infrastructure construction is regaining momentum and companies have started to step up by hiring and manufacturing. The reading underlined a pattern as also envisioned in the 12th Plan that the years of double digit growth are history and the Chinese economy is slowly coming to terms with a modest pace of expansion. The mid-January data in 2013 reveals 7.8 percent growth of the Chinese economy as compared to 9.3 percent in 2011 and 10.4 percent in 2010.[17]

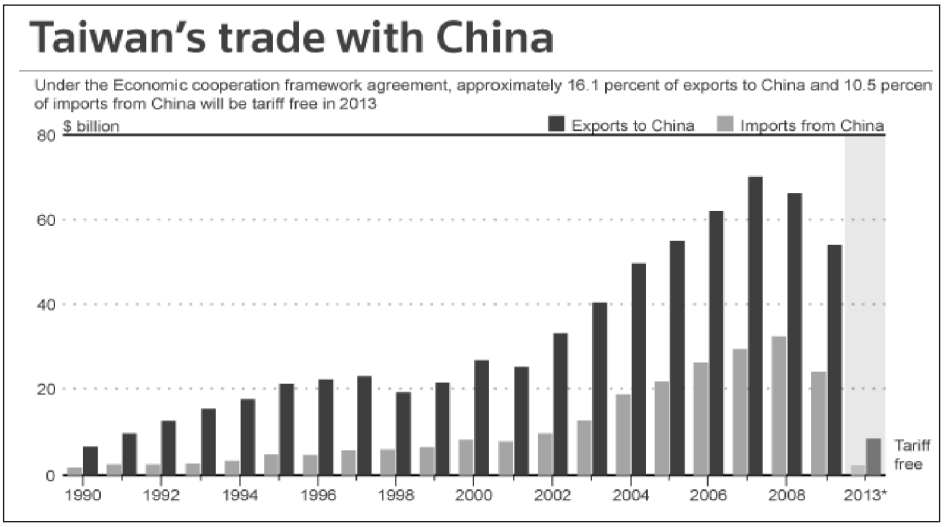
China has become Taiwan's largest trading partner, with bilateral trade worth $110 billion.

Therefore, China in the 21st century has turned out to be far less pervasive than what was perceived by Mao. Liberalisation of cross-border trade, development of services and infrastructure supporting international trade, changing international political dynamics, expansion of cross-national cooperation, and increase in, and expansion of, technology have been the prime drivers for globalisation in China. While, at one time, it was incomprehensible for China to even contemplate carrying out any kind of trade with Taiwan, today, trade between the two countries is governed by provisions laid down under the Economic Cooperation Framework Agreement (ECFA) on 273 items. China has become Taiwan's largest trading partner, with bilateral trade worth $110 billion.[18] Trade between China and Taiwan since December 2008, when the two sides opened trade links, has grown to an astounding figure of $554 billion in October 2012.

16. PMI higher than 50 indicates growth and reading below 50 indicates contraction of the economy.
17. Bettina Wassener, "Chinese Economy Shows Signs of Recovery From Slowdown", *International Herald Tribune*, *The Global Edition of the New York Times*, January 25, 2013.
18. "China and Taiwan Sign Key Investment Protection Pact", http://www.bbc.co.uk/news/business-19204608 accesed on January 29, 2013.

Chinese Mainland imports from Taiwan totalled $439 billion and its exports to Taiwan reached $116 billion (Fig 2).[19]

Fig 2



Source: Taiwan Bureau of Foreign Trade (* 2013 forecast figures based on 2009 figures).

Globalisation in the 21st century has also increased at an accelerated pace. Almost a quarter of world production (including military) is sold outside the country as compared to barely 7 percent in 1950. Restrictions on imports are decreasing, foreign ownership of assets as a percentage of world production has been increasing and the world is transforming into a global playground. While the 1960s and 1970s comprised lost decades for China, the 1980s and 1990s were periods of experimentation, consolidation and realignment. China grabbed opportunities, witnessed double digit expansion of its economy, thereby helping Beijing to leverage far greater influence than it ever expected. The first decade of this century, beyond doubt, has been a period of rationalisation, evident from the 11th and 12th Five-Year Plans, and China, as of 2013, has settled

19. "Trade Between China and Taiwan Hits $554.26 Billion", http://www.chinaeconomicreview.com/trade-between-china-taiwan-hits-55426bn, accesed on January 29,2013.

for a more modest and sustainable pace of growth under the prevailing global economic turmoil.

INDIA'S CONSTERNATION

Decoding both India's defence spending and investor sentiments and carrying out ballpark comparison with China since the 1990s reveals that while India has been far too conservative in defence spending, the overall institutional investments into India too have gradually depleted over the years. Surprisingly, the share of India's defence spending in the GDP declined steadily after liberalisation, whilst China has been increasing its allocation on defence by 17 percent every year. The foreign funds too have poured in more generously into emerging markets such as China, South Korea, Brazil and Taiwan when compared with India. There is also a new group of emerging countries like Mexico, Indonesia, Nigeria and Turkey – called the MINT—sucking substantial investments but at the cost of India. In January 2013, China recorded the highest foreign fund inflows of $5.6 billion as compared to the modest $1.3 billion into India in January 2013.[20] Also, India's own aspiration to evolve as an indigenous player in the defence sector appears suspect.

Therefore, if India is aspiring to emerge as one of the regional power centres, then it would certainly have to reverse the extremely skewed Self-Reliance Index (SRI), expand its defence expenditure and immediately address other critical areas that require attention in the defence economy. India's vision to close the gap with its major adversary will have to be backed with credible and perceivable actions. Joseph Nye described power as the ability to obtain the outcomes one wants.[21] Hence, India will have to effectively devise strategies to not only be perceived as a credible adversary but also possess the power to hedge on critical issues related to the economy of, and security in, the region. For India to envision a role for itself as a major player in the region after the US' exit from Afghanistan, it would necessarily have to be supported by substantial and meaningful increases in

20. "Foreign Funds Pour More into China Than India in Jan", *Business Standard*, February 8, 2013.
21. Joseph S. Nye Jr, 'Don't Try to Contain China", *International Herald Tribune*, January 28, 2013.

the defence budget that can enable it to leverage its position in the region – unlike our current strategy (budget 2013-14) founded on a meagre increase of 5.3 percent in the defence outlay against an overall increase of 12 percent in government expenditure.

India has to take meaningful strides, carry out significant amendments in the procurement procedures by effectively reducing the long gestation periods which, in turn, would result in reducing leakages and unnecessary cost overruns – effectively making procurements cheaper. Slippages in timelines due to long gestation periods and complicated procurement processes effectively result in acquisition of relatively old machines instead of modern contemporary platforms. This is because procurements conceptualised in the previous generation actually fructify in a different generation due to slippages in timelines, resulting in procuring of older generation platforms.

Also, India, at this juncture, cannot afford to succumb to financial pressures and surrender large chunks out of the capital expenditure when the armed forces are suffering from critical deficiencies, adversely affecting the military preparedness. India has surrendered Rs 10,000 crore under the capital head from the 2012-13 estimates. Also, in the 2013-14 budget, capital outlay has been pegged at Rs 86,740 crore, but how much of it will actually be spent on defence modernisation is only a matter of speculation. Carefully tracing the pattern of capital expenditure in this decade reveals certain facts and largely points towards the direction of our strategic thought process. The actual expenditure in 2011-12 was Rs 67,900 crore. The Revised Estimates (RE) in 2012-13 came to Rs 69,578 crore against the Budget Estimates (BE) of Rs 79,578 crore – a modest increase of less than Rs 2,000 crore against a planned budgeted increase of Rs 11,678 crore, broadly indicating a slowdown in the defence modernisation plan. In this election year too, it will be worthwhile to look out for major social sops and their impact on the capital expenditure projected at Rs 86,700 crore. While the government, on the one hand, will be eager to maintain a balance by trying to keep the fiscal deficit under 5 percent, the military, on the other hand, will be sweating to modernise its arsenal – and which of the two will prevail would only be known in February 2014.

Therefore, the figures at the end of this financial year will largely indicate the intentions and the strategic thinking of the government of the day at a time when India is poised at a critical juncture in geo-politics and the region is witnessing a gradual shift in the geo-strategic landscape. Unless the government considers it necessary to increase the defence outlay (BE) by 15 percent every year, pegs the defence budget at 2.5 percent of the GDP and targets R&D at the same percentage point, India will continue to lag behind in its modernisation plans and not be able to catch up with the rest of the world. Indian strategists will also need to shift focus from their obsession for acquisition to indigenisation. India will have to realign the Long-Term Integrated Perspective Plan (LTIPP), Services Capital Acquisition Plan (SCAP) and Annual Acquisition Plan (AAP).[22] Proposals for capital assets that flow out from the planning process should be founded on indigenisation instead of acquisition which, in turn, would help reverse the SRI. For India to emerge as a regional power centre, it will have to indigenously develop top performance systems with cutting edge technologies for future battlefields. It would also have to guard against any form of technology entrapment by strategising and cleverly lowering the threshold below the denial list and then crossing the threshold through indigenous R&D. India will have to lay emphasis on reducing life-cycle costs for the systems being indigenously developed by attracting private players who would eventually become key players in its defence modernisation strategy.

The Standing Committee on Defence (2010-11) adversely commented on underutilisation of the R&D budget.

India at this stage cannot afford to be stuck in the mud. The Standing Committee on Defence (2010-11) adversely commented on underutilisation of the R&D budget, resulting in project delays and slowing down of India's defence modernisation plan. Inability to utilise meagre allocations on R&D should be considered acts of indiscretion. Technology in the future would not only act as an elixir in the defence modernisation plans but will also

22. 15 years Long Term Integrated Perspective Plan(LTIPP), 5 years Services Capital Acquisition Plan (SCAP), Annual Acquisition Plan (AAP).

be the key factor affecting India's security dilemma. Therefore, in the changing geo-strategic landscape, with India poised to emerge as a credible regional power, it will have no choice other than to step-up allocation in R&D, develop a network of laboratories and undergo a seamless transition from the present mindset of 'acquisition' as the panacea to India's security challenges to laying greater focus on design, development, manufacturing and integration (including private players) of its defence economy.

An assessment of the ongoing projects undertaken by the Defence Research and Development Organisation (DRDO) and Defence Public Sector Undertakings (DPSUs) shows that they do not reflect the strategic thinking envisioned to guarantee India's security or ensure a smooth transition of the state into a credible regional power. The Tejas project, sanctioned in 1983 at an original cost of Rs 560 crore, is still preparing for the second Initial Operational Clearance (IOC) in 2012, though it should have been ready for operational deployment at least two decades ago. The first phase was completed at a cost of Rs 2,188 crore; the government sanctioned Rs 3,301.87 crore for the second phase and additional Rs 5,302.98 crore for Full Scale Engineering Development (FSED). The Intermediate Jet Trainer (IJT) project, Sitara (HJT 36) being developed by Hindustan Aeronautics Limited (HAL) (DPSU) since 1997, is yet to be put up for the IOC, and the delay is causing impediments to basic training in the Indian Air Force. Time slippages in projects undertaken by the DRDO and DPSUs are becoming a ritual, adversely affecting operational preparedness and the modernisation plans of the armed forces which is a matter of enormous concern.[23]

The Standing Committee on Defence (2010-11) also commented on the adverse impact that slippages in timelines and cost overruns were having on India's defence preparedness. The committee highlighted that the Indian Air Force was plagued with high accident rates and 44.59 percent of all accidents were being ascribed to human failure, largely due to non-availability of a basic trainer aircraft.[24] If this is true, then it is a matter of grave concern and further delays will necessarily have to be attributable

23. Standing Committee on Defence (2010-2011), Fifteenth Lok Sabha, MoD, Ninth Report December 2010.
24. Ibid.

to criminal negligence on the part of the DRDO and DPSUs, that have taken upon themselves the mammoth responsibility of guaranteeing India's security by developing credible weapon systems. The committee recommended that the ministry should focus on development and integration and make efforts to fully utilise allocation on R&D to push for indigenisation of weapon systems and modern platforms for our armed forces. Despite directions, the vision is not backed by credible actions by the government. The share of the defence budget in the GDP had fallen to less than 2 percent and R&D was at an abysmal rate of 6.5 percent of the defence budget which accounts for less than 0.2 percent of the total GDP. The standing committee also noted that the MoD was yet to implement the recommendations of the Rama Rao Committee submitted on March 5, 2008, for restructuring of the DRDO.

While the numbers of Indian researchers in R&D have not increased substantially, the numbers in China have grown in excess of 1,200 researchers per million people.

There is also a missing link in India's development strategy. While infrastructure continues to be a weak area, we also lack quality and trained manpower ready to toil on the shop floor to provide the necessary boost in the manufacturing sector. Disincentives for Foreign Direct Investment (FDI) and a weak framework for absorbing technology are also adversely affecting the flow of global knowledge into India. Inadequate infrastructure, lack of skilled manpower and weak R&D capabilities forced Mahindra and Mahindra to shift its manufacturing base to Australia for developing a 10-seat multi-utility aircraft. According to a World Bank report published in 2005, India is lagging behind its adversary since it is unable to effectively utilise the resources at its disposal (Table 4). In the present context, the performance gap between India and China has only widened. While India's expenditure on R&D has been almost at the same level, China has substantially increased its allocation on R&D to almost 1.8 percent of the GDP. While the numbers of Indian researchers in R&D have not increased substantially, the numbers in China have grown in excess of

1,200 researchers per million people. FDI into China is also increasing at a brisk pace while India still appears to be taking very small strides to attract FDI. Despite weak macro-economic indicators like rising costs from higher wages, dwindling working population and currency appreciation, China was able to attract FDI worth $111.7 billion in 2012.[25]

Table 4

Comparative Innovation Performance: India and China, Selected Variables, Most Recent Perioc

Variable	India	China
Gross Foreign Direct Investment as % of GDP (average 1993–2002)	0.60	5.40
Royalty and license fees payments/mil. pop. (2002)	0.33	2.43
Royalty and license fees receipts/mil. pop. (2002)	0.01	0.10
Science & engineering enrollment ratio (% of tertiary level students) (2002)	25.00	43.00
Researchers in R&D/million (1997)	98.85	583.88
Total expenditures for R&D as % of GDP (2001)	0.78	1.09
Private sector spending on R&D (2003)	3.50	3.80
Manufactured trade as % of GDP (2002)	13.02	41.84
High-tech exports as % of manuf. exports (2002)	5.00	23.00
Scientific and technical journal articles/mil. pop. (1999)	9.23	9.31
Availability of venture capital, scale of 1 to 7 (2003)	3.80	3.00
Patent applications granted by the USPTO/mil. pop. (2003)	0.33	0.33
University–company research collaboration, scale of 1 to 7 (2003)	3.20	4.20
State of cluster development, scale of 1 to 7 (2003)	4.10	3.70

Source: World Bank Knowledge Assessment Methodology

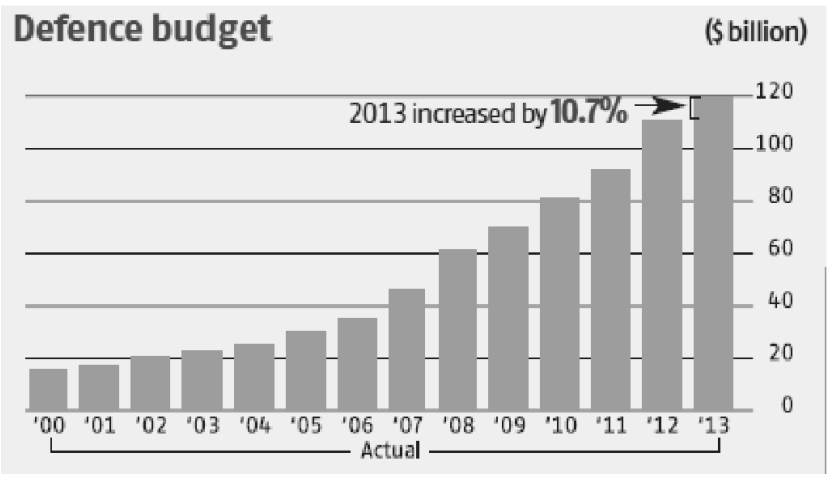
Therefore, disjointed structures, excessive reliance on imports and the DPSUs', lack of adequate impetus to indigenisation and a fuzzy aerospace strategy are the few impediments slowing down the development of India's defence economy. Long gestation periods and frequent changes in the procurement processes are inherent barriers for the entry of private players who, as it is, appear laggard and averse to making a foray into this untested area for carrying out business. While the private players are wary of participating in the Indian defence economy, lack of a definite vision from the government is further detracting them from actively participating in the defence economy. Minimal interaction and collaboration between DPSUs and the industry, coupled with lack of synergy among the DRDO, DPSUs and the end users are factors

25. Jamil Anderlini, "Foreign Direct Investments in China Fall", *Financial Times*, January 16, 2013, accessed from http://www.ft.com/cms/s/0/5537736c-5fc8-11e2-8d8d-00144feab49a.html#axzz2Me6JGeZ4 on March 5, 2013.

responsible for plaguing the development of a robust defence economy in India – essential to guaranteeing India's security and ensuring its elevation as a credible regional power.

