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VOL. 2, NO. 2, SUMMER 2007 (APRIL–JUNE)

EDITOR'S NOTE

With this issue, we complete three years of publication. This is a modest achievement and we are very conscious of the fact that "there are miles to go." But we are happy that *Air Power* has created a special niche for itself and middle level serving officers and strategic experts are coming forward to write dispassionately and objectively on serious professional issues . At the same time, we feel privileged to publish the perspectives of the top military and civil leadership of the country, making them available to our valued readers.

While air power has been around for over a century, with all its trials and tribulations, what the world is now witnessing is a revolution in military aviation, an RMA, if you like, for a variety of reasons. And this is not confined to the dominating industrial powers only. It has started to impact our region in significant ways that hold great promise which can be fully realised only if our own thinking and understanding are able to grasp the meaning and significance of the changes and broader trends as they would affect us, in technological, organisational and, above all, in operational terms.

Because air power, by its nature is technology and equipment intensive, it is but natural that most of the focus and emphasis of professional thinking leans towards this dimension of military power. Even organisations tend to be viewed in the context of how best to use technology and equipment. At the operating levels, the focus inevitably narrows down to skill levels with tactical orientation. In the process, there is an ever present risk that two crucial areas could receive less attention than they deserve: force employment, and human resources, both of which have played a more critical war-winning role throughout history than technology or equipment. With modern technology, weapons and weapon platform employment have assumed immense importance. But force employment – especially as battle spaces expand and tend to be more transparent – would continue to be the arbiter of military success and failure.

THE CHALLENGES AHEAD FOR INDIA'S FOREIGN POLICY

SHIVSHANKAR MENON

Prof. S. D. Muni,
Ladies & Gentlemen,

Thank you for asking me to speak to such a distinguished gathering of thinkers and opinion-makers this morning. The topic that was suggested, "The Challenges Ahead for India's Foreign Policy," lends itself to several and varied interpretations. Which challenges we choose depend upon what matters to us, i.e. our priorities. The primary task of our foreign policy is to ensure an external environment that is conducive to India's transformation and development. To oversimplify, what are the issues and what kind of foreign policy would enable us to eradicate poverty, grow at 8-10 per cent and transform India into a moderately well off state where our people can realise their potential?

Looked at in this light, broadly speaking, there would be three sets of challenges: firstly, ensuring a peaceful periphery; secondly, relations with the major powers; and, thirdly, issues of the future, namely, food security, water, energy and environment.

I

The first area of focus for our foreign policy is naturally our neighbourhood, for unless we have a peaceful and prosperous periphery, we will not be able to focus

Address delivered by **Shri Shivshankar Menon**, Foreign Secretary, Government of India, at the Observer Research Foundation, New Delhi, on April 10, 2007. We are grateful to the Observer Research Foundation for permission to reproduce it.

Unless we have a peaceful and prosperous periphery, we will not be able to focus on our primary tasks of socio-economic development.

on our primary tasks of socio-economic development. We must, therefore, accord the highest priority to closer political, economic and cultural ties with our neighbours and are committed to building strong and enduring partnerships with all our neighbours.

When we look around us today, each of our neighbours is going through accelerated internal political transformations. Bhutan is consciously introducing a form of constitutional monarchy and democracy. Recognising the changed realities, in February this year, we signed a new India-Bhutan Friendship Treaty to replace the earlier one of 1949. Both sides ratified the treaty in March. The new treaty updates the legal basis of our bilateral relations and reflects contemporary reality. Nepal is undergoing a remarkable double transition: bringing into being a new democratic order, while mainstreaming the Maoists. The transition, though delicately balanced, is on course, as evidenced in last week's formation of the interim government. While the basic decisions on the direction and nature of change lie with the Nepalese people, we have given our full support to Nepal in this process and remain committed to its success. In Bangladesh too, the new interim government is taking steps towards transforming the political landscape. As a friend and neighbour, India is interested in a democratic, stable and prosperous Bangladesh. While our relations with Sri Lanka continue to develop steadily, we remain concerned about continuing ethnic conflict. It is necessary to find a negotiated political settlement to the ethnic issue within the framework of a united Sri Lanka that is acceptable to all sections of Sri Lankan society. With Pakistan, the dialogue process continues to change the relationship. The composite dialogue, the Joint Commission and the Joint Anti-terrorism Mechanism have provided a structured framework within which major issues are discussed. For us, terrorism remains a particular concern. Infiltration continues from across the border. We have stressed to Pakistan that the success of the dialogue process is predicated on Pakistan fulfilling its commitment not to permit any territory under its control to be used to support terrorism in any manner.

The challenge for us in our neighbourhood is to build inter-dependencies which not only integrate economies but also create vested interests in each other's stability and prosperity in the subcontinent. Interestingly, today India is not the issue in any of our neighbours' political transitions; rather, the countries of the neighbourhood look to the Indian market and economy as positive factors for their own economic growth. The smooth and productive course of the 14th SAARC (South Asian Association for Regional Cooperation) Summit in Delhi, free of disputes or posturing, is a reflection of changing circumstances. The hope must be that as our engagement with each of our neighbours increases, the value of our bilateral linkages will outweigh the attractions of sterile confrontation.

The challenge for us in our neighbourhood is to build inter-dependencies which not only integrate economies but also create vested interests in each other's stability and prosperity in the subcontinent.

We will continue to work with each of our neighbours, through the innovative use of development partnerships, our economic and technological capabilities, the development of cross-border infrastructure projects as well as our civilisational linkages, to achieve the goal of a peaceful periphery. In this process, we are ready to provide benefits to our neighbours without necessarily insisting on reciprocity. Hence, the prime minister's announcement of unilateral zero-duty access to goods from least developed countries (LDCs) in the region by the end of the year, and the reduction of tariff lines for such countries.

In addition to our bilateral relationships, we see the SAARC process as contributing to our goal of building a peaceful and prosperous periphery. At the recently concluded 14th SAARC Summit in New Delhi, all the SAARC members including newly-admitted Afghanistan, agreed to a vision of a South Asian community where there was a smooth flow of goods, services, peoples, technologies, knowledge, capital,

We see the SAARC process as contributing to our goal of building a peaceful and prosperous periphery.

culture and ideas in the region. As you know, South Asia remains one of the least integrated regions in the world. Intra-regional trade is less than 5 per cent of total regional trade. In addition, cross-border investments and the flow of ideas are at rather low levels. Starting from such a low base, greater integration among South Asian countries could bring huge benefits to the people of the region. With present high growth rates in the countries of the region, we have an opportunity to advance together through trade, open borders and economic integration, and to bring about shared prosperity between India and her neighbours. Several practical steps were agreed, such as establishing a South Asia University, a SAARC Food Bank and operationalising the SAARC Development Fund. The SAARC Summit also agreed to work together to deal with water (including flood control), environment, energy and food security, involving multilateral organisations where necessary. It will be a challenge for India's diplomacy to translate these agreements into reality. As Chair of SAARC, it will be our endeavour to usher in a new phase of effective regional cooperation, reconnecting the subcontinent to itself and the world. We thereby hope to create a common space of prosperity in South Asia based on enhanced economic, trade and investment linkages and sustainable social and economic development.

II

The second set of challenges is that of managing our relationships with the world's major powers. The world today is increasingly multivalent, marked by considerable political cooperation among major powers whose economies are becoming inextricably intertwined with each other. The current global economy is increasingly defined by freer and substantial movement of capital and by the technology revolution, in particular, the information technology. While capital is free to roam the world, other factors of production like labour and technology are not, and access to markets remains patchy. As a result of our development, we are on both sides of a range of issues such as

We need to use our strengths to create partnerships with major powers in a manner which would allow us political and economic space to grow.

intellectual property rights (IPRs) – where we are both supplier and consumer. We need to, therefore, use our strengths to create partnerships with the major powers in a manner which would allow us political and economic space to grow. This will require us to strengthen relations with all the major powers of the world.