China, on the other hand, is aggressively increasing spending on its defence. Once again, this year (2013), the official defence expenditure has increased substantially to $119 billion, amounting to almost a quarter of US defence allocation (Fig 3). However, if the unofficial estimated figure is aggregated along with spending on internal security (which is more than China's defence expenditure), then China's defence allocation would amount very close to US defence spending! China is doing things which to the world may appear 'politically incorrect' but conform to its strategic vision and goals to elevate its status as an emerging power.

Fig 3: China's Defence Expenditure in the 21st Century



Source: Business Standard March 6, 2013

China has substantially reversed its dependence on imports. It was a top importer of arms in the first half of the previous decade of this century but successfully reversed its dependence as it considered technology and indigenisation as the guarantor for national security. In the ranking of countries importing arms, China slipped to the fourth position. India, on the other hand, has been consistent in maintaining a stable SRI at 70 percent since the last decade of the previous century. As a rarity, India

has successfully dethroned China to occupy the pivotal position as the largest importer of arms accounting for 10 percent of the total global arms import.

China is also not shy from declaring its long-term military aspirations which it considers as legitimate for an emerging power – rarely does a top power cede its position to the number two power peacefully.[26] But whether China is aspiring to dethrone the US as the number one power or is just happy to be slotted as the number one regional power is a matter of a larger debate. However, China spending billions of dollars on its military should hardly be perceived as a conspiracy but as a justifiable act of any sovereign nation with legitimate aspirations to guarantee national security to its citizens.

Therefore, China's readjustment strategy is structured on many verticals. While one vertical is looking to internalise its future development strategy, focus on controlling spiralling inflation and ease out the prevailing unsustainable rates of economic growth, the other vertical is dedicated to address people-centric policies aimed at arresting the increasing social unrest, also reiterated by the country's largest think-tank (CAS). As has been mentioned above, the government has abolished agricultural taxes, subsidised health care and education, provided an impetus to boost the internal demand and check the rising rates of unemployment, since the Party is extremely wary of any kind of potential fallout resulting from mass protests and anti-establishment sentiments spreading through the electronic medium. However, China's focus on building a robust military as part of its larger strategic vision and as an ultimate guarantor of national security will continue to be its final vertical.

26. Kishore Mahbubani, "While America Slept", *Foreign Policy*, February 27, 2013.

OPPORTUNITIES UNBOUND: SUSTAINING MULTI-DIMENSIONAL INDO-RUSSIAN RELATIONS

LUNGTHUIYANG RIAMEI

India's relations with the erstwhile Soviet Union (Russian Federation) are founded on trust and mutual interest. This trusted relationship played a significant role in India's economic development and security after independence. There were good reasons 'for' and 'against' cooperation with both power blocs during the Cold War. India had decided upon a quasi-socialist and planned economy style of the Soviet's economic system. India opted for the Soviet Union while officially retaining a 'non-aligned' status and maintaining equidistance with both blocs. India and the Soviet Union enjoyed a strong strategic, military, economic and diplomatic relationship. India greatly gained from the Soviet Union in developing its core industries and laying the foundation for future growth. The Indo-Russian strategic partnership has been built on five major components: politics (with a sustained, regular dialogue at the highest level), defence, civil nuclear energy, counter-terrorism and space cooperation.[1] In recent years, the economic component has grown in importance with both countries setting

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1. "Long Way to go For the Indo-Russian Ties", *Russia and India Report*, URL: http://indrus.in/articles/2012/12/20/long_way_to_go_for_indo-russian_ties_21159.html, accessed on February 26, 2013.

The Soviet leaders endorsed the entire range of Indian foreign policy based on the *Panchsheel* and supported India's position against Pakistan on Kashmir.

a target for $20 billion in bilateral trade by 2015.[2] India and Russia have moved to the phase of joint design and development, and of multi-year joint collaboration programmes with substantive sharing of critical technologies. The military-technical cooperation between India and Russia has been the centrepiece of their bilateral relations.

EMERGENCE OF INDO-RUSSIAN RELATIONS

During the Cold War, India, while not a member of a bloc, enjoyed a proximate relationship with Russia. A cordial relationship with India that began in the 1950s represented the most successful of the Soviet attempts to foster closer relations with Third World countries. Jawaharlal Nehru had expressed admiration for the Soviet Union's rapid economic transformation. After Josef Stalin's death in 1953, the Soviet Union expressed its hopes for friendly cooperation with India. This aim was prompted by the Soviet decision to broaden the country's international contacts and to cultivate the non-aligned among the newly independent countries of Asia and Africa. The relationship began with a visit by Indian Prime Minister Jawaharlal Nehru to the Soviet Union in June 1955. It was followed by the trip of Premier Nikolai Bulganin and General Secretary Nikita Khrushchev to India in November and December 1955. The Soviet leaders endorsed the entire range of Indian foreign policy based on the *Panchsheel* and supported India's position against Pakistan on Kashmir. The Soviet Union also supported India's position vis-à-vis Portugal on Goa, which was territorially integrated into India as a union territory by the Indian armed forces in December 1961 (it became a state in May 1987).[3]

The Indo-Russia relationship has embraced political, economic and military cooperation. This strategic cooperation was achieved in August 1971 with the signing of the "Indo-Soviet Treaty of Peace, Friendship and

2. "India and Russia set US$ 20 BN Bilateral Trade Target by 2015", *Overseas Indian Facilitation Centre,* June 2012, URL: http://m.oifc.in/Resources/News/India-and-Russia-set-US-24-20-BN-bilateral-trade-target-by-2015, accessed on February 26, 2013.
3. "Russia", URL: http://countrystudies.us/india/133.htm, accessed on February 26, 2013.

Cooperation". The treaty became a bulwark of India's territorial integrity, shaping the geo-politics of the Indian subcontinent and strengthening regional security and world peace. It provided a strong boost for developing multifaceted bilateral cooperation in all spheres of human activity, converting into a special relationship in the 1980s.[4] The contextual imperatives that forged the India-Russia strategic cooperation were from the Indian side: the US-Pakistan military alliance and aid, Indo-US estrangement, Sino-Pakistan strategic relationship and Sino-Pakistan-US strategic convergence. The Soviets had also accepted India's preeminence in South Asia, rather than seeing through the lens of the Indo-Pakistan relationship, as the US was repeatedly prone to do.[5]

Nehru obtained a Soviet commitment to neutrality on the India-China border dispute and the war of 1962. During the India-Pakistan War of 1965, the Soviet Union acted with the United States in the UN Security Council to bring about a ceasefire. By 1965, the Soviet Union was the second largest national contributor to India's development. These new arrangements contributed to India's emergence as a significant industrial power through the construction of plants to produce steel, heavy machinery and equipment, machine tools, and to generate power and extract and refine petroleum. Soviet aid was extended on the basis of long-term, government-to-government programmes which covered successive phases of technical training for Indians, supply of raw materials, progressive use of Indian inputs, and markets for finished products. Bilateral arrangements were made in non-convertible national currencies, helping to conserve India's scarce foreign exchange. Thus, the Soviet contribution to Indian economic development was generally regarded as positive.

When the Soviet Union invaded Afghanistan in 1979 which was a part of the Cold War, the Indian government avoided condemnatory language

4. Arun Mohanty, "The Indo-Soviet Friendship Treaty and its Legacy" *Mainstream*, XLIX (38), September 10, 2011, URL: http://www.mainstreamweekly.net/article2989.html, accessed on February 26, 2013. Also see, "Indo- Soviet Treaty of Friendship and Cooperation", *The Times of India,* URL: http://timesofindia.indiatimes.com/topic/Indo-Soviet-Treaty-of-Friendship-and-Cooperation,
5. Deepa M. Ollapally "The Evolution of India's Relations with Russia: Tried, Tested, and Searching for Balance" in Sumit Ganguly, ed., *India's Foreign Policy: Retrospect and Prospects*, (New Delhi: Oxford University Press, 2010), pp. 231-232.

and resolutions that could antagonise the bilateral relations. India called for withdrawal of all foreign troops and negotiation among the concerned parties. In meetings with Soviet leaders in New Delhi in 1980 and in Moscow 1982, Indira Gandhi pressed for the withdrawal of Soviet troops and for the restoration of Afghanistan's traditional non-alignment and independence.

After the Soviet Union disintegrated, India was faced with the difficult task of reorienting its external affairs and forging relations with the 15 Soviet successor states (Commonwealth of Independent States). But in 1993, New Delhi and Moscow worked to redefine their relationship according to post-Cold War realities. During the January 1993 visit of Russian President Boris Yeltsin to India, the two countries signed agreements that signalled a new emphasis on economic cooperation in bilateral relations.[6]

STRATEGIC PARTNERSHIP AFTER THE COLD WAR

India and Russia have sustained the close and cordial strategic relations of the Soviet era. This is reflected in the exchanges of visits between the two countries at the levels of heads of state and Prime Ministers. Both the countries have similar foreign and security policies which are based on the concept of a "multipolar" world. It is in this context that Russia has its interest in the South Asian region where it gives primary importance to India. Russia is one of the trusted partners with which India has a mutual compatibility and a close political, military and economic partnership for decades. Russia (and the Soviet Union) contributed to creating India's key strengths and capabilities in the nuclear, defence, space and heavy industry sectors when no other country was willing to support India's endeavours to modernise.[7] Despite the hype surrounding the visits of other members of the P-5 (permanent five members of the Security Council), India's relationship with Russia has brought it greater benefit than other major countries.[8] India

6. "Yeltsin Reaches Accords in India," *Los Angeles Times,* January 29, 1993, URL: http://articles.latimes.com/keyword/india-foreign-relations-russia, accessed on February 26, 2013.
7. Martin Malek, "Russian Policy Toward South Asia: An Update," *Asian Survey*, 44(3), May-June 2004.
8. Pallavi Pal, "The Way Ahead in Indo-Russian Ties", *IDSA Comment*, December 20, 2010, URL: http://www.idsa.in/idsacomments/ThewayaheadinIndoRussianties_ppal_201210, accessed on February 26, 2013.

sees Russia as a longstanding and time-tested friend that has played a significant role in its economic development and security. Since the signing of the "Declaration on the India-Russia Strategic Partnership" in October 2000 (during the visit of President Vladimir Putin to India), India-Russia ties have acquired a qualitatively new character, with enhanced levels of cooperation taking place in almost all areas of the bilateral relationship including political, security, trade and economy, defence, science and technology and culture.[9] Under the "Declaration of Strategic Partnership", several institutionalised dialogue mechanisms have been put in place that operate at the political and official levels, and ensure regular interaction and follow-up on cooperation activities. During the visit of President Dmitry Medvedev to India in December 2010, it was decided to further elevate the strategic partnership to the level of a "special and privileged strategic partnership". The 65th anniversary of the establishment of diplomatic relations between India and Russia was celebrated on April 13, 2012.[10] India benefits from its relationship with Russia in areas that are critical to Indian interests like Kashmir, energy security, and in relations with China and Central Asia.

INTENSIFYING POLITICAL-ECONOMIC FRIENDSHIP

After the Cold War, India continued to rely on Russia as an ally in resisting the "unipolar world order". The Russian attempt to construct multipolarity is based on collective security and the politics of inclusion. The multipolar vision emphasises non-military solutions to international problems. The bilateral agreements give India-Russia relations multiple directions and establish strategic and political sub-systems. The annual summit meeting between the Prime Minister of India and the President of the Russian Federation is the highest institutionalised dialogue mechanism. Since the Declaration of Strategic Partnership, meetings have taken place alternatively

9. "India-Russia Relations", January 2012, URL:http://www.mea.gov.in/Portal/ForeignRelation/Russia_-DEC_2012.pdf, accessed on February 26, 2013.
10. "India-Russian Relations", January 2013, URL: http://indianembassy.ru/index.php?option=com_content&view=category&layout=blog&id=50&Itemid=449&lang=en, accessed on February 26, 2013.

in India and Russia. The 13th Summit meeting was held in Delhi on December 24, 2012, between Prime Minister Dr. Manmohan Singh and Russian President Vladimir Putin. The two governments have also established two Indo-Russian Inter-Governmental Commissions (IRIGCs)— one on Trade, Economic, Scientific, Technological and Cultural Cooperation, co-chaired by the Indian External Affairs Minister and the Russian Deputy Prime Minister and another on Military Technical Cooperation co-chaired by the two Defence Ministers, both of which meet annually.[11] The IRIGCs comprise the main body that conducts affairs at the government level between both countries.

India and Russia are closely collaborating on matters of shared national interest at the UN, BRICS (Brazil, Russia, India, China and South Africa), Group-20 and Shanghai Cooperation Organisation (SCO). India has been given an observer status at the SCO and has been asked by Russia to become a full member. Russia has expressed interest in joining the South Asian Association for Regional Cooperation (SAARC) of which India is a founding member. The emergence of groups like the BRICS and G-20 is reflected in the bilateral strategic partnership, ushering in a world order of multilateralism.[12] Russia has strongly supported India for a permanent seat on the United Nations Security Council. The United States has declared its unambiguous support for Japan and remained evasive on the question of permanent membership for India.[13] In addition, Russia has backed India joining the Nuclear Suppliers Group (NSG) and Asia-Pacific Economic Cooperation (APEC). India is seen as a like-minded country that serves the interest and goals of the non-proliferation regimes.[14] Russia and India also intend to strengthen their cooperation on intend issues concerning the reforms of the United Nations and its Security Council. Russia has backed India's

11. Ibid.
12. Aurobinda Mahapatra, "India- Russia Partnership: Continuity in the Midst of Change", *Russia &India Report,* 2011, URL: http://indrus.in/articles/2011/12/20/india-russia_partnership_continuity_in_the_midst_of_change_14045.html, accessed on February 26, 2013.
13. Mussarat Jabeen, "Indian Aspiration of Permanent Membership in the UN Security Council and American Stance", *South Asian Studies*, 25(2), July-December 2010, p.243.
14. "India Moving Closer to Joining NSG, US Leads the Charge," *Deccan Herald* (New Delhi), September 24, 2012, URL: http://www.deccanherald.com/content/280773/india-moving-closer-joining-nsg.html, accessed on February 25, 2013.

claim for permanent membership in an expanded United Nations Security Council (UNSC). The joint declaration said that the UNSC reform should be carried out in such a way as to reflect the modern-day realities and make it more representative and effective in resolving the existing and emerging task of the global politics.[15] Both countries have also played key roles towards advocating fair play in international regimes and democratisation in the decision-making of international financial bodies like the International Monetary Fund (IMF) and World Bank.[16]

As New Delhi looks at an alternative policy to secure its strategic interests, the partnership between India and Russia is likely to strengthen in the coming years.