India's relations with the USA have been substantially transformed in the past few years, resulting in wide-ranging engagement across many fields, including defence and security issues, counter-terrorism, science and technology, health, trade, space, energy, agriculture, maritime cooperation and the environment. The July 18, 2005 decision to cooperate in civil nuclear energy is a major symbol of this transformed relationship. We seek to arrive at an early agreement with the US on civil nuclear energy cooperation within the parameters laid out in the July 18, 2005 India-US Joint Statement and the March 2, 2006 Separation Plan. While cooperation in nuclear energy is no doubt a very important step, we should avoid the tendency to view relations with the US only within the narrow confines of civil nuclear cooperation. There are many diverse strands to our cooperation with the US, which are progressing well, and which will impart greater resilience to our relations in the future. Relations with the US are important to us, not just because it is the superpower, but also because of the positive effect it has on our dealings with the rest of the world, and on our access to markets, high technology and resources crucial to our future economic growth and development.

We have developed a strong partnership with the European Union (EU) covering a wide range of areas, including trade and investment, culture, science and technology. Our traditional relations with Russia continue to remain strong as evidenced in the recent visit of Russia's President Vladimir Putin as the chief guest at our Republic Day this year. Agreements reached during the visit will significantly expand our cooperation in the fields of energy, high technology, defence and space. The strategic partnership between India and Russia is poised to deepen even further. India's relations with Japan have also developed considerably with several exchanges of high level visits. There has been a qualitative shift in India-Japan relations following our prime minister's visit to Japan in December 2006 and the visit of the external affairs minister to Japan in

March 2007 and we have agreed impart a strategic and global perspective to our partnership. The visit of Chinese President Hu Jintao to India in November 2006 strengthened the process of sustained comprehensive development of India-China relations. There have been some concerns expressed about the "peaceful rise" of China. However, as the prime minister has said, it is our belief that there is enough space for both of us to grow. We remain hopeful about steady progress in our relations with China, and, at the same time, will continue to work towards a resolution of the boundary question.

As we look forward to an increasing role in global affairs, we need to expand our network of international relationships, political engagement and economic and technical cooperation with the world. We are looking today at expanding circles of engagement, starting with the immediate neighbourhood, West Asia, Central Asia, Southeast Asia and the Indian Ocean region. This is reflected in our political, economic and defence engagement with these regions. Our Look East policy and the consequent intensified engagement with East and Southeast Asia have led to the rebuilding of India's historically benign and stabilising role in these regions, premised on the commerce of ideas and goods. Indian companies have long had a presence in Southeast Asia. Now they are venturing farther and investing in China, Japan and Australia. The Association of Southeast Asian Nations (ASEAN) and its member states are important markets for our goods and services, while South Korea and Japan are important sources of investment and technology. We need to strengthen political, physical and economic connectivity between India and East Asia and broaden the underpinnings of our quest for peace and prosperity. We are also adding important elements to our traditional ties with countries of the Persian Gulf region by leveraging economic opportunities.

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If our politics can create an enabling environment, the focus of our economic diplomacy in the coming years will be on promoting trade and investment flows

especially in critical areas such as infrastructure, in assuring predictable energy supplies and in securing the widest possible access to technologies. We also hope to work towards significantly upgrading our economic relationship with Southeast Asia, East Asia, Latin America and Africa, build new investment-driven partnerships with the USA and EU, and nurture a web of cooperative energy security networks in Asia and with new suppliers in West Africa, Central Asia and Latin America.

III

Lastly, there is a cluster of issues of the future such as food, water, energy and climate change. These are interlinked issues, and will have a critical impact as our ability to address them successfully will greatly shape our future. All these are cross-boundary issues, which require us to work with others to solve them. Some, like water and flood control and energy, have solutions in our immediate or extended neighbourhood. Hence, the Delhi SAARC Summit decision to undertake regional or sub-regional projects in these areas. Others, like the environment and climate change, are global in their nature and impact, and need global solutions, and will directly affect our food, water and energy security. Our participation in drawing up those solutions is essential if the outcomes are to be satisfactory and if our development is not to be affected.

Last year, India became a net importer of food after many years. The size of our population, economic growth and prosperity have led to consumption and life-style changes. Assuming a 7-8 per cent gross domestic product (GDP) growth rate, by 2020, we would require 340 million tonnes of foodgrains. This is a challenge both for scientists as well as for the agro-management of our rain-fed and dry-land farming areas. We need a second Green Revolution, harnessing

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contemporary tools like bio-technology, water conservation and rain harvesting techniques and other steps which are environmentally friendly and economically sustainable. We also need to tap into the resources of the developed countries. The India-US Agriculture Knowledge Initiative announced in July 2005, is a step in this direction and aims to address new challenges and facilitate agricultural research, education, and extension.

Food security is not only about food production because in India, 2/3rd of our population is dependent on agriculture for its livelihood. It is in this sense that international trade is a vitally interlinked component. The impasse in international trade negotiations is disappointing for us. When agriculture was brought into the multilateral trade negotiations, the developing countries were given a clear understanding that trade disparities created by agricultural subsidies would be phased out in a definite time-frame. Unfortunately, the developed countries, so far, have been reluctant to do away with their subsidies that render the playing field quite uneven.

Ensuring adequate water supply for both drinking and agriculture and industry will also be a critical challenge for the future. While our subcontinent is fortunate to have adequate resources, we have not seen enough collaboration in its use in the past. We must reverse this. As agreed at the SAARC Summit, we will work with our neighbours in this regard.

Our continued economic growth needs increases in the supply of cheap and sustainable sources of energy. Despite our large population and GDP growth averaging over 8 per cent in the last few years, our per capita electricity consumption continues to be as low as 1/6th of the world average. Presently, 67 per cent of our electricity comes from burning fossil fuels, and 70 per cent of our oil is imported. To meet our future energy requirements, we will have to build partnerships with other countries that have surplus energy. Additionally, we will have to increase the share of non-fossil-fuel based energy resources in our energy mix. The India-US civil nuclear energy cooperation is one step in this direction.

This brings me to the issue of climate change and global environmental degradation. We are ready to work with others on the principle of "common but

differentiated responsibilities" enshrined in the UN Framework Convention on Climate Change. In our view, this issue cannot be viewed in isolation and must be seen in the context of the developmental needs of the developing countries. Today, India has a very low per capita level of emissions and has an energy intensity per unit of GDP which matches the best in the developed world. We look at climate change in the context of the promises made by the international community for technology transfer and additional financing since Rio, which have remained unfulfilled. Critical technologies which can have significant impact on de-carbonisation, have been out of the reach of the developing countries because of prohibitive costs and the existing IPR regime. A related concern for us is that trade advantages should not be sought through the instrumentality of environmental treaties. This issue will be in sharp focus at the forthcoming G-8 Summit, particularly after the report of the Inter-Governmental Panel on Climate Change. Addressing climate change issues in a manner that also meets our concerns will be a major preoccupation for us in the foreseeable future.

I have tried to give you a sense of the challenges that our foreign policy faces and is likely to confront in the immediate future. Some of you might see a great omission in this listing of challenges. What about balance of power issues such as the military balance in our own region and the world, and issues of conventional security? These require a separate speech by themselves to do them justice. Besides, they probably receive sufficient public airing. Speaking personally, I believe that there is a good realist or balance of power argument to be made for choosing precisely these issues as our major foreign policy challenges. But, sadly, the language of strategic discourse in India is not yet developed enough to describe what we empirically know and face as reality around us. We need to develop our own strategic concepts

The language of strategic discourse in India is not yet developed enough to describe what we empirically know and face as reality around us. We need to develop our own strategic concepts and vocabulary.

and vocabulary. I am repeatedly struck by the use of concepts, ideas and methods of analysis that come from other situations and interests, (such as deterrence, parity, or reciprocity), and bear little relationship to our unique circumstance. That is something that needs serious examination on its own. It is probably best left to thinkers like you by diplomats like me.

Thank you for the patient hearing. I would be happy to hear your comments and to answer any questions.

STRATEGIC REACH-STRATEGIC DEPTH AND THE QUESTION OF THE IAF'S STRATEGIC POSTURE

JASJIT SINGH

Interest and articulation of "strategic reach" has lately been on the increase in the Indian Air Force (IAF); and concurrently the rationale of expanding military contingencies ranging from peace-keeping to disaster management has focussed attention on the need to translate the idea of strategic reach into strategic effect. It is obvious that if the strategic reach of the IAF is increasing, then we need to play close attention to its implications for strategic depth and how its exploitation could be optimised to our advantage.

Let us begin with exploring the concept of "strategic depth" – an often used term in military literature though mostly interpreted differently by different people. For example, over the decades, Pakistani elites have bemoaned the lack of their country's strategic depth. After 1971, Bhutto propagated the concept of Pakistan being not only a "South" Asian state, but also a co-religionist "West" Asian country. Its army leadership very often talked about the need to expand the country's strategic depth. During Gen. Zia-ul Haq's rule, a pervasive belief was promoted that the army was not only the defender of Pakistan's territorial boundaries, but also had a legitimate role in defending Pakistan's "ideological frontiers." Not surprisingly, strategic depth as a sequel to this formulation was often interpreted in religious-ideological terms to include Muslim populations and countries. But the core of politico-strategic factors remained dominant in the thinking and planning to expand the country's strategic depth and, tragically, the bulk of the people killed in

Air Commodore **Jasjit Singh,** AVSM VrC VM (Retd), Director, Centre for Air Power Studies, New Delhi.

consequent conflicts in the name of promoting Muslim interests were Muslims, whether in Afghanistan or in Jammu & Kashmir.

Militarily, of course, strategic depth has been interpreted in two ways. One is to signify the distance between the border/battle front and the combatants' territorial space for military manoeuvre behind it which would not place its full military potential, industrial core areas, capital cities, heartlands and other key centres of population at risk to sudden enemy attack and/or provide the enemy attack an advantage of time and space. But adequate geographical and strategic space could also permit a country to withdraw its military field forces deeper into its own territory, absorb the offensive thrust of the enemy short of its goal and far from the defender's sources of power, and apply concentrated military power at the attacker's selected vulnerabilities.

Mao's "People's War" doctrine was premised on this philosophy, exploiting the strategic depth that China's geographical spread provided, to allow the attacker's offensive to peter out, with its logistic lines extensively stretched and vulnerable; followed by concerted offensive by the defender against an over-extended enemy and defeating it with a combination of guerrilla and conventional war. In other words, strategic depth would permit the conduct of a tactical retreat, luring the attacker deeper into the country, extending its logistic lines of communications while shortening those of the defender, and then shifting to a strategic offensive. But progressively this approach became untenable when the attacker sought only limited territorial gains rather than occupation of the whole country.

The second approach has been to trade space for time. This, of course, requires that the country possesses adequate geographic depth and does not present too many valuable targets in the geographical areas through which an attacker would advance. Russia exploited its strategic depth in this form in the face of the Franco-Russian War when Napoleon attacked it in the early 19th century; and again during World War II when Hitler launched his eastern offensive. In both cases, the attackers managed to reach the gates of Moscow but found themselves too weak by that time to occupy it. The Soviet Union had shifted the bulk of its military industry even further, locating it east of the Urals.

Historically, countries have sought to generate strategic depth by controlling territory ahead of their traditional borders even where their own geographic spread has been large. The rationale behind that has invariably been to create a glacis of space outside the borders in relation to an external military threat. Depending upon geo-political factors, this has normally taken the shape of "buffer states" (as in the classical British policy in the late 19th and early 20th centuries across India's borders) and/or "client states" in the form of military alliances and political-economic influence as in the case of the Soviet Union (in Eastern Europe-Central Asia) and the United States (with its ring of military alliances in Europe and Asia). Conceptually, in consonance with the growth of its comprehensive national power, China has been expanding its "core" while shifting its "periphery" outwards, with Chinese characteristics.

What is important to note is that strategic depth is not limited to landmass. Oceans have provided enormous strategic depth to countries like the United States, allowing it to pursue a policy of non-alignment in relation to European military conflicts and rivalries during the 19th century, permitting its power to grow unhindered by costly entanglements in armed conflicts. Britain itself enjoyed the benefits of the English Channel and the oceans beyond it providing it strategic depth and defence for centuries as long as it could maintain superior naval power. It is the strategic depth offered by the oceans that facilitated the European powers, especially those that dominated the seas, to establish their colonial empires in the 18/19th centuries.

Strategic depth is not limited to landmass. Oceans have provided enormous strategic depth to countries like the United States.

THE SHRINKING OF STRATEGIC DEPTH?

But the traditional concepts of strategic depth have been strongly undermined by two factors. The first was the advent of air power a century ago when its fundamental attributes clearly indicated that it could directly target the enemy's heartland, regardless of terrain obstacles or the necessity of having to defeat the ground forces. Advances in technology kept extending the range, payload, accuracies, versatility and lethality of air power over the decades. The impact of

The critical factor that played a major role in the application of force was the ability of naval forces to tactically withdraw into the maritime strategic depth if the opposition was too strong.

military power's ability to target another country without necessarily having to fight and defeat the enemy's land forces was first felt in the employment of naval power which could be employed for destructive purposes independent of land forces. This was obviously limited to the areas contiguous to the seas. But the critical factor that played a major role in the application of force was the ability of naval forces to tactically withdraw into the maritime strategic depth if the opposition was too strong and come back to fight another day, so to say. Hence, this was always contingent to the attacker retaining naval dominance. The repeated Portugese naval attacks on India's west coast in the 16th century represent the advantages of maritime strategic depth while denying the advantage of the landmass-based strategic depth that India enjoyed.

Technological and doctrinal advances allowed air power to apply destructive force across a wide spectrum of roles, missions, targets and effects at great ranges, with ever increasing accuracy, under diverse conditions. This has witnessed dramatic growth in recent decades largely because air-to-ground warfare has finally shifted from the historically line-of-sight (LOS) air strikes to beyond-visual-range (BVR) capabilities. While air-to-air warfare had acquired BVR attributes long ago, air-to-ground warfare has moved into this arena more recently, signifying a virtual revolution in military aviation – an RMA of a different sort. Reconnaissance, surveillance and target acquisition (RSTA) technologies and capabilities, coupled with space-based systems, have advanced so much that any element of the military that moves can be detected, and anything that is detected can be destroyed from the air, and often very quickly.[1]

Precision strike capabilities of aerospace power have brought in dramatically enhanced effect and discrimination even with ballistic missiles.[2] Specialised

1. For an early study, see Jasjit Singh, "Reconnaissance, Surveillance and Target Acquisition," *Strategic Analysis* (IDSA) 1987.
2. Report of the US Presidential Commission on *Discriminate Deterrence*, Washington DC, January 1988.

munitions like bunker busters and precision guided munitions (PGMs) air-delivered at long ranges, place ground targets at great risk. The dramatic example of an unmanned combat air vehicle (UCAV) controlled from continental US locating and destroying a terrorist in a vehicle in the broad expanse of Yemen is a case in point. The speed and reach of air power has made it difficult to trade space for time; and, hence, the dominant trends to seek strategic depth by forward defence, buffer zones and military alliances. China, for example, which had relied on territorial air defence, has shifted to a more forward reaching and "active offence" based air force strategy that aims nothing short of "command of the air."[3]

Another facet of modern air power, hardly visualised in spite of dozens of aviation related terrorist acts, was the use of hijacked unarmed airliners to carry out coordinated strikes at the World Trade Centre and the Pentagon on the morning of September 11, 2001 (with a fourth aircraft possibly aiming for the Capitol which failed to carry out its nefarious act and crashed along with the innocent passengers). The natural focus of studies has been on the terrorism aspect of the attacks. But what we need to consider here is that while air power had largely outdated the traditional concepts of strategic depth, the strikes on "9/11" clearly implied the shrinking of the strategic depth of the vast land-cum-ocean areas of the United States which had traditionally relied on this depth for security and strength. In a more innocent display of air power overcoming strategic depth was the earlier case of Rust, the young German pilot, who flew an unarmed light aeroplane all the way across the heavily defended Warsaw Treaty air space to land in the Red Square outside the Kremlin in Moscow in 1988. Both events clearly demonstrated the vulnerabilities of the two superpowers. But from the perspective of our present examination, these examples demonstrate that expansion of aerospace power capabilities has led to the shrinking of strategic depth in its classical mould.