With the US in relative decline, Russia and India are struggling with the implications of rising Chinese hegemony over the Asian strategic landscape. Both countries have a common goal to make the world more just, democratic and secure and to facilitate resolution of global and regional problems in the Middle East, North Africa and South Asia.[17] The rapidly deteriorating security situation in Afghanistan has also been instrumental in bringing India and Russia closer in recent years. Moscow has repeatedly underlined that the situation in Afghanistan impacts the security of both India and Russia, underscoring their convergence of views and interests on the matter. Their stepped-up cooperation on Afghanistan comes at a time when India is worried about the departure of Western troops from Afghanistan in 2014.[18] As New Delhi looks at an alternative policy to secure its strategic interests, the partnership between India and Russia is likely to strengthen in the coming years.

15. "Russia Supports India's Claim for Permanent UNSC Seat" *The Hindu*, December 7, 2009, URL: http://www.thehindu.com/news/national/russia-supports-indias-claim-for-permanent-unsc-seat/article61516.ece, accessed on February 26, 2013.
16. Mahapatra, n. 12.
17. Vladimir Putin, "For Russia, Deepening Friendship with India is a Top Foreign Policy Priority", *The Hindu* (New Delhi), December 24, 2012, URL: http://www.thehindu.com/opinion/op-ed/for-russia-deepening-friendship-with-india-is-a-top-foreign-policy-priority/article4232857.ece, accessed on February 26, 2013.
18. Harsh V. Pant, "How Strong are the Ties that Bind Russia and India?", December 31, 2012, URL: http://www.dnaindia.com/analysis/column_how-strong-are-the-ties-that-bind-russia-and-india_1783591, accessed on February 26, 2013.

The economic relations are an important component of bilateral cooperation. Bilateral trade between Russia and India was severely affected due to the disintegration of the Soviet Union. The break-up of the USSR in 1991 and India's economic liberalisation resulted in a drastic reduction in bilateral trade and economic cooperation. Both economies are resurging and, at the same time, diversifying. Gradually, both countries have built a sound legal foundation for promoting trade and economic ties. Agreements on mutual investment protection and avoidance of double taxation are in place for facilitating ties.[19]

Russia's joining the World Trade Organisation (WTO) has facilitated more India-Russian trade cooperation and investment. The government banks of the two countries have signed an agreement to set up a US $2 billion fund for promoting trade and investment.[20] The protocol on completion of bilateral negotiations on the accession of Russia to the WTO and a Memorandum of Understanding (MOU) on cooperation between the Ministry of Commerce and Industry of India and the Ministry of Economic Development of Trade of the Russian Federation were signed in 2010.[21] The IRIGC is the body that conducts economic relations between the two countries. These include the Indo-Russian Forum on Trade and Investment, the India-Russia Business Council, the India-Russia Trade, Investment and Technology Promotion Council and the India-Russia Chamber of Commerce.

Enhancing trade and economic cooperation between India and Russia is a key priority for the political leadership of both countries. Bilateral trade has been growing steadily in the past two decades and witnessed positive growth despite the international financial and economic crisis in 2008-09. India is Russia's 10th largest trading partner, accounting for 1.4 percent of Russia's total trade, while Russia is India's 29th, making up just

19. Arun Mohanty, "Indo- Russian Trade and Economic Cooperation: The Way Ahead" in P. Stobdan, ed., *India- Russia Strategic Partnership: Common Perspective* (New Delhi: Institute for Defence and Analyses, 2010), p. 170.
20. "India, Russia Seek New Stimulus for Traditional Partnership During Putin's Visit", *Xinhua*, December 26, 2012, URL: http://www.globaltimes.cn/content/752325.shtml, accessed on February 27, 2013.
21. Keith Timimi, "Indo-Russian Trade Relations", *Economy Watch*, April 8, 2010, URL: http://www.economywatch.com/world_economy/russia/indo-russia-trade-relation.html, accessed on February 27, 2013.

0.97 percent of India's total trade.[22] Trade in 2009 was US$ 7.5 billion, US$ 8.5 billion in 2010, and in 2011, it reached US$ 8.9 billion. In 2011, Russian exports to India amounted to US$ 6.1 billion and imports from India to Russia amounted to US$ 2.8 billion. The two-way investment between the two countries stands at approximately US$ 7.8 billion. Given the respective size of the Indian and Russian untapped economies, there is vast potential for an increase in bilateral trade volumes and investment. In 2009, both sides set a target of US$ 20 billion in bilateral trade by 2015.[23] Special attention is being paid to the energy sector, pharmaceuticals, Information Technology (IT), steel, hydrocarbons, aerospace, diamonds and food products. Russia still relies on India for pharmaceutical exports that were one of the mainstays of Indo-Soviet trade. But in 2010, the Russian government sought to protect its domestic pharmaceutical industry by lowering the price of drugs and imposing regulations on foreign manufacturers, a plan which pushed a number of Indian pharmaceutical companies out of Russia.[24]

Given the respective size of the Indian and Russian untapped economies, there is vast potential for an increase in bilateral trade.

The greatest hindrance to trade between India and Russia is the lack of trade routes. There is need to optimise the shipping route because, until a viable and shorter route for trade is worked out, higher growth rates in trade of goods will continue to be hampered. The agreement on the new India-Russia transport corridor may help in reducing transport costs. The present route, which passes through the Suez Canal and enters the Russian port of St. Petersburg via Kotka (Finland) and Rotterdam (Netherlands), is long and time consuming. The new route—Mumbai-Bandar Abbas-Astrakhan—

22. For details, see Katherine Foshko Tsan, "Re-energizing the Indian-Russian Relationship: Opportunities and Challenges for the 21st Century", 2(1), *Jindal Journal of International Affairs*, August 2012, p. 162.
23. Vladimir Radyuhin, "Indo- Russian Trade Posts Impressive Growth," *The Hindu* (Moscow), January 26, 2013, URL: http://www.thehindu.com/news/international/indorussian-trade-posts-impressive-growth/article4348097.ece, accessed on February 27, 2013. Also see, "India-Russia Relations", (January 2013) URL: http://indianembassy.ru/index.php?option=com_content&view=category&layout=blog&id=50&Itemid=449&lang=en, accessed on February 27, 2013.
24. Foshko Tsan, n. 22, p. 164.

would comprise sea and land links across India, Iran and Russia and will shorten travel time by as much as ten days. Thus, the North-South Corridor which can link Mumbai to St. Petersburg with a 40 percent cut in cost and time, needs greater attention from both countries.[25] Despite the interest shown by both sides to increase bilateral flow of goods and services, there are still some trade barriers, and non-tariff barriers continue to plague bilateral trade. The Indo-Russian economic relationship is still dominated by defence sector transactions. The Military Industrial Complex (MIC) still stands at the core of strong Indo-Russian economic linkages.[26] Indo-Russian bilateral trade is far below the existing trade potential and there is a need for cooperation to increase bilateral trade.

BUILDING UP DEFENCE PARTNERSHIP

During the Cold War period, the Soviets were consistently more open to providing high technology and advanced military equipment than the US.[27] The military-technical cooperation has traditionally been accorded the most prominent status in the entire spectrum of the bilateral relations. The first deals involving the deliveries of Soviet weapon systems to India were made in August 1962, when India purchased helicopters, transport aircraft and MiG-21 jet fighters. The same year, the construction of production facilities for military hardware was undertaken at Nasik, Koraput and Hyderabad. After the India-Pakistan armed conflict in 1965, the US and other Western countries imposed an embargo on the exports of weapon systems to India and Pakistan. From that time, the principal supplier of arms and military equipment to India became the USSR. Throughout the period from 1965 to 1969, the USSR accounted for 80 percent of India's

25. Rajeev Sharma, "Transport Corridor Offers Many Opportunities for Indo- Russian Trade", *Russian & India Report*, November 29, 2012, URL: http://indrus.in/articles/2012/11/29/north-south_transport_corridor_offers_many_opportunities_for_indo-ru_19421.html, accessed on February 27, 2013. Also see, Vladimir Radyuhin , " India, Russia will Strive to Galvanise Bilateral Trade", *The Hindu* (Moscow) November 18, 2011, URL: http://www.thehindu.com/business/Economy/article2639758.ece, accessed on February 27, 2013.
26. Niveta Kundu Das, "India and Russia Need to Deepen Economic Relations", *IDSA Comment*, March 7, 2007, URL:http://www.idsa.in/idsastrategiccomments/IndiaandRussiaNeedtoDeepenEconomicRelations_NDKundu_070307, accessed on February 27, 2013.
27. Ollapally, n. 5, p. 231.

imports of military hardware. Consequently, by the mid-1990s, nearly 70 percent of the Indian Army, 80 percent of the Indian Air Force and 85 percent of the Indian Navy was equipped with Russian made military hardware.[28] Following the signing of the Treaty of Friendship and Cooperation between the Russian Federation and the Republic of India in 1993, a long-term programme on military and technical cooperation till 2000 was endorsed. The joint venture to produce the BrahMos missiles was established in early February 1998 in conformity with the agreement between the Russian and Indian governments on the development and production of anti-ship cruise missile systems.[29]

Arms sales have been the pillar of Russia-India relations. After the Cold War period, over 70 percent of India's military equipment imports were from Russia.

In September 2008, India and Russia decided to extend their military cooperation for another 10 years beyond 2010 and set up an apex body to monitor proper focus. In a joint statement, Defence Ministers A.K Anthony and Anatoliy Serduykove, agreed to take the relationship further from the vendor-seller one to areas of design development, co-production and co-marketing of military hardware. Further, the Indian government reached an agreement with Sukhoi to upgrade 42 SU-30MKI with new radars, avionics and BrahMos supersonic missiles. The project was carried out by Hindustan Aeronautics Limited (HAL) at the cost of $ 2.34 billion with the assistance of Russian experts. By the end of this decade, the Indian Air Force (IAF) will have a total of 272 SU-30 MKI fighters in service at a total cost of around $14 billion, making it the dominant aircraft in the IAF.[30]

Arms sales have been the pillar of Russia-India relations. After the Cold War period, over 70 percent of India's military equipment imports were from Russia.[31] India and Russia have several major joint military

28. Jerome M. Conley, "India- Russia Military and Nuclear Cooperation: Implications for US Security", US Air Force, National Strategic Institute Studies Paper, February 2000.
29. Tatiana Shaumyan, "Russian-Indian Bilateral Cooperation" in Stobdan, ed., n. 19, pp. 156-159.
30. T. M. Asthana , "Russia- India Military Cooperation in the Future", in Jasjit Singh, ed., *India-Russia Relations* (New Delhi: Knowledge World Publishers Pvt Ltd, 2012), p. 68.
31. "India, Russia Sign New Defence Deals", *BBC News*, December 24, 2012, URL: http://www.bbc.co.uk/news/world-asia-india-20834910, accessed on February 27, 2013.

Russia continues to be India's largest defence partner. Russia has sold India some weapon systems that it has not offered to other countries.

programmes and supplies of military hardware, including: the BrahMos cruise missile programme, fifth generation fighter jet programme, Sukhoi SU-30MKI programme (230+ to be built by HAL), Ilyushin/HAL tactical transport aircraft, nuclear powered submarines, Typhoon class, destroyers, and T-80, etc.[32] In December 2012, India and Russia signed defence deals worth around $ 4 billion. Prime Minister Manmohan Singh called Russia a key partner in India's efforts to enhance its defence preparedness. Both countries took note of the progress made in the joint development and production of high-technology military equipment and projects.[33]

Recently, the defence relationship between India and Russia has been drifting apart. The relationship has been strained due to delays and frequent price changes for the *INS Vikramaditya*.[34] In the meantime, the Indian government has sought to diversify its foreign weapons suppliers despite the higher costs and complexity. The Indian military began buying large quantities of Soviet weapons but has always complemented these purchases with European and Israeli systems.[35] The Government of India has also awarded non-Russian companies, including American ones, multi-billion dollar contracts for advanced military equipment.

However, Russia continues to be India's largest defence partner. Russia has sold India some weapon systems that it has not offered to other countries. Geo-political ties remain strong, with the two countries elevating their relationship in 2011 to that of a "Special and Privileged

32. Subhash Kapila, "India-Russia Strategic Cooperation", URL: http://www.southasiaanalysis.org/paper144, accessed on February 27, 2013.
33. "India Signs $ 4- bn Defence Deals with Russia", *Indian Express* (New Delhi) December 25, 2012, URL: http://www.indianexpress.com/news/india-signs--4bn-defence-deals-with-russia/1049883, accessed on February 27, 2013.
34. INS *Vikramaditya* is the name of an aircraft carrier set to enter service with the Indian Navy in 2013. It was postponed after three of the eight boilers that power its four engines broke down during sea trials in September 2012.
35. Richard Weitz, "Maturing of Russian- India Defence Relations", *Journal for Defence Studies and Analyses*, 5(3) 2012, p. 89.

Strategic Partnership".[36] The sales and other defence cooperation have been institutionalised in regular meetings of the Russian-Indian Governmental Commission on Military Technical Cooperation which meets annually at the level of Defence Ministers. Both countries have undertaken a series of joint military exercises. Joint exercises like "Indira-2010" serve as a good opportunity to build bilateral military-to-military cooperation and demonstrate development of the defence forces.[37] The joint military exercise not only strengthens the bilateral military cooperation but gives the countries an opportunity of learning from one another. Russia is the only country with which India has such an institutionalised military cooperation mechanism at a such high level.

COLLABORATION IN AEROSPACE AND ENERGY SECTORS

India and Russia have been collaborating in several high-technology space projects. The space partnership is mainly focussed on space navigation, lunar exploration and man-controlled space flight programmes. India could not have made such deep forays into space without the Russian cooperation. It was the erstwhile Soviet Union that had launched the first Indian satellites, Aryabhatta and Bhaskara, from its Baikonur cosmodrome, in the 1970s and 1980s. Rakesh Sharma, the first Indian astronaut, travelled to the Soviet Salyut-7 space station in 1984.[38] In 2004, both the countries signed an Inter-Governmental Agreement on cooperation in outer space for peaceful purposes and the Inter-Space Agency Agreement on cooperation in the Russian satellite navigation system. The cooperation provides joint use of the Russian Global Navigation Satellite System (GLONASS) and the possibility of launching Russian spacecraft on Indian-made space launch vehicles. GLONASS, a radio-based satellite navigation system, operated for the Russian government by the Russian Aerospace Defence Forces, is an

36. Niveta Kundu Das, "President Vladimir Putin's India Visit will Boost-up India-Russia Relations" *Valdai International Discussion Club,* December 24, 2012, URL: http://valdaiclub.com/asia/52980.html, accessed on February 28, 2013.
37. Anatoly R. Klimenko, "Russia-India Strategic Partnership: Military and Military- Tech Aspects" in Singh, ed., n. 30, p. 63.
38. "Rakesh Sharma", URL: http://www.aerospaceguide.net/astronaut/rakesh_sharma.html, accessed on February 28, 2013.

Space is an important sector of Indo-Russian bilateral cooperation. India's flagship space agency, ISRO, has plans to launch its first manned space flight in 2017.

alternative to the US-controlled Global Positioning System (GPS). Both countries are exploring the possibility of developing equipment for earth probes, joint research in the area of engines for spacecraft, and joint projects for probing the lunar surface and building a space-based solar observatory to study X-ray radiation. [39] The two countries are cooperating on projects such as the Moon mission Chandrayaan-2 and the human space flight project. Chandrayaan-2 is a joint lunar exploration mission proposed by the Indian Space Research Organisation (ISRO) and the Russian Federal Space Agency and has a projected cost of Rs. 425 crore. On April 20, 2011, the jointly developed Indian-Russian students satellite "Youthsat" was successfully launched by India on a Polar Satellite Launch Vehicle (PSLV) rocket.[40]

Space is an important sector of Indo-Russian bilateral cooperation. India's flagship space agency, ISRO, has plans to launch its first manned space flight in 2017. The Indian government is eyeing deep space missions for a lunar human landing by 2020 and participating in an international expedition to Mars that is tentatively planned for 2030.[41] ISRO's ambitious programmes include the setting up of several ground facilities like launch pads, an astronaut training centre and a mission control centre. India and Russia have collaborated on technologies in the space sector which integrate into platforms that India is developing.[42] India needs to catch up with other countries that are investing heavily in research and development.