Expansion of aerospace power capabilities has led to the shrinking of strategic depth in its classical mould.

The second aspect is the fundamental change in the nature of warfare.

3. White Paper, *China's National Defence in 2004*, Beijing, December 28, 2004.

Historically, territory was the central object of war since territory implied resources, both material as well as human, which could be acquired by the conquering state. The British Empire had been largely built upon, expanded, and defended by the manpower and material resources of India and, hence, it came to be called the "jewel in the crown." Territory also made it incumbent on any state that sought to acquire it to defeat the defending land forces before that territory could be occupied and its resources expropriated; and that is where strategic depth assumed importance. But for a range of reasons that we need not go into here, occupation of a country or even a significant portion of its territory through military force had become a high-cost low-benefit phenomenon by the last decades of the 20th century.[4] The possession of nuclear weapons by the contending states, for example, has virtually eliminated the possibility of territorial conquest with military power.

But if territory itself was no longer a prime political-military objective, what was the worth and significance of strategic depth in its different manifestations? What would be the role of buffer states/territories in the 21st century? If Pakistan's forays into creating and expanding its strategic depth westward into Afghanistan and eastward into India (Punjab and Jammu & Kashmir), physically, militarily or ideologically, are any indication, the costs are enormous and the gains, if any, of questionable value.

If territory has been shrunk for the purposes of providing strategic depth, the air space above a large geographical spread has expanded the aerospace strategic depth.

On the other hand, there is no gainsaying that the extent and control of geographical spread (over land and sea) continues to be a distinct asset in the exercise of employment of military power. But if territory has been shrunk for the purposes of providing strategic depth, the air space above a large geographical spread has expanded the aerospace strategic depth. It is inevitable that air space would be contested as long as states in conflict are willing and

4. Iraq's invasion and annexation of Kuwait in 1990, and US invasion and occupation of Iraq since 2003 are visible examples.

capable of doing so. It becomes important in this context, therefore, to examine the role that strategic depth could play. It would also be relevant to note here that since air dominance is critical to employment of military (land, naval and air) force, this would need to be planned for during peace time and then, when and where required, acquired through contest in war.

STRATEGIC REACH

The Indian Air Force has been focussing on "strategic reach" as a major factor of its transformational processes. It has been acquiring the wherewithal for expanding that reach in recent years to trans-continental ranges not only with its transport fleet but also with its combat aircraft.

There is a larger politico-economic rationale behind the attempts to expand the reach of the IAF. India's economy has been growing at an average of 9 per cent in recent years after maintaining an average of over 8 per cent during the previous decade. External trade has increased manifold. This is in spite of the acute deficit of energy in the country. Sustaining the past levels of economic, industrial and trade growth would require additional sources of affordable energy. Our import dependency on oil has already reached 73 per cent of total consumption; and gas imports would soon touch similar figures. The acquisitions of hydrocarbon equities across the world, ranging from Venezuala to Sudan and Sakhalin in the east indicate the expanding economic interests that may have to be protected in unforeseen contingencies. At the same time, with increasing globalisation and integration of Indian economic and trade activities across the world in this process, the Indian expatriate community has been expanding, which could become hostage to political instability and local-regional contingencies. These contingencies may, in some cases, require sufficient and appropriate military capabilities to back up our political-diplomatic steps.

At the same time, the task of international peace-keeping, mostly undertaken by us for nearly six decades either under the UN mandated missions or at the request of a legitimate government of a friendly country, demands increasing strategic reach. Concurrently, peace-keeping in today's world has become more complex and more often than not, and often rapidly slides into peace-enforcement

operations. India's geographical spread itself requires a substantive strategic as well as tactical airlift capability with the Indian Air Force to meet diverse commitments in diverse terrain and weather, from the Himalayan mountains to the jungles of the northeast and the desert of the western region, for rapid response. Natural disasters in and outside the country pose a special type of challenge as the Gujarat earthquake earlier and the tsunami in December 2004 had demonstrated. Political direction indicating the growing national interests abroad has been clearly articulated by Prime Minister Manmohan Singh.

The strategic reach of the IAF for these and other unanticipated contingencies abroad would be crucial (and likely to increase in the coming years and decades) for the pursuit of our national interests, ranging from evacuation of Indian citizens from conflict zones to disaster relief, peace-keeping, peace-enforcement, etc. But this is a subject that requires a detailed study by itself. Suffice it here to state that expanding the strategic reach of the IAF for combat and non-combat roles would need to be strengthened further in the years to come.

But what we would like to focus on here is the issue of strategic depth in relation to the challenges of national defence and the influence strategic reach would (or should) have on the strategic posture and deployments of the IAF.

To begin with, while Pakistani elites have demonstrated near paranoia about the lack of their country's strategic depth, the issue of strategic depth in India's defence has been virtually absent in strategic thinking. The only time it received some indirect – and actually negative – attention was before the Chinese attack in 1962 when influential army leaders argued for a tactical withdrawal from the Himalayan regions contiguous to the borders in the face of any Chinese attack, and then to fight the People's Liberation Army (PLA) in the plains of Assam. When war finally came, this belief may well have contributed to the hurried withdrawal from the Sela Pass (where the Burma experience of fighting battles in "boxes" in which many of our senior officers had participated, could well have held the Chinese for months). In the face of the Chinese advance, the army actually decided to defend the country south of the Brahmaputra in a distorted implementation of the concept of strategic depth.[5]

5. Maj. Gen. D.K. Palit, *War in the High Himalayas* (New Delhi: Lancer International, 1991), pp. 344-345

The absence of strategic thinking on exploiting geography could well be due to the widespread belief (except before 1962) that the country was powerful enough to fight at the borders and prevail. It is interesting to recall that while Pakistan sought to expand its strategic depth by invading Jammu & Kashmir in 1947 and create a buffer zone by hanging on to the occupied territories of Pakistan Occupied Kashmir (POK), we did little to even ensure forward defence in spite of the directions of the Defence Committee of the Cabinet based on the defence minister's proposal for the creation of a 10-mile broad *cordon sanitaire* along Kashmir's western border (with Pakistan) to interdict infiltration of invaders.[6] Small wonder that six decades later, it is Pakistan that seeks further expansion eastwards while we have virtually forgotten that this buffer zone is Indian territory, but does not provide us any advantage of a buffer! On the other hand, this territory has become the launch pad for Pakistani covert and overt aggressions over the decades.

This also points to a second reason in that we have not approached the issue of national defence from a strategic perspective. While this can be explained largely by the British imperial policies of retaining strategic planning and capabilities under their direct control and limiting Indian involvement only to the tactical levels, and the fact that the Indian officers in the armed forces had little experience of strategic planning, this factor cannot adequately explain why this tendency appears to have continued decades later into what is nearly the third generation of military leadership in the country since World War II . The major factor, at least as it concerns the air force, is that the Indian Army (like so many armies earlier) had perceived the air force almost exclusively as a support Service, perhaps at a somewhat higher level than the ASC (Army Supply Corps) transportation system in relation to airlift and as an extension of its corps of artillery in terms of firepower support. The fact that the army as the largest Service itself has been oriented toward land warfare for territorial defence with a near total concentration on "boots on the ground" has not allowed adequate attention to be paid to the role of air power in the changing operational-technological environment of the past five decades. This, of course, has been changing in recent years.

6. Jasjit Singh, *Defence From the Skies* (New Delhi: Knowledge World, 2007), p. 53. The fact that all three chiefs were British at that time and they opposed the proposal at the meeting, may have had something to do with this.

But we also need to recognise the reality that till recently, the IAF itself had not really sought a strategic role for itself in national defence. It had essentially looked at fighting a hostile air force without a clear focus on the "effect" sought toward an identifiable end-state. A perceptive RAND study had politely but candidly stated:[7]

> "The IAF has not figured prominently in Indian thinking about defence."

> "At least from the outside, it appears that the air force did not take the initiative in pushing concepts of air power or in preparing an air plan for the defence of India. While it did not wish to appear as just a supporting service, the IAF was largely forced into that role."

A PARADIGM SHIFT IN THE MAKING

It is against this broader context that we would like to focus on the IAF's increasing strategic reach in the context of taking advantage of strategic depth. The first issue is that with greater strategic reach, the air force can obviously reach further into a hostile territory, expanding the battle space. The primary limitation of this expansion would be the ability of aircraft to operate in hostile air space with integral fuel. Aerial refuelling, so critical to modern expansion of reach, would necessarily have to be undertaken in safer skies.

But, in principle, with expansion of strategic reach, coupled, of course, with enhanced RSTA and air intelligence capabilities, much larger space would be opened up for targeting, and the number of targets and options would increase exponentially. This flies against the conventional wisdom that force multipliers would enable force reduction in future. In turn, precision strike capabilities in an expanded battle space would place a greater premium on target intelligence and information, and, hence, for strategic reconnaissance and intelligence covering potential area(s) of operations during peace and war. These would require additional assets in terms of platforms and sensors; and the larger numbers of targets would demand larger numbers of platforms as shooters with onboard sensors and weapon guiding systems and precision weapons.

7. George Tanham & Marcy Agmon, *The Indian Air Force: Trends and Prospects* (Santa Monica : RAND, 1995), p. 42.

The failure to exploit the country's vast geographical depth in the past can be traced to the following factors:

- Historically, a defensive culture that amounts to the "Panipat Syndrome" due to the propensity of Indian rulers to defend as close to the seat of power as possible rather than exploit strategic depth which would have required a fighting withdrawal.[8] Strategically, the optimum points of defence from invasions from the northwest were the two main passes – the Khyber Pass leading to Peshawar, and the Bolan Pass further south, opening to Quetta. But this was not followed even though the territory east of these passes as they opened into plains mostly belonged to erstwhile India. Indians opted to defend often at Panipat, a short distance from Delhi, the traditional seat of power, forsaking the landmass between the eminently defensible passes and Delhi.
- A "defensive-defence" doctrine and philosophy at least at the political level,[9] which in the past was often interpreted to imply a strategy of defending "every inch" of territory.
- Opportunities for forward defence-based strategic depth were given up during the Kashmir War 1947-48 and never seriously reclaimed; and the loss of Tibet as a buffer zone without settling the boundary.

EXPLOITING AEROSPACE STRATEGIC DEPTH

But the most important aspect from our point of view has been the impact of non-utilisation of India's strategic depth. Empirical evidence is overwhelming in respect of the IAF. Close to 80 per cent of the IAF's operational bases are located within a zone less than 300 km from the international border with China as well as Pakistan, with the balance (except for three) located at less than 400 km. This deployment posture owes a great deal to the factors noted

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8. This also signifies the culture of lack of long-term thinking, unwillingness/inability to address challenges in time and rely on intuitive reactions once the crisis become a veritable threat.
9. Shri K.C. Pant (then defence minister), "Philosophy of Indian Defence" in Jasjit Singh and V. Vekaric, eds., *Non-Provocative Defence: The Search for Equal Security* (New Delhi: Lancer International, 1989) pp. 206-214.

above. But the type of weapons acquired after 1962 have had profound, even if unintended, consequences on the IAF's strategic posture and effect.

A series of steps triggered by the Chinese invasion in 1962 and the unwillingness of the United States to supply arms to India resulted in increasing reliance on Soviet military equipment for a variety of reasons, among which the most prominent were the lower cost of Soviet weapon systems of high quality, payment in rupees in an era of severe shortage of hard currency, and payment for weapon systems acquired on long-term credits at nominal rates of interest. The cost to the exchequer can be gauged from the fact that in the late 1980s, the French Mirage 2000 and Soviet MiG-29 carried a similar unit cost tag; but the real cost of the MiG-29 worked out to one-third the price of a Mirage 2000!

Contrary to conventional wisdom, the Soviet Union had pursued a defensive military strategy. This, in fact, was most visible with respect to air power which relied very heavily on ground-based terminal defences with anti-aircraft artillery and surface-to-air missiles (SAMs). Till the mid-1980s, except for the strategic bombers for nuclear delivery, Soviet combat aircraft had limited operational radius of action, carried limited weapon loads, and had limited BVR/all-weather capabilities. At one stage, as many as 32 combat squadrons (out of 39) were equipped with Soviet aircraft, with limited range and payloads. And even Canberra light bombers had to transit for refuelling for bombing missions in Pakistan during the 1965 War.

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In view of this factor, the most logical option to extend the combat radius of aircraft to be able to hit key targets across the borders was to adopt a basing philosophy of forward airfields which rapidly became near permanent stations rather than the earlier concept of staging airfields. It is worth recalling that the two airfields where we lost a large number of aircraft on the ground to Pakistani air strikes in the first few hours in the 1965 War, were located less than 50 km from the international border, and the third (Kalaikunda) had little air defence

warning cover. A number of such airfields were constructed after the 1965 War, some of them as little as 60 km from the border. This, in turn, drastically reduced the warning period for incoming strikes. It was not surprising, therefore, to witness the Pakistan Air Force (PAF) concentrating their counter-air strikes in 1971 targeting only the forward bases. And, hence, dependence on SAMs increased rapidly. At one stage, the IAF had three dozen SAM squadrons absorbing technical manpower at par with Jaguar squadrons. The Anglo-French Jaguar was advertised and sold as a "tactical fighter" but was christened "deep penetration strike aircraft" in the IAF!

It is against this background that the strategic reach of the IAF started to increase from mid-1990 in spite of strong resistance from some influential sections of the air force. For example, the change in the standard of the preparation of Jaguar and Mirage 2000 to include aerial refuelling probes (standard equipment in Britain and France) took place in the early 1980s, but aerial refuelling tankers were acquired more than a decade later. The airborne early warning system was perceived as contributing little to operational capability; and the indigenous development programme remained underfunded. It would take another two decades before the thinking changed.

The central question that we must address is that now that the air force has moved firmly into expanding its strategic reach, how can this be leveraged for greater strategic effect, especially when its force level has been dropping and could take a decade or more to recoup ?

Now that the air force has moved firmly into expanding its strategic reach, how can this be leveraged for greater strategic effect ?

The issues of state-of-the-art RSTA capabilities, precision strike at long ranges, integral electronic warfare and other defensive capabilities, and so on (which would all cost large sums of money and difficulties in access to technology, etc.) need to be addressed in their own right. But the aspect that we wish to focus on here is that of strategic posture in the shape of force deployment for substantially enhanced strategic effect by exploiting India's strategic depth. In principle, if the IAF operational bases are relocated beyond

about 400-500 km from the international border, it would place them completely outside the reach of PAF aircraft and what it could possibly acquire in the next two or more decades. Acquisition of aerial refuelling capability by Pakistan would be of little value since it would have to be undertaken mostly over the Indian air space, increasing its vulnerability to IAF interception. This is obviously less applicable in the case of China since the strategic depth available for exploitation by the IAF is limited in the northeast region. The rational solution would be to look for that depth in Manipur and Tripura, on one side, and southern Bengal, Bihar, Orissa, Jharkhand, and Chattisgarh region, on the other. It is worth recalling that this is the region where the United States Air Force (USAF) had built a large number of bases to exploit India's strategic depth in World War II to strike targets in Southeast Asia, China and Japan.