39. "Russia, India Sign Space Cooperation Protocol", *ESA Permanent Mission in Russia*, URL: http://www.esa.int/About_Us/ESA_Permanent_Mission_in_Russia/Russia_India_sign_space_cooperation_protocol, accessed on February 28, 2013.
40. Rajeev Sharma "Indo- Russian Inter-Governmental Commission to Meet in mid-October", September 26, 2012, URL:http://indrus.in/articles/2012/09/26/indo-russian_inter-governmental_commission_to_meet_in_mid-october_17907.html, accessed on February 28, 2013.
41. Shaumyan., n. 29, p.163.
42. Rajeev Sharma, "Space Pacts to put Indo-Russian Ties in Still Higher Orbit", *Russian and India Report*, December 6, 2012,URL:http://indrus.in/articles/2012/12/06/space_pacts_to_put_indo-russian_ties_in_still_higher_orbit_19591.html, accessed on February 28, 2013.

In the field of energy, Russia's importance for India is likely to keep growing as the Indian economy expands at an unprecedented rate. India is an energy deficient country and Russia has surplus energy which makes for mutual interest in this sector. By 2030, India is expected to become the third-largest energy consumer, next to the United States and China, and ahead of Russia and Japan. Russia's oil output has risen dramatically (after dropping nearly 50 percent from the Soviet era), making it the world's second largest producer, behind only Saudi Arabia. Russia is the world's largest producer of natural gas and has the biggest share of the world's gas reserves. India's Oil and Natural Gas Corporation Videsh Limited (OVL) is gaining an important foothold in Russia's oil and natural gas production, especially on Sakhalin Island and Siberia.[43] OVL was allowed to acquire a 20 percent stake in the Sakhalin I project totalling more than $2.8 billion which constitutes India's largest investment abroad.[44] The Russian gas giant Gazprom has entered into a strategic cooperation agreement with the Gas Authority of India Ltd (GAIL) to supply gas and hydrocarbons. A gas deal was signed with Gazprom for 20 years for importing 2.5 million tonnes of liquid gas a year.[45] Russia's massive energy resources can ensure India's vital energy security. Both the nations can expand cooperation in the energy sector as they did in the defence sector.

Russia has been a valuable long standing partner of India's nuclear energy programme. Russia recognised India as a responsible state with advanced nuclear technology and an impeccable non-nuclear proliferation record. The construction of the Kudankulam Nuclear Power Project (KKNPP) with two units of 1,000 MW is a good example of nuclear energy cooperation. During President Dmitry Medvedev's first visit to India in December 2008,

43. "ONGC Videsh Ltd Eyes Stake in Russia's Arctic Blocks", *The Times of India* (New Delhi), August 20, 2010, and URL: http://timesofindia.indiatimes.com/business/india-business/ONGC-Videsh-Ltd-eyes-stake-in-Russias-Arctic-blocks/articleshow/15565361.cms, accessed on February 28, 2013.
44. Nivedita Kundu Das, "Energy Cooperation Between India and Russia: Policy and Approach", *Russia and India Report,* October 11, 2012, URL: http://indrus.in/articles/2012/10/11/energy_cooperation_between_india_and_russia_policy_and_approach_18291.html, accessed on February 28, 2013.
45. "GAIL Inks Gas Deal with Gazprom" *The Times of India* (New Delhi), October 2, 2012, URL: http://timesofindia.indiatimes.com/business/india-business/GAIL-inks-gas-deal-with-Gazprom/articleshow/16633028.cms, accessed on February 28, 2013.

an agreement was signed for the construction of four more nuclear reactors at Kudankulam with Russian technical help. The signing of the agreement on civil nuclear cooperation marks a new milestone in strengthening the existing Indo-Russian relations.[46] The agreement went beyond the 123-Agreement in the civil nuclear energy sector with the United States. The Indo-Russian nuclear pact gives enrichment and reprocessing rights to India and assures the country against termination of ongoing projects and fuel supply arrangements if bilateral nuclear cooperation is ended. [47] India has faced a nuclear trade ban since its first atomic test in 1971 amid its refusal to sign the nuclear Non-Proliferation Treaty (NPT) designed to limit the spread of nuclear technology.

India and Russia are considering setting up a joint project to build a factory for the production of nuclear fuel in India. The possibility of setting up a nuclear fuel facility in India is envisaged in the Inter-Government Agreement on Cooperation in the use of Atomic Energy for Peaceful Purposes.[48] Russia is to provide for the reprocessing of spent nuclear fuel in India under International Atomic Energy Agency safeguards.

INDISPENSABLE COOPERATION IN SCIENCE AND TECHNOLOGY

India and Russia have been Science & Technology (S&T) partners for a very long time. The Working Group on Science and Technology functioning under the Indo-Russian Inter-Governmental Commission (IRIGC-TEC), the Integrated Long-Term Programme (ILTP) and the Basic Science Cooperation Programme are the three main institutional mechanisms for bilateral S&T cooperation. A working group focusses on collaboration activities in mutually

46. "India, Russian Ink Nuclear Deal", *Geopolitical Monitor*, December 5, 2008, URL: http://www.geopoliticalmonitor.com/india-russia-ink-nuclear-deal-1494/, accessed on March 1, 2013.
47. Vladimir Radyuhin and Sandeep Dikshit, "India and Russia Sign Civil Nuclear Agreement" *The Hindu* (Moscow), December 7, 2009, URL: http://www.thehindu.com/news/national/article61503.ece, accessed March 1, 2013. Also see, Sandeep Dikshit, "India- Russia Civil Nuclear Pact Practically Sealed", *The Hindu,* Moscow, December 6, 2009, URL:http://www.thehindu.com/news/national/indiarussia-civil-nuclear-pact-practically-sealed/article60980.ece, accessed on March 1, 2013.
48. Vladimir Radyuhin , "Plan for Nuclear Fuel Plant in India", *The Hindu* (Moscow), March 24, 2010, URL: http://www.thehindu.com/news/national/plan-for-nuclear-fuel-plant-in-india/article244473.ece, accessed on March 1, 2013.

agreed priority areas of biotechnology, industrial realisation of technologies, medical research, meteorology, oceanology and seismology. In 2010, the programme was extended for 10 years with a renewed mandate: "Innovation Led Technology Growth". An Indo-Russian Science & Technology Centre was set up in 2011-12 with a branch each in Delhi and Moscow to promote transfer of technologies developed jointly/ independently by scientists of the two countries.[49] A Memorandum of Cooperation was concluded between the Ministry of Science and Technology, Government of India, and the Ministry of Education and Science of the Russian Federation.[50]

Russia is keen to use the Indian experience in the area of building IT parks in several leading cities.

India is a leading nation in Information Technology (IT), with a 40 percent annual growth. The profits of Indian software exports are comparable to the revenue from Russian gas exports to Europe. Russia is keen to use the Indian experience in the area of building IT parks in several leading cities.[51] India should also participate in the Russian initiative to create a counterpart to Silicon Valley in Skolkovo, outside Moscow. The Russian IT and innovation sector is competitive and Russia enjoys enormous depth in scientific studies.[52] In December 2012, the two governments concluded a protocol on Protection and Usage of Intellectual Property Rights. The Indo-Russian Science and Technology Centre, with units at Moscow and Delhi was set up in December 2011 to catalyse transfer of successful technologies between the two countries.[53] The Indo-Russian science and

49. "India-Russia Relations" (December 2012), URL: http://www.mea.gov.in/Portal/ForeignRelation/Russia_-DEC_2012.pdf, accessed on March 1, 2013.
50. "Joint Statement on the 13th India- Russia Annual Summit: Partnership for Mutual Benefit and a Better World" October 16-18, 2012, Delhi, URL: http://ristc.com/, accessed on March 1, 2013.
51. Arun Mohanty, "Indo- Russian Trade and Economic Cooperation: The Way Ahead", in Stobdan, ed., n. 19, p. 170.
52. Pallavi Pal, "The Way Ahead in Indo- Russian Ties" *IDSA Comment*, December 20, 2010, URL: http://www.idsa.in/node/6435/2006, accessed on March 1, 2013.
53. Vladimir Radyuhin, "Russia-India Scientific, Technology Centre Opened", *The Hindu* (Moscow), December 16, 2011, URL: http://www.thehindu.com/news/international/article2718289.ece, accessed on March 1, 2013. Also see, "Indo-Russian Science & Technology Cooperation", Embassy of India, Moscow, URL: http://www.indianembassy.ru/index.php?option=com_content&view=article&id=60&Itemid=520&lang=en, accessed on March 1, 2013.

technology cooperation is pivotal in promoting modernisation as well as commercialisation of innovative technologies.

COOPERATION IN COMBATING INTERNATIONAL TERRORISM

International terrorism is perceived as a threat to both India and Russia and they have expressed concern that the international coalition against terrorism has not paid sufficient attention to volatile regions like Kashmir, Chechnya, etc. Both countries agreed that there is no justification for terrorism, and this must be fought against, without compromise, and wherever it exists. Russia has supported the Indian draft at the UN on the Comprehensive Convention on International Terrorism (CCIT).[54] In December 2003, both countries signed a Memorandum of Understanding (MoU) on cooperation in combating terrorism. A Joint Working Group on Combating International Terrorism meets from time to time. India has faced terrorist activities in Kashmir and Russia in Chechnya; both countries are supportive of each other on the issue of international terrorism. Russia's stand on the issue of Kashmir and the terrorism faced by India has been consistent and unconditional over time or regime change. Every Russian leader has reiterated this and it forms the basis for India's trust in Moscow. Russia has never tried to balance India's interest with Pakistan and India has never put itself in a position of having to compete with other countries to prove its loyalty by approving all other Russian positions.[55] Both countries have resolved to exchange information and set up working groups to address the problem globally.

NEW TRENDS IN CULTURAL RELATIONS

India and Russia have historically enjoyed solid and strong traditional ties in the cultural sphere. Humanitarian cooperation has a particular significance for both countries which have a great cultural heritage. The Jawaharlal

54. See,"India and United Nations, Counter- Terrorism", URL: http://www.un.int/india/india_counter_terrorism.html, Also see, "UN Meet: India to Press for CCIT UN Reforms," *The Times of India* (New Delhi), September 19, 2010, URL: http://articles.timesofindia.indiatimes.com/2010-09-19/india/28269009_1_terror-groups-comprehensive-convention-international-terrorism, accessed on March 1, 2013.
55. Debashis Sarkar, "Indo-Russian Relations", URL: http://www.academia.edu/2103282/Indo-Russia_Relations, accessed on March 1, 2013.

Nehru Cultural Centre (JNCC) at Moscow maintains close links with Russian institutions. In the past, cultural activities were held, promoting people-to-people contacts between the two countries. There are also Russian experts in Indian languages such as Tamil, Marathi, Gujarati, Bengali, Urdu, Hindi, Sanskrit and Pali. In 2008, the Year of Russia in India was held. In 2009, the Year of India in Russia was conducted. In September 2011, a mini Festival of Indian Culture was organised in Russia, while several cultural events and academic conferences were held as part of the celebrations of the 150th birth anniversary of Rabindranath Tagore. In 2012, the Embassy of India in Moscow organised a very large number of academic, cultural and other events to mark the 65th anniversary of India-Russia diplomatic ties. A Festival of Russian Culture was organised in India from October 4 to November 29, 2012. And a "Days of Moscow" event was held in Delhi from October 26-29, 2012. The Indian community in the Russian Federation is estimated at about 15,000. There are approximately 4,500 Indian students enrolled in medical and technical institutions in the Russian Federation. About 90 percent of these students are pursuing medical studies in 20 universities/institutions spread across the country.[56] Frequent educational projects, youth exchanges and tourism should be more actively promoted and developed.

CONCLUSION

India and Russia support the concept of a multipolar world, an idea shared by many developing countries. A foreign policy based on a multipolar world supports the coexistence of collective security which fosters common regional interest. As India's economy continues to grow, regional collaboration and cooperation rather than hegemony is what it wants in the international politics. Building regional alliances and being proactive in organisations like the SCO, SAARC and BRICS will broaden the Indo-Russian bilateral relationship into a multilateral one. The political friendship between the two countries needs to be harnessed and used in several areas, where the

56. "India-Russia Relations", January 2013, URL: http://indianembassy.ru/index.php?option=com_content&view=category&layout=blog&id=50&Itemid=449&lang=en, accessed on March 1, 2013.

countries enjoy synergy. People-to-people contacts should be strengthened and there is a need to get support across the political spectrum like that which existed in the past. In the meantime, India also needs to be aware of the strategic options in the emerging international security environment. Seeking convergence with Russia cannot be at the expense of India's quest for new strategic relations with other emerging countries. Nevertheless, in the evolving world order, which is characterised by uncertainty, the partnership has emerged, appreciating each other concerns while keeping the primary determinants of the relations unchanged. Hence, the Indo-Russian partnership can be described in the paradigm of continuity amidst change in the global politics.

IRAN'S AIR POWER: IS IT POWERFUL ENOUGH FOR THE US?

INDRANI TALUKDAR

Iran must have given a surprise to the US and the West with its firing on a US drone last year. It shows that Iran, like other countries, has been developing all the sectors of its military defence. In a talk, Uzi Rubin, former Director of the Israel Mission Defence Organisation in the Israel Ministry of Defence (MoD) had said that although in 2010 Iran had the largest air force parade in Sastan where it showcased 220 aircraft, it is neither interested in modern aircraft technologies nor aircraft. The Iranians have shown interest in long-range missiles. In fact, aircraft purchase has been giving way to missile programmes.[1] But the November 1, 2012 attack by two Russian-made SU-25 jets known as Frogfoots on a US MQ-1 Predator[2] and Iran's development of the indigenous Thunderbolt fighter jets might lead the Western militaries to change their opinion. This article talks about Iran's military strategy and its

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1. "Israel's Air and Missile Defense Program", a talk by Uzi Rubin at the Centre for Air Power Studies, on June 4, 2012.
2. Thom Shanker and Rick Gladstone, "Iran Fired on Military Drone in First Such Attack, U.S. Says", *The New York Times*, November 8, 2012, http://www.nytimes.com/2012/11/09/world/middleeast/pentagon-says-iran-fired-at-surveillance-drone-last-week.html?pagewanted=all&_r=0, accessed on November 19, 2012.On December 4, 2011, Iran announced that its defence forces had downed the aircraft through a sophisticated cyber attack. The Iranian experts had hacked the US RQ-170 Sentinel stealth aircraft and had brought it down by hacking its control system and uploading a new programme to it. It was also further reported that Iran was able to copy the US RQ-170 drone after decoding its hard disc. US officials had described the loss of the aircraft in Iran as a setback and a fatal blow to the stealth drone programme. "Official: US Informed of Iran's Air Power after RQ-170 Capture", *FARS News Agency*, December 4, 2012, http://english.farsnews.com/newstext.php?nn=9107124234, accessed on February 21, 2013.

Protecting its centres of gravity is crucial for any nation, and towards this, air power is the best option in both offensive and defensive roles.

development in air power. With the upgradation in this sector, will Iran be a tough opponent for the US, Israel and the West? Will Iran be able to counter-attack its opponent through its military capabilities, especially by relying on air power?