The counter-argument to this approach, besides that of costs involved in creating new air bases, would be that dense air defence systems, concrete covered aircraft shelters, parallel taxi-tracks, mutual support from other air bases, etc. have reduced the vulnerability of air bases and, hence, the premium on air base attacks in counter-air strategies. This is only partly true. Aircraft will remain vulnerable during the critical phases of taxiing, take-off, circuit and landing. In the past, enemy strikes during these phases were much more a matter of chance; and even then, significant air effort was expended to cover the launch and retrieval of operational missions. But with enemy airborne early warning/airborne warning and control system (AEW/AWACS) able to 'see' aircraft launch and retrievals, counter-air operations out to nearly 300 km inside our territory would assume a new and deadly dimension. The experience of the Israeli Air Force shooting down 86 Syrian combat aircraft through a similar process in June 1982 stands as testimony to the potential of strategic effect in the changing environment.

It is useful to note here that Pakistan already possesses aerostat radars and unmanned aerial vehicle (UAVs), has ordered 6 Swedish Erieye AEW&C systems, has sought to acquire 3 American P-3 aircraft with Hawkeye AEW systems, and has been evaluating the Chinese AWACS. By any logic, that is a lot of air surveillance capability for a country of Pakistan's size and commitments

which would play a much greater offensive role in counter-air operations than in defensive counter-air. Meanwhile, covering most of peace-time flying from current air bases would help Pakistan build an air power order of battle (ORBAT) of the IAF tactics, quantum of flying, and aircraft capabilities so critical for working out air strategy.

It needs to be recalled that in past wars (of 1965 and 1971), we devoted nearly 50 per cent of air effort to air defence, mostly over our operational air bases because they were within striking range of the PAF. In other words, the advantages of mass and larger size had to be employed in reactive terminal defence which the enemy often chose to ignore, as indeed it did in 1971, concentrating on air bases closer to the border. This, in turn, led to increasing reliance on ground-based SAMs and reinforcing a defensive mindset .

The advantages of mass and larger size had to be employed in reactive terminal defence which the enemy often chose to ignore, as indeed it did in 1971.

A key element of our strategy should be to shift our operational bases out of the range of PAF air surveillance, reduce our air defence commitments for 80 per cent of our air bases and plan to meet the PAF with the IAF almost fully on the offensive. Technology matched with geography would give us the advantage of monitoring the PAF peace-time training, as well as strike at their vulnerabilities in war. The sheer advantage of the unambiguous prospect of air dominance – at the planning as well as operational levels – would constitute a powerful and credible deterrence against any misadventure by Pakistan in the future.

In the case of our friend in the north and northeast, the balance of strategic depth lies with the other side. Geography and short range combat aircraft had forced us to forgo operational advantages. But with the strategic reach of the IAF increasing, it is possible to at least reduce the balance of advantage against us.

There is an obvious issue of costs and redundancy of the enormous assets created over the decades if we have to reorientate our strategic posture to exploit

increasing strategic reach and achieve strategic effect. The first question that may appear rhetorical but actually, in this context, is not, is: what cost is acceptable for ensuring credible deterrence against war and success in the case of deterrence failure? With the unit cost of Su-30 class aircraft crossing Rs 200 crore, the cost of removing operational bases beyond the reach of the enemy air force assumes a different dimension than in the case of the Rs 1 crore MiG-21 or Rs. 0.6 crore Gnat. More concretely, we will continue to need a certain number of existing operational bases for a variety of reasons. Thus, a phased programme over the next 15-odd years could be drawn up in the first instance with objective calculations of costs, etc. to relocate around half of the existing bases which are within 300 km of the borders. Judicious planning could ensure one air base in the country's heartland accommodating far more air assets than existing forward bases. It is not intended here to go into the details of comparative costs and other advantages which would/could accrue as spin-off. What is important is to recognise that mere strategic reach would be ephemeral if it cannot be converted into strategic effect; and that requires exploiting our aerospace strategic depth. This combination of the two demands a serious paradigm shift in the strategic posture of the IAF.

What is important is to recognise that mere strategic reach would be ephemeral if it cannot be converted into strategic effect; and that requires exploiting our aerospace strategic depth.

INDIA'S NUCLEAR DOCTRINE: THE BASIS FOR CREDIBLE DETERRENCE

MANPREET SETHI

It is said, "One swallow does not a summer make." Along similar lines, the mere acquisition or demonstration of a nuclear weapons capability does not make for credible deterrence either. For the weapons to be gainfully employed for national security based on nuclear deterrence, a number of other steps are necessary. These include conceiving a clear role for the weapon, making it deliverable, instituting adequate command and control systems, and formulating a targeting philosophy to inflict unacceptable damage on the enemy. These parameters can best be defined by a national nuclear doctrine.

A nuclear doctrine is a basic statement of principles that lays down the purpose of the nuclear weapon, the manner of its development and deployment, and the concept of its employment. It, therefore, provides the conceptual underpinning for the role that the weapon would play in the overall security strategy – whether it would be considered a militarily usable tool of war, or a political instrument for enforcing deterrence. India's nuclear doctrine is premised on this second understanding and, hence, has certain distinctive characteristics.

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This paper seeks to identify and describe

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the salient features of the country's nuclear doctrine. It begins by explaining the critical *importance of having a nuclear doctrine as the basis for credible deterrence*, since in its absence a nation's nuclear strategy would meander aimlessly and an adversary could construe actions wrongly. Irrespective of whether a nuclear doctrine professes an aggressive nuclear posture or is defensive in nature, its enunciation enables some sort of threshold identification and provides some stability to a nuclearised environment. The second section of the paper takes an in-depth view of the *principles on which India's nuclear doctrine*, as put forth by the National Security Advisory Board (NSAB) in 1999[1] and subsequently in the statement issued by the Cabinet Committee on Security on January 4, 2003[2], is based. It also *assesses the appropriateness* of these principles for India. The last segment describes some of the *supporting structures that flow out of these tenets and that need to be in place* for the sake of the credibility of India's deterrence.

THE NEED FOR A NUCLEAR DOCTRINE

Stated simply, the purpose of a nuclear doctrine is to provide the *raison d'etre* of the nuclear weapon for a nation, as also to make available the philosophy behind fundamental questions of when, how, and where the weapon would be used for national defence. These objectives may be met through the formal enunciation of a doctrine or through hints dropped in more amorphous statements. In fact, nuclear doctrines of not all countries exist in the form of structured, publicly shared documents, as in India. In some cases, such as Pakistan, the doctrine can only be gleaned from official statements or articles written by retired military officers or political leaders or members of the strategic community.

In either case, though, the nuclear doctrine is expected to serve a critical, but only limited purpose. Limited, because there are several things that a doctrine is not. It is not a statement of account that calculates the cost of the nuclear weapons. Neither is it a fact sheet that identifies all the threats and challenges faced by a country. Nor is it an operational strategy or a set of tactical rules that

1. National Security Advisory Board, Draft Indian Nuclear Doctrine, August 17, 1999. Available at http://www.meadev.nic.in
2. Cabinet Committee on Security, Government of India, "India's Statement on 'Operationalisation' of Nuclear Doctrine," January 4, 2003. Available at http://www.meadev.nic.in

describes force postures or deployment patterns. Instead, the doctrine is a system of beliefs that:

(a) describes the utility of nuclear weapons to the state. It, thereby, reflects the worldview as seen by the state and what purposes are served by the acquisition of nuclear weapons;

(b) identifies the manner in which the weapons would be employed to meet the purpose they have been acquired for. In performing this function, the doctrine addresses important subsidiary issues pertaining to force posture, concept of operations and weapon deployment.

Hence, the doctrine encapsulates the philosophy that is expected to guide national nuclear strategy. Based on these tenets, it should become possible for the national leadership, civilian and military, to determine the nature and size of the nuclear arsenal, including delivery vehicles, the kind of command and control systems, the type of retaliation and the identification of targets, deployment status, etc. Similarly, it should provide some inkling to the adversary as to how a nation intends to use its nuclear capability, at what stage of conflict nuclear weapons could come into play, and how they may be deployed.

While a doctrine must be rooted in the practical realities confronting a nation, such as its strategic culture, its threat perceptions, its economic strengths and the state of its existing scientific-technological capabilities, yet it can also afford to take little flights of fancy in aspiring for an ideal situation. For instance, India's nuclear doctrine, despite seeking to provide the basis for nuclear deterrence, still contends, "India shall continue its efforts to achieve the goal of a nuclear weapon-free world at an early date." It identifies "global, verifiable and non-discriminatory nuclear disarmament" as a "national security objective."[3] Similarly, the doctrine also establishes the need for India's nuclear forces to be "based on a triad of aircraft, mobile land-based missiles and sea-based assets."[4] While neither of these situations is immediately available, the doctrine encourages movement towards them in the interest of national security. Therefore, unlike a nuclear strategy that must be solely dictated by

3. As stated in Para 8.1 of the *Draft Indian Nuclear Doctrine*, n.1.
4. As stated in Para 3.1 of the *Draft Indian Nuclear Doctrine*, n.1.

existing realities and capabilities, the doctrine can display a greater sense of freedom and flexibility.

A coherent document on India's nuclear doctrine was formulated just fifteen months after the conduct of nuclear tests in May 1998. In one of its earliest tasks, the first NSAB[5], constituted soon after India declared itself a state with nuclear weapons, produced a draft that encapsulated recommendations on what the country's nuclear doctrine should be. On August 17, 1999, the draft nuclear doctrine was made available for public scrutiny and debate. The national and international community were likewise taken by surprise not only by the speed with which the task was undertaken, but also by the transparency that the then caretaker Indian government offered on a subject that is normally considered elitist and kept out of public purview. Not surprisingly, therefore, the Indian doctrine was subjected to a fair amount of criticism from within the country and outside, not all of which was either justified or constructive.

Amongst the responses from the international community, the US, in its capacity as the self-appointed spokesperson of global non-proliferation promptly articulated its disapproval of the draft doctrine. The White House did not find the draft an "encouraging document" and the Pentagon too pointed out to the dangers inherent in such an act and called for the denuclearisation of South Asia. Russia and China also expressed concern at the Indian move and urged restraint.

While the P-5 were shocked at the audacity of a newly nuclear country to be able to articulate a nuclear doctrine in such a short time after nuclearisation, there seemed to be some amount of confusion in Pakistan on how much importance it should attach to the Indian action. While, on the one hand, Pakistan criticised India's move in bringing out the document, as also the substance contained therein for being "dangerous and ominous," on the other hand, in a typical "me too" response, it quickly announced that Islamabad too was engaged in giving "final touches" to its own doctrine![6] While no doctrine has since been officially announced by Islamabad, a statement attributed to the then Pakistani foreign minister revealed

5. The NSAB exists as an official body that is part of the National Security Council. It acts as a forum through which the government decision-making apparatus can draw on the advice and experience of appointed academics and retired civil servants and military officers. Members of the NSAB serve a term of one year.
6. "Pakistan Reacts Strongly to India's Assertion," *The Times of India*, August 19, 1999.

what Pakistan actually thought about the Indian nuclear doctrine. He was quoted in *Dawn* as saying, "By announcing its nuclear doctrine before Pakistan, India was *trying to score points and present itself as a more responsible nuclear power in the region*."[7]

As derived from here, one would assume that the release of a nuclear doctrine actually amounts to a display of responsible behaviour. This, in fact, is the truth. The declaration of a nuclear doctrine by a country that has unambiguously demonstrated its nuclear capability actually clears the air and injects transparency into an issue otherwise shrouded in secrecy. By clearly defining a political role for its nuclear weapon and the philosophy behind its use, New Delhi provided a rare clarity. While this was wrongly, though not unexpectedly, construed as India getting ready to "embark on a further and even more dangerous escalation in the nuclear and conventional arms build-up," the doctrine actually only formalised what India had declared as its nuclear position all along after the nuclear tests in May 1998. The draft doctrine reflected the same precepts that had been articulated by then Prime Minister Vajpayee in Parliament within days of the tests.[8] It emphasised the acquisition of a credible "minimum" deterrent and advocated a no first use (NFU) posture premised on a counter-strike capability to inflict unacceptable damage. With each one of these parameters, India had chosen to impose restraints and checks upon its own self.

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In fact, it is this restraint that was criticised by several quarters of the Indian strategic community. While a few decried the doctrine for being too ambitious since it spoke of a triad[9], there were others that objected to the concept of

7. M Ziauddin, "Pakistan's Nuclear Doctrine Being Finalised: FM," *Dawn*, August 19, 1999. (Emphasis added.)
8. Suo Motu Statement by Prime Minister Vajpayee in Parliament on May 27, 1998. As reproduced in *Strategic Digest*, July 1998
9. Praful Bidwai, "New Delhi's Nuclear Doctrine Could Ignite Arms Race," *Dawn*, August 23, 1999.

minimum deterrence[10], and yet others who dismissed minimum deterrence as "making a virtue out of necessity."[11]

Perhaps, it should be conceded that India's choice of minimum deterrence is to some extent dictated by the resource (not just monetary, but also available fissile material) and technological (missile range, accuracy and payload carrying capability) constraints that the country faces, but, as is argued in the body of this paper, minimum deterrence more than adequately addresses India's security concerns required to be met with nuclear weapons.

Its criticism notwithstanding, to its credit, the draft doctrine provided the essential starting point for a coherent nuclear strategy. On January 4, 2003, the government issued a statement on the basis of a decision taken by the Cabinet Committee on Security which further amplified the nuclear doctrine and operational arrangements governing India's nuclear assets. While this 'official' nuclear doctrine largely retained the recommendations of the NSAB draft document, it did, however, make a few changes, not all of which have been particularly helpful in explaining the nuances of deterrence. Some, in fact, such as the expansion of the role of nuclear weapons to deter chemical and biological weapons, as also the use of "massive retaliation" in place of "punitive retaliation" have created some confusion. These are discussed in greater detail in the following sections.

The draft doctrine provided the essential starting point for a coherent nuclear strategy.

INDIA'S NUCLEAR DOCTRINE – THE UNDERLYING PRINCIPLES

Use of Nuclear Weapons for Deterrence

From the time of the first demonstration of the destructive power of the nuclear

10. Bharat Karnad, for example, advocated a "maximally strategic" deterrence posture built around multiple kinds of high yield nuclear weapons and many delivery systems. For more on his views, see Bharat Karnad, "A Thermonuclear Deterrent," in Amitabh Mattoo, ed., *India's Nucxlear Deterrent: Pokhran and Beyond* (New Delhi: Har-Anand Publication Pvt. Ltd., 1999), p. 108.
11. Brahma Chellaney wrote, "India does not have the plutonium or financial resources to exercise more than the barest of minimum deterrence, and is far from having the capacity to carry out a disabling first strike against an opponent…" "India's Nuclear Planning, Force Structure, Doctrine and Arms Control Posture," Paper presented at the UNESCO International School of Science for Peace, Forum on Nuclear Disarmament, Safe Disposal of Nuclear Materials, or New Weapons Developments: Where are the National Laboratories Going?, Landau Network-Centro Volta, , Italy, July 2-4, 1998.

weapon in 1945, there has never been a consensus on the actual role of nuclear weapons in national security. In 1950, George Kennan pithily articulated this crucial question before the then US secretary of state:

> Are we to rely upon weapons of mass destruction as an integral and vitally important component of our military strength, which we would expect to employ deliberately, immediately, and unhesitatingly in the event that we become involved in a military conflict with the Soviet Union? Or are we to retain such weapons in our national arsenal only as a deterrent to the use of similar weapons against ourselves and as a possible means of retaliation in case they are used?[12]