IRAN'S DEFENCE STRATEGY

Iran, today, is one of the most sought-out countries because of its nuclear enrichment programme which has not gone down well with the West and the US. This theocratic country has always been able to counterpose the US, Israel and the West since the 1979 Revolution. In fact, Iran's first priority since the 1979 Revolution has been the survival of its theocratic regime. Along with this, it has sought to become the strongest and the most influential country in West Asia, able to influence the world affairs. Its leadership's ideological goal is to be able to export the theocratic form of government, its version of Shia Islam. In this process, in order to protect the regime's survivability, Iran has based it security strategy on deterring an attack. For years, it has spoken about its "20-Million Man Army" and its asymmetric doctrine as deterrents to any would-be invader. Its military strategy is designed to defend against external or "hard" threats from the US and Israel. It includes deterrence, asymmetrical retaliation and attrition warfare. It also prefers a point defence[3] strategy, with its strongest defences located around key strategic centres.[4] Protecting its centres of gravity is crucial for any nation, and towards this, air power is the best option in both offensive and defensive roles, with the latest development of precision-guided munitions, airborne early warning systems, radars, ballistic missiles, cruise missiles and different varieties of technologically advanced fighter aircraft. Iran has been giving

3. Point defence is the defence of a single object or a limited area, e.g. a ship, a building or an airfield, now usually against air attacks and guided missiles. Point-defence weapons have a smaller range in contrast to area-defence systems and are placed near or on the object to be protected.
4. "Unclassified Report on Military Power of Iran" April 2010, http://www.foxnews.com/projects/pdf/IranReportUnclassified.pdf, accessed on November 16, 2012.

importance to air power, with air defence developments like Surface-to-Air Missiles (SAMs) and Anti-Aircraft Artillery (AAA).[5]

Iran's air power and its logistic ability and capability, in comparison to the US or Israel or Turkey, is weak. But with the latest developments in Iran regarding the nuclear weapons, which are giving sleepless nights to the West, especially to the US and Israel, the atmosphere in the international arena has become tense. Despite the sanctions that have been imposed upon Iran by the international community, militarily, Iran has been able to check the latest attacks inflicted upon it. This unexpected defence against the US might have astonished it, but the advanced technologies which the West, especially the US and Israel possess, would be difficult for Iran to resist.

In fact, inside the Pentagon, a plan for an air war against Iran has not been ruled out. With the highly capable US Air Force, the West and the US have the ability to mount intense strikes against Iranian targets. The US has been preparing for a formidable air campaign[6] with missiles, bombers and strike fighters that would be sent against Iran's air defences. It has been reported that along with these, there would be other aircraft which would be targeted on Iran's nuclear sites, accompanied by command-and-control aircraft, airborne electronic counter-measures and electronic warfare systems, all choreographed with aerial tankers.[7] The above gives a clear picture of an air power battle which would be supported by naval assets. Therefore, the "air-sea battle" concept which has been the doing the rounds in US national security circles might be applied in Iran. But a similar doctrine may be observed in Iran as well.

5. In September 2012, Iran displayed a new all-Iranian-made air defence system, which is said to be designed to confront American warplanes in case of a US attack on the country. The system is known as the Raad, or Thunder, is more advanced than its Russian predecessor and is designed to confront fighter jets, cruise missiles, smart bombs, helicopters and drones. The Raad carries missiles with a range of 50 km (30 miles), capable of hitting targets at 22,000 m (75,000 ft). Naseer Karimi, "Iran Air Defense System Makes Debut", *Huffington Post*, September 21, 201, http://www.huffingtonpost.com/2012/09/21/iran-air-defense-system-_n_1903183.html accessed on February 21, 2013.
6. Air campaigns, which are strategic in nature, due to their capability to turn any air operation into air dominance through combat power, and combat support to both ground and naval troops, leading to the control of air, help any nation to turn the fate of a war.
7. David Wood, "Iran Air War: US Plans for Possibility, But Goal Remains Unclear", *Huffington Post*, February 29, 2012, http://www.huffingtonpost.com/2012/02/29/iran-air-war-plans-us-military_n_1310777.html, accessed on November.

In response to this and also for its survivability, Iran has been trying to build a self-sufficient military programme since 1992, manufacturing its own tanks, armoured personnel carriers, missiles, radars, boats, submarines, and fighter jets. More recently, Iran's military leaders have said that they believe future wars would be air- and sea-based and Tehran has sought to upgrade its air defence systems and naval power in anticipation of such a possibility.[8] Though Iran has been giving much attention to building missiles,[9] in view of the trend of attacks by the West and the US[10], it has also been developing and upgrading its air power. It must have understood the importance of air power to defend itself from any air strikes which the US or Israel or in a worst case scenario, the North Atlantic Treaty Organisation (NATO) might opt for.

IRAN'S AIR POWER

The Islamic Republic of Iran Air Force (IRIAF) is the aviation branch of the Iranian armed forces. The present air force came into being in the early 1980s when the former Imperial Iranian Air Force was renamed. It remained largely dependent on 1970s-vintage US aircraft like the F-4 Phantom II, F-14A Tomcat and F-5E Tiger II. The air force has attempted, with some success, to maintain in service these American-built aircraft which Iran acquired during the Shah's regime. Also, the air force had purchased Soviet and Chinese aircraft, and pressed ex-Iraqi aircraft into service, along with indigenously built aircraft,

8. "Iranian Military to Test New Air Defense System Modeled after US Hawk During Drill, TV says" , *The Washington Post*, http://www.washingtonpost.com/world/middle_east/iran-tv-military-to-test-new-air-defense-missile-system-modeled-after-us-hawk-during-drill/2012/11/12/903eb798-2cb7-11e2-b631-2aad9d9c73ac_story.html, accessed on November 15, 2012.
9. Iran, understanding its position to be on the defensive (because the possibility of Iran flying across the continent to attack the US conventionally is thin in comparison to the US), has been relying on its missile systems. Recently, it has been reported that Iran was getting ready to test its new air defence system modelled after the US Hawk system. It is named "Mersad" or Ambush. Iran has also displayed its S-200, a Russian-made air defence system. It is a medium to high altitude surface-to-air missile system designed primarily to track, target, and destroy aircraft and cruise missiles. "Iran's Army Drill to Test new air Defense System", *Bloomberg Business Week*, November 12, 2012, http://www.businessweek.com/ap/2012-11-12/irans-army-drill-to-test-new-air-defense-system, accessed on November 19, 2012.
10. In all the conflicts where the US or Israel or West has been involved, it is air power which has been used. The recent Libyan crisis is proof of this.

in order to maintain a capable force. Following the 1979 Revolution, due to its strained relations with the West, Iran had to procure new equipment from Venezuela[11]and Brazil, apart from Russia and China. The continuous spare parts shortages faced by the air force led to a decision in the late 1980s to develop the local aerospace industry to support the air force. In 2002, Iran with the cooperation of Ukraine, successfully started the manufacture of the Iran-140, a licensed-built version of the Antonov AN-140 transport aircraft. Simultaneously, Iran began construction of two domestically produced fighters, upgraded using technology from the F-14 Tomcat and F-5 Tiger II. The fighters have been named the Azarakhsh and Shafaq. Since then, the country has also become self-sufficient in the manufacture of helicopters. Iran claims that it has the capability of producing the old US AH-1 Cobra gunship. Additionally, Iran also produces the Bell Helicopters Bell-212 and Bell-206 in serial production. These are known respectively as the Shabaviz 2-75 and Shabaviz-206.[12]

Iran has recently made good progress in the aircraft industry and has succeeded in gaining the technical knowhow for producing stealth aircraft and drones. The IRIAF possesses new generations of aircraft, and continues updating the electronic warfare operations, radars and smart ammunition. The Iranian Air Force tested its defence capabilities in massive air drills, dubbed as "Fidaeeyan-e Harim-e Velayat III", in Iran's northwestern regions. During the exercises which started on September 6, 2012, the Iranian Air Force fighter jets practised electronic war operations and Iran's two well-known home-made fighter jets, namely the Saeqeh (Thunderbolt) and Azarakhsh (Lightning) staged successful missions and bombed the specified targets under full radio silence. The Saeqeh and Azarakhsh were among the several squadrons of the Iranian Air Force fighter jets which conducted night raids on fixed

11. Military cooperation between Chavez and Ahmadinejad was recently proved by the use of some Iranian Mohajer 2 drones, operating in Venezuela under the name of Sant Arpia. Richard Clements, "Did Iran Really Get One or More F-16 Fighter Jets From Venezuela?" *The Aviationist*, August 20, 2012, http://theaviationist.com/2012/08/20/iran-f16/, accessed on November 19, 2012.
12. Source: Wikipedia, accessed on November 16, 2012.

and mobile targets under complete radio silence. An array of fighter jets, fighter bombers, cargo and transportation planes, including the F-4, F-5, Sukhoi-24 (SU-24) fighter-bombers, MiG-29 and the logistic C-130 planes, were used in the exercises.[13] In a gap of months, the next air drill has taken place. The "Velayat-4" manoeuvres would involve the biggest air drill the country has ever held.[14]

Giving a recent update (February 2, 2013) on Iran's air power, Iranian Defence Minister Ahmad Vahidi said that Iran has successfully tested a new stealth fighter with short take-off and landing capability. This new aircraft is known as the F313 "Qaher". Qaher in Farsi means to conquer. The vital characteristics of this advanced aircraft include a very small radar cross-section and the capability of operating and flying at low altitude. The new jet has advanced electronic systems and could be armed with missiles and other weapons developed by the Iranian industry. Qaher was the first Iranian jet to use a front control wing. Advanced computer design software (CATIA) was used for designing this jet, and the aerodynamic analysis methods such as Computational Fluid Dynamics (CFD) also were used. The software and the analysis method was done with the help of numerical grid generation software (GAMBIT), flow analysis software (FLUENT) and other design computation software. The configurations of the above give a lethal projection to the aircraft. The jet has ten important characteristics. These are:

- Two inlets and inlet ducts make up the air induction system to deliver air to the engine. Due to the indirect angle of the engine to the air inlets, the radar reflectivity is reduced, and it allows the angled design of the inlet ducts to the surface to get radar energy waves, just like in the F-3.
- The hot exhaust gas mixes with cold air through the inlet ducts, and gets cooler before it gets out of the exhaust system, to reduce the heat effect on the surface of the aircraft.

13. "Commander: Pentagon Assessing Iran's Air Power in Secret Sessions", *FARS News Agency*, November 15, 2012, http://english.farsnews.com/newstext.php?nn=9101290105, accessed on November 15, 2012.
14. "Eye on US? Iran Launches Biggest-ever Air Drill", *The Times of India*, November 13, 2012.

- Use of radar-absorbent materials in the body allows absorption of wave energy and reduces radar reflection, for greater stealth effect.
- Considering that the estimated length and height of the aircraft is less than 16 and 4 m, respectivly, the two compartments have a payload capacity of two 2,000 pound bombs, or a greater number of smaller smart guided missiles, or at least 6 air-to-air missiles in the category of the R-17 or PL-12.
- The relatively large vertical tail surface creates favourable directional stability and the canted vertical tails create aerodynamic benefits as well specific appropriate lateral manoeuvring capabilities.
- The very large canopy gives a 360 degree visibility, which is essential for low altitude fly-by flights, especially helps ground mission attacks, and is also very useful in close dogfights.
- The angled wing is a perfect example of indigenous design for aircraft, which gives a side profile like an M, and similar to a W profile, which is the best form to use in modern aircraft.
- Single-cycle landing gear is proof that the F-313 is a lightweight aircraft, with minimum flying weight of 12 to 14 tonnes, and maximum flying weight of 20 tonnes.
- There are 8 analogue displays in the cockpit, which shows that the Multi-Function Display (MFD) technology has room for improvement in the Qaher jet.
- The F-313 has a central control stick, with the control systems, wing movable surfaces, rudder, and vertical stabiliser all hydraulically controlled and not the Fly-By-Wire (FBW) system.[15] This aircraft is similar

15. "Under the Skin of the New Iranian Stealth Fighter", *Arabian Aerospace Online News Service*, February 7, 2013, http://www.arabianaerospace.aero/under-the-skin-of-the-new-iranian-stealth-fighter.html, accessed on February 9, 2013. The Minister has further said that given the apparent small size of the aircraft and its single engine design, the Qaher 313 could be powered by reverse engineered variants of the General Electric J-85 turbojet that Iran has known to have in its possession. Ibid.

to the US-built F/A-18.[16]

Apart from this new addition to the Iranian basket of aircraft, Iran's most advanced fighter aircraft—the tactical MiG-29 Fulcrum—has been upgraded with a modern electronic system. This fourth-generation advanced jet fighter aircraft, designed for an air combat superiority role, is being powered by two Klimov RD-33 afterburning turbofan engines that can achieve a maximum speed of Mach 2.25 or 1,490 mph. Its armament includes the 1X30 mm GSh-30-1 cannon with 150 rounds and it can carry 7, 720 pounds of weapons, including 6 air-to-air missiles – a mix of Semi-Active Radar Homing (SARH) and AA-8 "Aphid", AA-10 "Alamo", AA-11 "Archer", AA-12 "Adder", FAB 500-M62, FAB-1000, TN 100, EMC pods, S-24, AS-12, AS-14. Its avionics include the Phazotron N019, N010 radar systems. Also, there is an "in-flight refuelling nozzle making them compatible with the drogue refuellers operated by the IRIAF".[17] The latest additions which have joined the Fulcrum are the indigenous Saeqeh (Thunderbolt) fighter jets and recently the Qaher (F-313). It is reported that the Iranian single-seat bomber has the ability to track down enemy aircraft, engage in combat, target locations on the ground, and carry a load of assorted weapons and ammunition.[18]

16. "Ahmadinejad Unveils new Iranian Air Force Fighter", *The Voice of Russia*, February 2, 2013, http://english.ruvr.ru/2013_02_02/Ahmadinejad-unveils-new-Iranian-air-force-fighter/ accessed on February 9, 2013. The F/A-18 Hornet is a twin-engine supersonic, all-weather carrier-capable multirole fighter jet, designed to dogfight and attack ground targets. Attaining speeds of up to 1,200 miles per hour, the supersonic jet can fly for 2,084 miles before refuelling, which can be done in-flight. Multifaceted in use, the jet can escort fighters or carry out reconnaissance and strike missions – both air-to-air and air-to-ground – at any time of day and in all types of weather. Upgrades to the F/A-18 since 1989 have included night strike capability, enhanced-performance engines that enable the craft to reach speeds in excess of Mach 1.8, improved radar, and a laser-guided bomb delivery device. This jet has undergone structural changes like in the fuel tank's capacity. "F/A-18 Hornet", http://usmilitary.about.com/od/fighter/a/f18hornet.htm, accessed on February 21, 2013. This aircraft can be refuelled in flight. The F/A-18 multi-mission aircraft can operate from either aircraft carriers or land bases. "Top 10 World Modern Fighter Aircraft", http://weapons.technology.youngester.com/2010/04/top-10-world-modern-fighter-aircraft.html
17. "Iran Upgrades its MiG 29 Fighter Jets with Modern Electronics", August 4, 2012, http://www.examiner.com/article/iran-upgrades-its-mig-29-fighter-jets-with-modern-electronics, accessed on November 19, 2012.
18. "Iran to Produce New Generation of Fighter Jets, Destroyers: Official", http://www.presstv.ir/detail/2012/08/26/258186/iran-to-build-fighter-jets-destroyers/, accessed on November 19, 2012.

A new Saeqeh-V has also been developed. The front section of the new fighter (an advanced version of the Saeqeh, a modified F-5 with Hornet-like tails) is attached to the tail of a Tu-154 testbed that would be used for high speed tests.[19] Apart from these, Iran has built an indigenous Unmanned Aerial Vehicle (UAV) called Shahed-129, which would be able to carry out combat and reconnaissance missions with its 24-hour non-stop flight capability.[20] Iran's air planners understand the value of airborne early warning and C41 systems, airborne intelligence, electronic warfare platforms, UAVs and airborne refuelling. It has an active programme of reconnaissance, target and lethal UAVs.[21] From the above, Iran's air power capabilities and also its interest in developing and upgrading the systems, become clear.

During the Iran-Iraq War or the First Persian Gulf War in 1980, the strategy that Iran used was that of strategic bombing and aircraft scrambling to defend the Iranian air space.[22] It conducted successful hit-and-run operations using groups of small boats against vessels passing through the Strait of Hormuz. Combined with extensive mine-laying in the strait, the guerrilla tactics allowed Iran to sink over 500 vessels during the war. However, in a direct confrontation with a US fleet after an Iranian mine caused damage to a US frigate, Iran's Navy was crushed.[23] But with the latest technology and the change in strategies, Iran would try to enhance its capabilities in both defensive and offensive roles, and give a tough fight to the US. Therefore, it would continue to build up its air power abilities alongside its missile defence systems till it is able to come out openly with its nuclear weapons.

Meanwhile, the US, the superpower with the super military ability, till date has the ability to overpower its enemies. This was witnessed during

19. David Cenciotti, "Iran's Next Generation Fighter Jet Testbed Unveiled (and it Looks Like an F-5 Attached to a Tupolev 154)", *The Aviationist*, August 21, 2012, http://theaviationist.com/2012/08/21/iran-new-fighter/, accessed on November 19, 2012.
20. "New Indigenous Saeqeh Fighter Jets to Join Iran Air Force", http://www.presstv.ir/detail/2012/09/25/263480/irans-new-fighter-jets-to-join-iriaf/, accessed on November 19, 2012.
21. "Unclassified Report on Military Power of Iran" April 2010, http://www.foxnews.com/projects/pdf/IranReportUnclassified.pdf, accessed on November 16, 2012.
22. Although Iraq initially had bombed Iran's airfields which are the centre of the gravity of any nation, Iran retaliated through the strategies of bombing and offensive air power.
23. For more details, refer http://www.globalresearch.ca/iran-s-military-capabilities-iran-could-attack-us-military-facilities-asymmetric-warfare-russian-defense-analyst/28668, accessed on November 19, 2012.

As for Israel, its military has been the best equipped and best trained in the whole region but some sections of Iran's military have also been battle-tested.

the ejection of the Iraqis from Kuwait in 1991, the bombing of Serbia in 1999, the kicking out of the Taliban regime in Afghanistan in 2001, and the defeat of Saddam and his cronies in 2003. The US has the ability to launch big strikes on Iran with bombers, stealth aircraft and cruise missiles, followed up by drones that could carry out damage assessments to help direct further strikes. Unlike Israel, the United States has plenty of refuelling capability. Bombers could fly from Al Udeid air base in Qatar, from Diego Garcia in the Indian Ocean or from bases in Britain and the United States.[24]

But a little twist has been seen as potential target countries (read Iran and China) and even some lukewarm allies (Turkey) have been figuring out ingenious ways to blunt American power without trying to meet it head-on, using a combination of high-tech and low-tech jujitsu. At the same time, US naval and air forces have been shrinking under the weight of ever more expensive hardware. It's no longer the case that the United States can overwhelm clever defences with sheer numbers. Defence Secretary Robert Gates had summed up the problem recently, saying that countries in places where the United States has strategic interests – including the Persian Gulf and the Pacific – have been building "sophisticated, new technologies to deny our forces access to the global commons of sea, air, space and cyberspace.''[25] As mentioned earlier, the attack on the US Predator might have surprised and propelled the US to be on high alert regarding the potential of its opponent. Iran, although reeling under the sanctions, would try every method for its survival.

As for Israel, its military has been the best equipped and best trained in the whole region but some sections of Iran's military have also been battle-

24. Elisabeth Bumiller "Iran Raid Seen as a Huge Task for Israeli Jets", February 19, 2012, http://www.nytimes.com/2012/02/20/world/middleeast/iran-raid-seen-as-complex-task-for-israeli-military.html?pagewanted=all&_r=0, accessed on February 21, 2013.
25. David Wood, "China, Iran Creating 'No-Go' Zones to Thwart U.S. Military Power", 2010, http://www.politicsdaily.com/2010/03/01/china-iran-creating-no-go-zones-to-thwart-u-s-military-power/, accessed on November 16, 2012.

tested. The asymmetrical methods and tactics Iran uses in small decentralised units[26] could be a concern for Israel, the US and the West. In fact, one vital observation regarding Israel's attack on Iran could be the distance factor between the countries. Apart from Oman, Israel doesn't have a cordial relationship with any of the Gulf states from where it would be able to access air bases if there was a conflict between Israel and Iran. Moreover, Oman only allows the US and UK to use to air bases. Though it has a good bilateral relationship with Israel, Oman also has a strong relationship with Iran. Hence, Israel's capability to strike Iran using the Gulf bases would be doubtful in the conventional manner as long as it doesn't build bridges with the Arab countries.

In a scenario of a clash between Iran and Israel, at the time of the attack, Israel would need to use its electronic warfare planes to penetrate Iran's air defences and jam its radar systems to create a corridor for an attack. But, at the same time, Iranian missiles could force Israeli warplanes to manoeuvre and dump their munitions before they could even reach their targets. Iran could also strike back with missiles that could hit Israel.[27] There are three routes which could be accessible for Israel at the time of such a situation. They are to the north over Turkey, to the south over Saudi Arabia or taking a central route across Jordan and Iraq.[28] Unfortunately, Israel no longer has a cordial relationship with Turkey after the *Mavi Marmara* incident or the Gaza Flotilla Raid in 2010. Though trade and commerce between the two countries is still going on, the defence relationship which was very strong, has deteriorated to the point of complete non-cooperation.

However, one opening for Israel could be the route from Azerbaijan. This air base would prove to be vital for Israel if a conflict starts with Iran, as Azerbaijan shares its border with Iran. For Israeli intelligence, there would also be a possible added benefit from Azerbaijan: the Israelis would be

26. For further details, refer Ben Piven, "Iran and Israel: Comparing Military Machines ", *Al Jazeera*, April 24, 2012, http://www.aljazeera.com/indepth/features/2012/03/201232613134385363 6.html, accessed on February 21, 2013.
27. Bumiller, n. 24.
28. Ibid.

able to collect information because of the significant cross-border contacts and trade with Iran's large ethnic Azeri community. The Azeri military, after its independence from the Soviet Union, has four abandoned Soviet-era airfields that could be made available to the Israelis, as well as four air bases for its own planes. In February 2012, Israeli defence officials confirmed the completion of a $1.6 billion deal to sell drones and anti-aircraft and missile defence systems to Azerbaijan, bringing sophisticated Israeli technology to Iran's doorstep.[29] At the same time, there is a word of caution for Israel, which an observer (Anshel Pfeffer) has pointed out could be of importance: although a range of American military experts had claimed that Azeri airfields would be invaluable for Israel as it would solve some of the fuel/range issues of a 2,000+km strike, they failed to address the problem of where the Israeli warplanes would fly to once they were refuelled in Azerbaijan. There is no friendly route to fly back to Israel. Only the Iranian space would be available which would not be accessible in the event of a war. Moreover, hardly any appealing alternatives would be available for Israel once an attack was carried out. All the countries would be on the highest alert.[30]

CONCLUSION

The unfolding of the future regarding Iran would be interesting to follow. Both Iran and the US are becoming well equipped to counter each other. On the one hand, Iran is protecting its centres of gravity, namely, the nuclear enrichment sites where an important factor to be remembered for any future strike would be that these are "not a pinpoint target''. However, towards this end as well, the US has armed itself with the option of attacking the sites with a Massive Ordnance Penetrator (MOP). What needs to be seen is the impact of this penetrator—whether it would be inconsequential or

29. "Azerbaijan Allows Israel to use its Air Bases Near Iran Border", *Israel Hayom,* March 29, 2012, http://www.israelhayom.com/site/newsletter_article.php?id=3718, accessed on February 22, 2013.
30. Anshel Pfeffer, "Azerbaijan will be a Platform for Israel - if Not for F-15s, then Punk Rock", *Haaretz*, March 29, 2012, http://www.haaretz.com/news/israel-s-eye-on-iran/azerbaijan-will-be-a-platform-for-israel-if-not-for-f-15s-then-punk-rock-1.421555, accessed on February 22, 2013.

consequential.[31] Iran's one time weak point was its not-so-well developed air power which could have been an Achilles heel but this has been turned around. Iran, with its foresight, has taken care of this factor. Its aircraft have been fitted with indigenous precision-guided munitions like the Zoobin, Qadr, Qassed and also the Sattar-1C. Although, deployment of the former two has not been revealed (though the munitions were displayed), the latter ones were seen being deployed from the F-4E and F-5[32] respectively during exercises. There are many precision-guided munitions which are being developed. How many will be successful in deterring its adversary would be witnessed only in the future.

Whether it would be able to defeat the West is a huge question but given the psyche of Iran, it would give it a tough time. It has the capability to unbalance US power [33]through its asymmetric strikes on the defence bases within the West Asian region which the US has been allowed to use (like Masirah Island base, Khasab in Musandam Peninsula, Al Udeid air base in Qatar, etc). Through the help of Hamas and Hezbollah, Iran has the capability to create instability within the region, especially in Iraq, whose spillover effect on the US would be grave.

Iran won't accept defeat easily, though the scenario is bleak with the

31. David Wood, "Iran Air War: US Plans For Possibility, But Goal Remains Unclear", *Huffington Post*, February 29, 2012, http://www.huffingtonpost.com/2012/02/29/iran-air-war-plans-us-military_n_1310777.html, accessed on November 19, 2012.
32. "Iran's Indigenous Precision Guided Munitions", *The Arkenstone*, June 16, 2011 http://thearkenstone.blogspot.in/2011/06/irans-indigenous-precision-guided.html, accessed on November 19, 2012.
33. The downing of the RQ-170 drone in 2011 by Iran should be taken seriously by the US, Israel and the West, because this spy drone, manufactured by Lockheed Martin, has special coatings and a batwing shape designed to help it penetrate other nations' air defences undetected. The specialty of the drone is that it carries either an inertially stabilised electro-optical or an infrared camera. The gimballed camera allows the operator to easily track both stationary and moving targets, providing real-time intelligence. In addition to this, it has the capability of flying above 16,000 ft and also the ability to provide persistent low-altitude reconnaissance. Hence, the very fact that the Iranians could down it should be enough for the US and its allies to be careful in future. "Official: US Informed of Iran's Air Power", *FARS News Agency*. Also last year Brig. Gen. Amir Ali Hajizadeh, the Commander of the Islamic Revolutionary Guards Corps (IRGC) Aerospace Force had said that the 35 military bases which the US has around Iran were all within the reach of Iranian missiles. Also, the missiles have the capability to hit in the early minutes after an attack. Lee Ferran, "Iran: We Can Hit 35 US Bases in 'Minutes'", *ABC News*, July 5, 2012, http://abcnews.go.com/Blotter/iran-hit-35-us-bases-minutes/story?id=16716804, accessed on February 22, 2013.

Through the help of Hamas and Hezbollah, Iran has the capability to create instability within the region, especially in Iraq, whose spillover effect on the US would be grave.

heavy economic sanctions being levied on it. The biggest minus point for Iran in this encounter is that it is alone. Even though China and Russia support it, they would take a back seat if the allied powers attack Iran through the green signal given by the United Nations. But if the building of the nuclear weapons proves true, then it would be a completely different story. Another important observation is that manned aircraft would have an upper-hand over the UAVs in the future, though the UAVs' significance is no less important. UAVs or Unmanned Combat Aerial Vehicles (UCAVs) are undoubtedly important as they can identify a target and also attack it. They have the capacity for reconnaissance, surveillance and intelligence gathering but a manned piloted aircraft would always be important. A pilot being present in the scenario would be able to not only strike the specific target but would also be able to assess the surrounding environment and take the next tactical step accordingly. For the UAVs, this might take some time as the pilots who would be controlling them would be in their main stations, far away from the target area. Also, another important factor to keep in mind about the UAVs and UCAVs is that with the upcoming technology of electromagnetic pulses, these unmanned aircraft might be easy targets in the air space of an adversary. The systems of these unmanned aircraft can be easily jammed. Hence, the debate which has been going for some time regarding the phasing out of manned aircraft and the taking over of their role by the UAVs and the UCAVs could be put to rest with the Predator being fired upon — at least, till the time machines have the capability to completely take over humans, which is not possible. It is because of the human mind that the latest technology is arrived at.

A balanced defence system is vital for every country's national security but having a strong strategy for air power is necessary and proves the indispensability of the role of air power.

SPACE: THE INDIAN ODYSSEY

RAJAT JAIRATH

India's first indigenous satellite, the Aryabhatta, entered orbit in April 1975 launched aboard a Soviet rocket. It took another five years for the nation to achieve its first indigenous space launch. The four stage solid-fuel Satellite Launch Vehicle-3 (SLV-3) blasted off from the Indian launch site, Sriharikota, in July 1980, successfully placing the Rohini-1 satellite into a Low Earth Orbit (LEO), enabling the nation to become the seventh in the world's select group of countries with the capability of indigenous space launchers that could launch and place satellites in orbit. This was at a time when India had already acquired nuclear capability in 1974 but the space programme was conceived and executed with a purely peaceful orientation. India has displayed tremendous acuity and maturity, and in its ventures in space, the new dimension, it took the path for peaceful purposes for the benefit of its people, with no content that offered any military utility.

This essay chronicles the motives behind the Indian space programme and traces its evolution to the contemporary times.

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The Indian Space Programme

100th Milestone in India's Space Chapter

In a landmark achievement in its ongoing space programme, India on September 9, 2012, launched its 100th mission into space. The Indian Space Research Organisation (ISRO) launched a commercial payload aboard its space workhorse, the PSLV–C21. Two satellites were successfully placed in orbit, the French 712 kg optical remote sensing satellite, SPOT 6, and a 15 kg Japanese micro-satellite, the Proiteres. With this launch, ISRO has successfully launched 62 satellites, including 28 foreign ones, aboard 38 rockets.

The foundation of the space venture in the country was laid based on the forward thinking policies enunciated by Pandit Nehru. The Indian Astronautical Society was formed in 1957, with the aim to encourage domestic research on space topics. It took another 18 years to launch the first indigenous satellite, in 1975, and then another five years to achieve an indigenous space launch. There has been no looking back since then in the success story of the Indian space venture.

THE MOTIVES BEHIND THE SPACE PROGRAMME

Pandit Nehru was not only an advocate of the Non-Aligned Movement (NAM) but also one of the founding fathers of the movement in 1961. His vision of non-alignment was to avoid dependency on either of the two power blocs and seeking to occupy the middle ground, he sought to avoid being drawn into a possible third World War.[1] India applied a self-imposed moratorium on developing ballistic missiles as a means of delivery of long range munitions. Dr. Vikram Sarabhai, the father of the Indian space programme, piloted the space programme towards applications that could functionally benefit the Indian masses in terms of education and health care, and bolster the nation's economy, for which three areas were selected and energised for development: communications, weather/climatology and

1. Percival Spear, *India: A Modern History* (Ann Arbor, Michigan: University of Michigan, 1961), p.444.

remote sensing.[2]

India's Space Launch Vehicles (SLVs), unlike those of the other global space players, did not emerge from ballistic missiles but originated from civilian rockets. Over the decades of execution of the Indian space programme, the earlier vision of Dr. Vikram Sarabhai of space-based applications was engineered for social needs that encompassed capability-building in areas as far and wide as telemedicine, education, weather forecasting, remote sensing, agriculture, telecommunications, disaster management, environment monitoring and Direct-To-Home (DTH) television, aimed towards social upliftment and poverty eradication through a constellation of 20 in-orbit and operational satellites as of September 2012.

Backed by a relatively modest[3] annual budget of around US$ 1.5 billion for the year 2012-13, the Indian space programme offers additional dividends by gaining tremendously in the realm of self-reliance. Over the years, the motive has undergone a paradigm shift by way of broadening into a vision that appears to have naturally gravitated from societal development to a stance that also views space as an arena for global prestige.[4] Commencing in 1999, the Indian space initiative entered another exclusive field, that of providing low cost launch services. Commerce is not necessarily the only motivator as such partnerships with global players offer tremendous foreign policy spin-offs in India's favour.

The year 2008 saw another glorious chapter being added to the Indian space-success narrative. Chandrayaan-1, launched in October 2008, was the country's first unmanned lunar probe and made a controlled landing on the lunar surface, making the country the fourth in the world to have its flag planted on the Moon.[5] It was this mission that made the world aware that

2. Rajeev Lochan, "Some Reflections on Collective Security in Space," in John M. Logsdon and James Moltz, eds., *Collective Security in Space: Asian Perspectives* (Washington, D.C.: George Washington University, Space Policy Institute, 2008), p.33.
3. A modest budget for space is a relative term as it is 7.5 percent of NASA's budget, a quarter of the European Space Agency's and a mere 0.34 per cent of the Indian government's expenditure. "Winning is a Matter of Belief: ISRO Chief," *The Hindu*, September 9, 2012, accessed at http://www.thehindu.com/todays-paper/tp-features/tp-downtown/winning-is-a-matter-of-belief-isro-chief/article3875930.ece, on September 26, 2012.
4. Bharath Gopalalswamy, "Indian Space Policy: Aiming Higher," *Space News,* July 21, 2008, P. 23.
5. "Tricolour's 4th National Flag on Moon," *The Economic Times,* November 15, 2008.

water exists on the Moon. The mission carried the most international lunar payloads ever, a result of the combined efforts of the USA, Bulgaria and 17 countries within the European Space Agency (ESA). With plans afoot for Chandrayaan-II and Mangalyaan to the Moon and to Mars respectively, India's motive would need to be beyond the scope of just acquiring 'international prestige'.

A HISTORICAL PERSPECTIVE

The launch of the Sputnik-1 by the Soviets in October 1957 was an event that galvanised Dr. Sarabhai into looking at the potential of satellite applications for socio-economic development and brought to the government's attention the need to build an indigenous satellite. The government saw reason and the Indian National Committee for Space Research (INCOSPAR) was set up in 1962, with Sarabhai as its first Chairman. Building rockets was the obvious first step in any space venture and that led to setting up the Thumba Equatorial Rocket Launching Station (TERLS) near Thiruvananthapuram. Sarabhai spearheaded the establishment of the Indian Space Research Organisation (ISRO) in 1969.

The very first cooperative venture in the realm of rockets came about with partnering the Soviets in launching their scientific sounding rockets from TERLS. It was largely due to India's non-aligned stance that it held the middle ground, with the USA and USSR both playing a part in the early steps in rocketry. Indian scientists underwent training on sounding rockets at the National Aeronautics and Space Administration's (NASA's) launch facility in Virginia. The first rocket launched from TERLS in November 1963 was based on the design of the US Nike-Apache.[6] This enabled Indians to gain expertise in modern rocketry that eventually led to indigenous capability in SLV.[7]

The first purely indigenous rocket, the 10-kg solid-fuelled Rohini-75 (75 indicating the diameter, in millimetres), was launched in November 1967 from TERLS. Over time, the rockets became bigger,[8] went higher, carried

6. B. N. Suresh, "History of Indian Launchers," *Acta Astronautica 63,* 2008, p. 429.
7. James Clay Moltz, *Asia's Space Race* (New York: Columbia University Press, 2012), p. 114.
8. In a span of five years, the rocket launch weight went from 60 kg to over two tons. http://www.bhaskarastro. org/earlyhistory.htm, accessed on October 1, 2012.

better technology payloads and, most importantly, with an enormous amount of hands-on experience, boosted confidence in testing advanced sub-systems and evaluating more powerful propellants. TERLS was limited to launching rockets of a diameter of only up to 0.56 m from its three launch pads, which was obviously inadequate to realise the dream of launching bigger and heavier SLVs. A launch site at Sriharikota Range (SHAR), an island off the east coast of Andhra Pradesh, was selected and made operational in October 1971.

To provide focus to the space programme, ISRO was placed under a newly created Department of Space (DOS) in 1972, with a strategic plan to place a 40 kg satellite into LEO. ISRO continued on the course charted by Sarabhai, that of 'leap-frogging' the process of development by acquiring advanced technologies and then developing them to suit domestic requirements.[9]

SPACE LAUNCH VEHICLE TAKES FLIGHT

Development of the four-stage, solid-fuelled SLV-3 commenced in 1973 under the Project Director, Dr. A. P. J. Abdul Kalam, with plans of a 17-ton launch mass, 13 tons of which was fuel. The SLV-3 had 44 main systems totalling 10,000 components, 85 per cent of which were indigenous. Forty-six organisations in the public and private sectors were involved in the project. The SLV-3's first successful launch was on July 18, 1980; it orbited the 40 kg remote sensing satellite Rohini, heralding India's entry into to a select group of launch-capable space-faring nations, the seventh in the world to do so.

Launching heavier satellites would need larger rockets. A low cost 'augmented' version of the SLV (ASLV) was the next step: a 23-m tall, five-stage, solid fuelled rocket designed to place a 150-kg satellite into a circular orbit, launching two 'stretched' Rohini satellite series, or SROSS, in the period 1992-94.

While the SLV-3 and the ASLV were designed as experimental launch

9. V.S. Mani, "Space Policy and Law in India and Its Relevance to the Pacific Rim," *Journal of Space Law* 35, no. 2, Winter 2009, pp. 618-619.

The Technology Experimental Satellite (TES) launched in October 2001 provides imagery of one metre resolution, making the country the only one other than the USA to possess such capability.

programmes, it was the Polar SLV or PSLV that conferred on India the rites of passage into the 'big launcher league'. To place in orbit larger satellites of one ton class that was envisaged for the series of Indian Remote Sensing (IRS) satellites, the need was to exploit the advantages of power and control that liquid-fuelled rockets offered. The 44-m tall and 275-ton PSLV was almost ten times bigger and heavier than the ASLV and had a combination of alternate solid-liquid stages in its four stages with strap-on boosters. The first successful launch of the PSLV was in October 1994 that placed the 870-kg IRS P2 satellite into an 825-km orbit. This feat allowed the country to break away from its reliance on Russian launchers for orbiting the IRS series of satellites and, in addition, made the domestic launch services commercially available to foreign partners. PSLVs till date have an enviable track record of 21 consecutive successes in 22 launches[10] and continue to launch and orbit satellites in LEO. The most notable amongst them remain the series of IRS satellites that have enabled the nation to have the *largest constellation of remote sensing satellites in the world*, with some of the newer ones providing sub-metre resolution. Other notable and successfully orbited payloads and missions launched aboard the PSLVs include the first commercial launch in May 1999 that orbited three satellites, including one each of Korea and Germany; the Technology Experimental Satellite (TES) launched in October 2001 that provides imagery of one metre resolution, making the country the only one other than the USA to possess such capability;[11] Metsat (later renamed Kalpana), the first indigenous meteorological satellite, in September 2002; SRE-1, the space capsule recovery experiment that was de-orbited and recovered after 12 days, in January 2007; mission PSLV C-9 that placed 10

10. ISRO, "Launch Vehicles'", accessed at http://www.isro.org/Launchvehicles/launchvehicles.aspx, on October 6, 2012.
11. "India's Spy Satellite Boost", *BBC News*, November 27, 2001, accessed at http://news.bbc.co.uk/2/ hi/south_asia/1679321.stm, on October 15, 2012.

satellites into orbit simultaneously in April 2008 and made the nation the first in the world to do so; Chandrayaan-1, the unmanned lunar probe in October 2008; and RISAT-1, the first indigenous all-weather radar imaging satellite weighing 1,858 kg, in April 2012.

To gainfully exploit the complete spectrum of space applications, one essential segment was of having dedicated satellites operating at the Geo-Stationary Orbit (GEO) — satellites that would orbit once every 24 hours and would appear to be permanently 'parked' 36,000 km over a geographical point in the Indian subcontinent. Launching two-ton satellites into GEO required yet another quantum leap in launch technology. For economic reasons and more, importantly, the nationalistic desire for self-reliance, it was in 1987 that India felt the need for indigenous launchers for orbiting its two-ton satellites in GEO, a need that gave birth to the Geo-Stationary Space Launch Vehicle (GSLV) programme. The design of the 49 m tall, 414-ton, three-stage GSLV caters for the already proven solid-fuelled first stage of the PSLV as its first stage. The second stage is the same proven Vikas engine that formed the second stage of the PSLV that sent Chandrayaan-1 to the Moon. The development and operationalising of the third stage, the liquid-fuelled cryogenic engine, turned out to be an altogether different story, both technologically and politically.

In 1991, the USSR and India entered into an agreement wherein India would buy cryogenic engines and related production technology. Having apprehensions that such technology would violate the provisions of the Missile Technology Control Regime (MTCR) by being used for developing long range ballistic missiles, the USA applied sanctions on this deal in 1992. The reason for such apprehensions was not necessarily violation of the MTCR, as cryogenic fuel takes a long time to prepare on the ground and has no utility for military rockets that need to be launched at shorter notice, but was rather, commercial.[12] Prior to the deal with the Soviets, India had approached Japan for its LE-5 cryogenic engine, which did not fructify. Getting wind of this, the American General Dynamics Corporation offered

12. Prof. U.R. Rao, former ISRO Chairman, *Space India,* October 1993-March 1994, accessed at http://www.frontlineonnet.com/fl2710/stories/20100521271010100.htm, on October 8, 2012.

the cryogenic engine and its technology transfer. India did not express an interest as the cost was found to be prohibitive. Some are also of the view that the American intervention in the USSR-India deal was to keep India out of the commercial space launcher market. Post the break-up of the Soviet Union, the need for hard cash made Russia initially reject the US request for sanctions. The American financial aid package to Russia in 1993,[13] however, turned the tide and Russia held up the Indian deal, agreeing only to the sale of seven of the completed cryogenic engine, the KVD-1.

The first successful launch of a GSLV fitted with the Russian cryogenic engine placed an educational satellite, the 1.5-ton G-SAT 1, in a near-GEO in April 2001. Of the balance six Russian rockets, five were expended in GSLV launches between 2003 and 2010. The nation's first indigenous cryogenic engine fitted GSLV, the GSLV Mark, II, launched in April 2010, crashed into the sea five minutes into its flight. With only one KVD-1 engine in its hand, it is now for ISRO to draw lessons from the failure of the first indigenous cryogenic engine and face up to the challenge of bearing fruit for the ambition of self-reliance. While the saga of Indian space launchers has been creditable, the space launcher industry, at the very least, should aim to catch up with the domestic satellite industry whose progress and reach have been even more remarkable.

SPACE-BASED APPLICATIONS FOR THE SOCIETY

In the 1960s, when satellite-based applications were still in the experimental stages even in the USA and USSR, Dr. Sarabhai was quick to understand the implications of such applications in support of, and to supplement, ground-based systems. While charting the course for developing indigenous satellites, Sarabhai realised the need to tap into existing space assets by initially banking on foreign satellites for proving applications, building the requisite ground support infrastructure and then innovating to indigenise.

13. The financial aid package was essentially US$ 400 million that the USA paid to Russia for seven American flights to the Mir space station, the very exact amount that the Russians lost in the Indian cryogenic deal. Brian Harvey, Henk H. F. Smid and Theo Pirard, *Emerging Space Powers: The New Space Programs of Asia, the Middle East, and South America* (Chichester, UK: Praxis Publishing Ltd., 2010), p. 224.

Partnership with the US in the 1970s led India to capitalise on available American satellites in two fields: rural education and remote sensing. India experienced first-hand, space-based applications that emerged from both the distinctly different orbits: education and communications from the ATS-6 satellite in GEO, and remote sensing from the Landsat satellite in LEO. Dr. Sarabhai presented a plan on the Indian National Satellite System (INSAT) in 1970 that involved procuring the first set of satellites from foreign partners and building the subsequent series domestically.[14] Within the domestic satellite programme, ISRO commenced its work in essentially two fields. The first was in the field of remote sensing, the Indian Remote Sensing (IRS) satellite system and the other in the realm of geo-synchronous satellites, by way of the INSAT system for communications, TV broadcasting and meteorological services. INSAT aimed at another first in the world: to harness the advantages of communications (in GEO) and Earth observation (in LEO) from a common satellite platform in GEO, an approach more complex but 40 per cent cheaper in the long run.[15]

SAGA OF THE INDIGENOUS SATELLITES

The country's first indigenous satellite, the Aryabhatta, a 360-kg scientific satellite for study of the Earth's atmosphere was launched aboard a Soviet Cosmos 3M rocket in 1975 on a 594-km circular orbit but lasted only five years.[16] The first step towards remote sensing was the satellite Bhaskara-I launched in June 1979 from the Soviet Union that provided one kilometre resolution photographs. It sent ten pictures a day and provided valuable information on snow melting in the Himalayas, river flooding in north India, desertification in Rajasthan, rainfall in the coastal belts and mineral resources in Gujarat. Bhaskara-II, launched in 1981, returned the most useful data in its ten years life, providing information on agriculture, vegetation and weather, and in assisting in making maps of Bengal.

14. "History of Indian Space Programme," accessed at http://www.bhaskarastro.org/earlyhistory.htm#a10, on October 10, 2012.
15. Harvey, et al., n. 13, pp. 184-185.
16. n. 14.

Come the time to test the indigenous space launch capability, as the SLV programme had progressed on course, it was obvious that the first step to orbit the satellite would be small and tentative. The first indigenously launched satellite, the Rohini that was launched from SHAR in July 1980 was a mere 35 kg mass, though equipped with a TV camera of one kilometre resolution. Upbeat and assured with this success, Rohini-2's launch in May 1981 was covered live on TV and radio. Rohini-3, launched two years later, performed even better by beaming back 5,000 images, picking out water, vegetation, snow and clouds.

THE IRS SYSTEM TAKES SHAPE

The indigenous satellite-building capability stood proven with the successes achieved in the experimental satellites of the Bhaskara and Rohini class. IRS satellites were designed to be of one ton weight, revisit or cross the same point on the Earth every 21 days to carry out systemic mapping of the Earth's surface. The first IRS, IRS-1A was ready but the SLV/PSLV was not. IRS-1A was launched in March 1988 on a Russian rocket. The 975-kg satellite was put in a 904-km polar sun-synchronous orbit of 22 days revisit, providing a resolution of 36.25 m. It operated for over eight years,[17] returning 400,000 images that enabled comprehensive mapping of forests, salt land, water and wasteland. IRS-1B, specifically designed to forecast crop yields of tea and coffee, was launched in August 1991, again from the Soviet Union.[18]

The first in the series of IRS satellites to be launched by an indigenous PSLV was the 804-kg IRS-P2 (P for Polar) in October 1994. The satellite-capability envelope thereafter was raised and the country moved to its second generation IRS satellites. India orbited the 1,250-kg IRS-1C in December 1995 aboard the Russian Molniya rocket and the satellite's operation was unique in two ways. Its panchromatic camera with a six-metre resolution provided a significant boost in the accuracy of remote

17. ISRO, "Earth Observation Satellites," accessed at http://www.isro.org/satellites/irs-1a.aspx on, October 15, 2012.
18. Harvey, et al., n. 13, pp. 174-175.

sensing, making it the most advanced remote sensing satellite in the world at that time.[19] Such an output enabled digital mapping of the whole country on a 1:125,000 scale and coupled with the output from the infrared-band sensor, fed in to the early years of mapping of the domestic Geographical Information System (GIS). The other ground breaking activity linked to the IRS-1C was India's entry as an exporter at the global level. India permitted a franchise to EOSAT, an American company, to sell this imagery to the global market, while the Japanese space agency, NASDA, bought the IRS data for its own remote sensing centre.

The PSLV programme stabilised, grew from strength to strength and the days of dependency on foreign launchers for the IRS satellites were over.

The PSLV programme stabilised, grew from strength to strength and the days of dependency on foreign launchers for the IRS satellites were over. The all encompassing IRS series gave way to a variety of satellites that are designed and operated exclusively for individual facets of remote sensing, with the satellites being named as per their area of application. The OceanSat (IRS-P4) launched in May 1999 carried payloads exclusively for oceanographic studies and had instruments that could see up to 200 m depth. The Technological Experimental Satellite (TES) launched in October 2001 to experiment with, and validate, new technologies in spacecraft and payloads, provides a one metre resolution that made the country the only one other than the USA to possess such capability at the time, raising apprehensions in some who saw implications of such a capability in matters military.[20] Metsat, in September 2002, later renamed Kalpana, orbiting in GEO, was specifically for meteorological purposes. It carried out hourly scans in the visible, infrared and water vapour bands, collected data from weather stations across the country and relayed them to the meteorological centre at New Delhi. The Cartosat series of satellites operate for digital mapping, town planning, and road and canal building. The highly agile

19. Ibid., p 175.
20. n. 11.

and steerable Cartosat 2B launched in July 2010 provides a resolution better than one metre.[21] The technological graph gained a notch with the launch of a radar imaging satellite, the RISAT-2 in 2009. This was the country's first observation satellite with an all-weather radar imaging application for disaster monitoring. It has applications in the field of radar-based tracking of ships, a special need that arose in November 2008 during the Mumbai blasts, necessitating an outright buy from Israel within five months.[22] The state-of-the-art RISAT-1 took this application further. Launched in April 2012, the 1,858-kg indigenous satellite, the heaviest launched by PSLV into LEO, carries a microwave synthetic aperture radar operating in C band, that enables day and night imaging operations in all weather conditions.

With over a dozen satellites currently in operation, the IRS system is the largest civilian remote sensing satellite constellation in the world, providing imageries in a variety of spatial resolutions, spectral bands and swaths.[23] Resolution available today is that of less than one metre. The data is used for wide-ranging applications covering agriculture, water resources, urban development, mineral prospecting, environment, forestry, drought and flood forecasting, ocean resources, conservation of wildlife and disaster management, activities across a broad spectrum that are contributing immensely to India's economic, environmental and social development.

THE INSAT IS IN PLACE

Dr Sarabhai's presentation in 1970 on the envisaged INSAT system operating in GEO, found favour with the powers-that-were and approval of the programme was accorded in 1977. GEO slots were registered two years later with the International Telecommunication Union (ITU) for orbiting INSAT satellites in GEO. The INSAT programme involved the Ministry of Telecommunications, All India Radio, and Departments of Space and of

21. ISRO, "Cartosat-2B," accessed at http://www.isro.org/satellites/cartosat-2b.aspx, on October 15, 2012.
22. "Why RISAT-2 Came Before RISAT-1," May 3, 2012, accessed at http://www.strategypage.com/htmw/ htspace/20120503.aspx, on October 18, 2012.
23. n. 17.

Meteorology. With the rather unique aim of providing applications in the dual role, that of communications and weather systems, an agreement was finalised with the US in 1978 to build the first of the INSAT-1 satellites[24] and with NASA for launching them. Events unfolded thereafter in a manner that allowed India to collaborate with the European Space Agency (ESA) too in the field of space launch. The first four flights of ESA's Ariane launcher were development flights and ESA offered free space to ISRO—free, as these were test flights and there was an inbuilt element of failure. The Indian response was prompt. The 630-kg[25] satellite, Ariane Plane Passenger Payload Experiment (APPLE), built by HAL, took 36 months to design, build, test and ship to Kourou, French Guyana, from where it was launched aboard Ariane V3, the third flight, in July 1981. This was the period when the indigenous satellites Aryabhatta, Bhaskar and Rohini had already been launched. Most welcome was the Indian hands-on experience and confidence in the GEO-based space relay platform that would pave the way for the indigenous INSAT-2 series of satellites.

Four of the US built INSAT-1s were launched in the period 1982 to 1990, by the USA and Ariane. The indigenous INSATs commenced with the second-generation INSAT-2 series of satellites that, however, still required foreign launchers. Five satellites in this series of two-ton class of satellites were launched in the period 1992-99 all aboard ESA's Ariane rocket. INSAT-2A and 2B were near identical 1,906-kg multi-purpose satellites that provided communications (C, extended C and S bands), meteorology and satellite-based search and rescue services. INSAT-2C and 2D satellites were purely for communications and, in addition, had transponders in Ku band. INSAT-2C provided coverage to remote parts of the northeast, Andaman and Nicobar Islands and as a yet another first, with enlarged C band transponders, reached out to countries beyond the subcontinent. The higher frequency Ku band enabled higher-density traffic, while transmission began being received by small rooftop antennae. The last in this series, the multi-purpose INSAT-2E weighed 2.55 tons and besides the standard fare

24. n. 14.
25. Harvey, et al., n. 13, pp. 184-189.

in payload, carried for the first time, a high-resolution sensor for the water vapour band and a Charged Coupled Device (CCD) camera that provided one kilometre spatial resolution. It collected and retransmitted data from 100 weather stations in remote areas. The performance of this satellite was such that a European consortium, INTELSAT, leased 11 transponders for 10 years at a cost Euro 188 million. With the INSAT-2 system in place, 90 per cent of the population was covered by space-based TV, while 700 TV and almost 200 radio stations used signals retransmitted from the INSAT series. By the turn of the century, the INSAT system was extensive enough to provide video teleconferencing and education for farmers and rural development workers through 4,700 voice circuits via 430 Earth stations and 1,200 terminals. Fishermen in the coastal areas were being guided to fishing grounds by the space platforms. The ground stations for INSAT-based search and rescue applications set up at Bangalore and Lucknow not only served distress calls to the mainland but acted as relay stations for countries as far as Indonesia to the east and Tanzania to the west.[26]

The INSAT-3 series of satellites were driven by increased domestic demand for communication channels. Four of them launched in the period 2000-03, all on Ariane, with the aim of placing more transponders in space as also to step into the GEO slot and fulfil the role carried out by the ageing INSAT-1 and 2 series of satellites. INSAT-3E is purely a communications satellite, while the other three are multi-purpose satellites launched to augment the services being provided by the preceding INSAT satellites. The fifth in this series, the INSAT-3D, planned for launch in 2012-13 will be purely a weather satellite.

The need for the INSAT-4 series of satellites arose essentially to build upon the services that were already in use, primarily in the rapidly growing fields of telemedicine and DTH TV. Four INSAT-4 satellites were launched between 2005 and 2007, of which one satellite failed to reach its orbit. The INSAT-4A enabled ISRO to connect 33 specialised hospitals to 132 remote, rural or district hospitals in its telemedicine network in 2006,[27] while the

26. Ibid., pp. 190-195.
27. Ibid., p. 196.

figure today stands at 80 hospitals connected to 306 remote/rural hospitals and 16 mobile telemedicine units.[28]

WIDENING THE SPECTRUM OF SPACE APPLICATIONS

Sqn Ldr Rakesh Sharma, a fighter pilot in the Indian Air Force became the first Indian and the 139th human to reach space, aboard the Soyuz T-11 in April 1984, for a week-long stay on the Salyut space station. Though remarkable, this could have been considered a singular feat but for the fact it gave birth to the idea of an indigenous manned space flight in the years to come. True enough, the Space Recovery Experiment (SRE) was launched in 2007 aboard the PSLV and the spacecraft safely deorbited and returned to Earth 12 days later. This was the natural first step to prove the desired capability of safely recovering space travellers back.

While the INSAT series of satellites provide services in communications, weather and Earth observation, it was in the field of rural development that a new range of geo-synchronous satellites was conceived. The Department of Space and the Ministry of Rural Development partnered in 2000 to introduce the GRAMSAT (*Gram* is Hindi for village) programme aimed to transmit TV, CD-quality sound, data and internet over the communications network connecting state capitals to districts and rural blocks. The terrestrial grids were planned to be connected via communications satellites. Thus, was born the GSAT series of satellites that were based on the INSAT-2 design with six powerful transponders on a national beam for educational TV and two spot beams to transmit sound in four different languages.[29] Commencing with the launch of the GSAT-1 aboard the GSLV in 2001, a total of six GSATs were launched, including the last one, the GSAT-10, aboard Ariane, in September 2012. This constellation of satellites has, equally importantly, also augmented the communications services of the INSATs, by adding transponders in space. Indian geo-stationary satellites, that is, the complete series of INSATs and the GSATs, occupy GEO slots of 55, 74, 83 and 93.5

28. ISRO, "Telemedicine," accessed at http://www.isro.org/scripts/telemedicine.aspx, on October 17, 2012.
29. Harvey, et al., n. 13, p. 220.

In the field of satellites, ISRO announced on October 8, 2012, that it plans for 58 space missions in the next five years to place 33 satellites in orbit.

degrees east longitude,[30] some of which have three or more satellites parked together, including a few obsolete ones.

To encourage study of space sciences among students of the domestic universities, ISRO has invited partnerships for building satellites and then launched them on home-grown PSLVs.

THE YEARS AHEAD

In the ever changing global geo-political milieu, the nationalistic focus on self-reliance is not likely to be lost sight of. Towards this end, the immediate aim would need to be in the launch sector, by achieving success in the critical cryogenic technology that has so far eluded the indigenous GSLV-Mk II and then following it up with its technological successor, the GSLV-Mk III that would place a five-ton satellite in GEO — a programme that has already been approved by the government in 2002. This three-stage GSLV will be mightier and more powerful, with a launch weight of 630 tons, 200 more than the GSLV. Self-reliance in this core capability, besides the issues of pride and cost savings, would offer tremendous benefits by way of geo-political spin-offs.

In the field of satellites, ISRO announced on October 8, 2012, that it plans for 58 space missions in the next five years to place 33 satellites in orbit.[31] Besides just the numbers of satellites, it would be more prudent to look at the applications that are planned to be fielded. The INSAT and GSAT series to be launched in the years to come, would continue to add transponders in space to meet the burgeoning need of domestic communications as well cater to those of foreign partners. Equally important are service-based systems that are planned for the mid-term. One of the notable among them is the GPS Aided Geo-Augmented Navigation (GAGAN) system, a satellite-based

30. Committee on the Peaceful Uses of Outer Space, "Actual Situation in the Geostationary Orbit," 49th Session, Vienna, February 6-17, 2012, accessed at http://www.unoosa.org/pdf/limited / c1/AC105_C1_2012_CRP25E.pdf, on October 17, 2012.
31. "ISRO to Launch 58 Space Missions by 2017," October 8, 2012, accessed at http://www.satellitetoday.com/st/headlines/39643.html?hq_e=el&hq_m=2537808&hq_l=22&hq_v=7c49e30760, on October 25, 2012.

regional navigation service that is being fielded by the Airports Authority of India (AAI) and ISRO that aims to provide air traffic management and navigation over the Indian air space, making India the fourth in the world to do so. GSATs-8 and -10, with GAGAN payloads, are already in their GEO slots and provide better than seven-metre accuracy[32] while the third satellite to complete the constellation, the GSAT-9, is planned for launch in 2013-14. To be operational in 2014, GAGAN, with its enhanced accuracy, will not only make the skies and landings safer by providing by a three-dimensional approach operation but also enable less safety-spacing between two aircraft allowing three times more aircraft to fly. Better air space management is estimated to cut airline fuel costs by 20 per cent[33] providing for cheaper air travel. Even though designed primarily for civil aviation applications, GAGAN is scalable enough to provide far-ranging enhanced end-user services like agriculture, land mapping, emergency response, natural resources, mining and vehicle tracking.[34]

In yet another giant leap towards self-reliance, the Indian Regional Navigational Satellite System (IRNSS) is being fielded by ISRO. Approved in 2006, the project envisages a constellation of seven navigation satellites, three in geo-stationary and four in geo-synchronous orbits, providing 10 m accuracy over the mainland[35]. The first satellite of the IRNSS constellation, the IRNSS-1, is planned to be launched aboard the PSLV in 2013, while the full constellation is planned to be operational in 2014.[36] The project includes complete indigenous content in the space and ground segments as well as in the end-user receivers.

32. ISRO, "Future Programme," accessed at http://www.isro.org/scripts/futureprogramme.aspx, on October 26, 2012.
33. "Air Navigation System GAGAN to Help Jet Airways, Indian Airlines, Others to cut Fuel Cost by up to 20%," *The Economic Time*s, October 8, 2012, accessed at http://articles.economictimes.indiatimes.com/2012-10-08/news/34323085_1_indian-skies-air-navigation-airlines-end, on October 26, 2012.
34. A.S. Ganeshan, ISRO, "GAGAN is Expected to Replace the GPS Receivers and Provide Data Integrity," February 2012, http://mycoordinates.org/gagan-is-expected-to-replace-the-gps-receivers-and-provide-data-integrity/, on October 26,2012.
35. A. Bhaskaranarayana, ISRO, "Indian IRNSS and GAGAN," presentation to COSPAR meeting at Montreal, July 15, 2008, accessed at http://www.oosa.unvienna.org/pdf/icg/2008/expert/2-3.pdf, on October 29, 2012.
36. n. 32.

The Space Vision 2025 strategy enunciates the use of a two-stage Reusable Launch Vehicle (RLV), called Avatar.

In its mid- and long-term visions, ISRO sees itself performing a stellar role in three fields. The first aims at lowering the cost of orbiting a satellite, which currently costs US$ 6,000-7,000 per kg on a PSLV/GSLV. The Space Vision 2025 strategy enunciates the use of a two-stage Reusable Launch Vehicle (RLV), called Avatar[37]. The first stage would be designed to shoot the payload to twelve times the speed of sound, separate and fly back to the launch pad, while the second stage continues onwards to orbit the satellite.[38] Avatar would weigh 25 tons and eventually bring down the cost of orbiting a one-ton satellite to US$ 67 per kg.[39] The second field for focus would be manned space flights. Buoyed by the success of the space Capsule Recovery Experiment-1 (SRE-1), the next step would be a two or three-man crew in a fully autonomous orbital vehicle on a 300-km LEO.[40] As per an agreement with Russia in 2008, an Indian cosmonaut will receive training on a Russian Soyuz flight in 2013, followed by an Indian-only three-man crew aboard a capsule launched by GSLV in 2015.[41]

The third sector involves active participation in the space sciences that centre around missions to the Moon and Mars, including manned ones. In the realm of exploring space beyond the Earth, Chandrayaan-1's remarkable success has bolstered ISRO's confidence in planning for Chandrayaan-2 to the Moon in 2013. Mangalyaan, a mission to Mars, that aims to place a scientific payload in orbit around the red planet, is also slated for end 2013.[42]

37. ISRO, "Space Vision India 2025," accessed at http://www.isro.org/vision.aspx, on October 29, 2012.
38. P. V. Manoranjan Rao and P. Radhakrishnan, *A Brief History of Rocketry in ISRO* (Hyderabad: Universities Press (India) Private Limited, 2012), pp. 318-319.
39. Susmita Mohanty, "Indian Space Programme," June 2008, accessed at http://www.earth2orbit.com/ pdf/ISRO.PDF, on October 29, 2012.
40. ISRO, "Future Programmes," accessed at http://www.isro.org/scripts/futureprogramme.aspx, on October 29, 2012.
41. K. S. Jayaraman, "India Plans First Manned Mission with Assistance from Russian Space Agency," *Space News*, February 2, 2009, p. 11.
42. Press Trust of India, "Manmohan Formally Announces India's Mars Mission," *The Hindu*, August 15, 2012, accessed at http://www.thehindu.com/sci-tech/science/article3775271.ece, on October 31, 2012.

CONCLUSION

At the global geo-strategic level, it would be prudent for India to focus on two growth areas that will impact its stand in the international arena in the years to come. First and foremost is the field of international relations, where the need emphasises a larger and an all-encompassing Indian presence in the global field of partnerships and collaborations. This could be realised by a two-pronged strategy. The first should aim at joint ventures with countries that have modest budgets but relatively larger space ambitions. Such countries should be proffered the entire range of services that Antrix, the marketing arm of ISRO, currently engages in, with a view to project and expand the country's "soft power". The second prong should aim at bilateral and multilateral partnerships with nations that have already established themselves as major players in space, with the aim of sharing emerging technologies and trends for mutual benefit and energising cooperative ventures in space sciences and in space exploration missions beyond the Earth.

The second growth area for the indigenous space industry lies within the national realm, that of safeguarding the country's space interests. Ranking sixth in the world in terms of space budget and technological capabilities, India can ill afford to ignore the practical aspects of ensuring the security of its space infrastructure, especially of its space-based assets. It would serve the Indian interest well to remain actively engaged in the international fora on discussions and negotiations on space security, with a view to remain abreast of the dynamic and ever-evolving power balance. This essay concludes with the thought that it would well serve India's growth narrative to have a comprehensive space security policy in place, from which should evolve key drivers that should chart the course for a national space security framework.

DIRECTION OF THE NUCLEAR DRAGON

ARJUN SUBRAMANIAN P

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.

The future course of China's nuclear policy and its nuclear force structure will largely be shaped by Beijing's perspective of US actions.

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.

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.

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.

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

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.

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.

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