This dilemma – whether the nuclear weapon is just another type of weapon that is militarily usable or whether the absolutely horrific consequences of its use place it in the realm of the unusable except as a political instrument of deterrence – has preoccupied every country that possesses it. India has resolved the issue for itself by accepting the latter use of the nuclear weapon. Accordingly, the Indian nuclear doctrine is firmly rooted in the belief that nuclear weapons are a political instrument for deterrence and not a military tool for war-fighting. This assertion, for India, emanates from two facts: one, from the comprehension of, and abhorrence for, the high destruction potential of the nuclear weapon that makes its use unthinkable for any rational political end. There can be no cause precious enough to justify the actual use of nuclear weapon; secondly, from the realisation that there is no credible defence against nuclear weapons. Way back in the mid-1950s, a British scientist, Patrick Blackett, had conceded, "There is no effective defence at present, nor is there one in sight, against a *large-scale and determined atomic attack on cities and centres of population*."[13] Over the decades, defence has fought back with technological advancements. The erection of ballistic missile defence (BMD) does today offer some form of protection against a nuclear attack. But even this is several years from offering a foolproof guarantee against a large scale, determined and multi-directional atomic attack. Washington justifies its

12. As cited in Lawrence Freedman, *The Evolution of Nuclear Strategy*, Third Edition (New York: Palgrave Macmillan, 2003), p. 63.
13. P.M.S Blackett, *Atomic Weapons and East-West Relations* (Cambridge: Cambridge University Press, 1956), p. 3

BMD as providing protection against a few errant missiles from countries such as North Korea or Iran that would have no more than a few nuclear weapons, and not against the Russian or even the Chinese arsenal. Besides, the BMD provides protection only against one form of delivery, the ballistic missile. In case nuclear bombs are air delivered or through some other more mundane means, there can be no defence against the horrendous destruction they would cause.

Hence, the Indian doctrine, with its emphasis on deterrence, actually seeks to obviate the possibility of the use of this weapon of mass destruction (WMD) in the first place. It aims to persuade the adversary that any nuclear use by him would result in such retaliation as to make the cost of the action unacceptable. It compels a reconsideration of the decision to use nuclear weapons at all.

The second important characteristic of India's nuclear doctrine, at least as put forth in the NSAB draft, was to restrict the possible use of nuclear weapons only against the adversary's use of nuclear weapons. In other words, India perceived a role for its nuclear deterrence only against the use or threat of use of other nuclear weapons and not against conventional [as the North Atlantic Treaty Organisation's (NATO's) and Pakistan's nuclear doctrines profess] or other WMD such as chemical or biological weapons (as US doctrine contends). Of course, there were analysts that thought this view to be too restrictive. For instance, Brahma Chellaney argued,

> It should not be simplistically assumed that nuclear weapons are only for deterring a nuclear threat, as if it is okay for others to employ conventional force against vital Indian interests. Given the decades-old technology sanctions it has suffered and the way its foreign policy has been seriously constricted, India has had to pay an extraordinarily heavy political price for its nuclear weapons. It should seek to derive the full security value from them, the way the wealthy nuclear powers do.[14]

Perhaps, this rationale ultimately did hold sway over nuclear decision-makers since, in the January 2003 official statement, the scope of nuclear deterrence was expanded to include chemical and biological weapons too. It may

14. Chellaney, n.11.

be recalled that the US too had done the same in its *Nuclear Posture Review* of 2001. The move, however, made little sense for the US and hardly makes the Indian nuclear deterrent more credible. This is for two reasons: first, the international community has already outlawed the use of these two classes of WMD by way of the Chemical Weapons Convention and the Biological and Toxic Weapons Convention respectively. Countries signatory to the two conventions are supposed to have declared their stockpiles and undertaken their destruction. Therefore, India's potential adversaries should not normally be assumed to possess these weapons. In case India still fears such an eventuality, it can seek redressal by invoking its right to inspections. Despite these, if there are still apprehensions about any clandestine stocks of the adversary being used in a conflict, even then, should India retaliate with its nuclear weapons? Would this then not escalate the situation into a sure nuclear exchange? What then should India's response be? While it is beyond the scope of this paper to discuss this scenario at length, it may be said that conventional capabilities should be able to, or made able to, handle such a situation. Contemporary threat perceptions, in fact, accrue greater probability to these WMD being used by non-state actors for whom treaties are irrelevant. But against them, classical nuclear deterrence can anyway not hold good. Non-state actors do not provide a fixed target that can be deterred with unacceptable damage through use of nuclear weapons against them. A different cache of military and foreign policy tools needs to be employed against them. Therefore, except for some symbolic value, the expansion in scope of the nuclear doctrine holds little relevance for nuclear deterrence as required by India against its potential adversaries.

Instead, India's narrow articulation of nuclear weapons as a means of deterrence only against nuclear weapons actually accurately reflected India's traditional abhorrence for nuclear weapons and the reluctant steps it took down this path. It underscored that India had consistently argued that nuclear disarmament, and not nuclear deterrence, can, and must, constitute the basis for lasting world peace and security. But the absence of any substantive progress on this front, coupled with a deteriorating regional security environment, compelled India to acquire the nuclear deterrent. Yet, it continues to view its nuclear weapon as a pure deterrent. As Prime

New Delhi does not "intend to use these weapons for aggression or for mounting threats against any country; these are weapons of self-defence to ensure that India is not subjected to nuclear threats or coercion."

Minister Vajpayee said soon after India's nuclear tests, New Delhi does not "intend to use these weapons for aggression or for mounting threats against any country; these are weapons of self-defence to ensure that India is not subjected to nuclear threats or coercion."[15]

Credible Minimum Deterrence

The rejection of the concept of nuclear war-fighting frees India from the need to match the nuclear arsenal of its adversary/(ies), weapon for weapon. It was stated by Kenneth Waltz several decades back, "Forces designed for war-fighting have to be compared with each other. Forces designed for war-deterring need not be compared. The question is not whether one country has less than another, but whether it can do unacceptable damage to another…."[16] With the principal role of India's nuclear force being to protect the nation from nuclear blackmail and coercion, instead of any desire to enforce compellence, or mount aggression, the country's policy-makers perceive the need for only "minimum deterrence" or a small nuclear force. Official pronouncements, however, have refused to be drawn into quantifying the minimum deterrent. Rather, the draft doctrine leaves the decision on the actual size and composition of the nuclear arsenal to threat perceptions from the strategic environment, technological imperatives and the needs of national security. As Jaswant Singh, India's foreign minister in 1998, said,

> The minimum is not a fixed physical quantification. It is a policy approach dictated by, and determined in, the context of our security environment. There is no fixity. Therefore, as our security environment changes and alters and as new demands begin to be placed on it, our requirements too are bound to be evaluated.[17]

15. Suo Motu Statement, n.8.
16. Kenneth Waltz as quoted by Gen. Sundarji, *The Blind Men of Hindoostan: Indo-Pak Nuclear War* (Delhi: UBSPD, 1993), p. 68,.
17. India's foreign minister's speech in Parliament on December 16, 1998. Downloaded from http://www.meadev.gov.in.

While the determination of minimum deterrence would change with transformation of threat perceptions and technological developments, it definitely need not seek superiority or even parity with an adversary's nuclear forces in the number of weapons, or yields or types of weapons. However, this freedom is qualified by the need to acquire an assured capability of a second strike that can inflict unacceptable damage on the enemy. Credible deterrence based on such a principle, therefore, imposes its own prerequisites, as defined below:

- Sufficient, survivable and operationally "ready" nuclear forces. This implies that while mere numbers and balance of force might not be relevant because the scale of destruction caused by even a few nuclear weapons could constitute unacceptable damage, what is critical is to ensure that sufficient warheads and delivery vehicles survive a first strike,[18] and be ready for retaliation. This calls for the creation of a secure second strike potential in the form of hardened silos, mobile launchers, deployment beyond the reach of hostile delivery systems, dispersion of the arsenal on a triad, and structured weapon release authority in order to guarantee an assured appropriate response. Reliability of the delivery system is critical for deterrence credibility and this includes dependability of communication (that the correct message is delivered at the right time for launch); of launch (that the missile actually lifts off); of the booster (that it ignites in time); of separation (of the booster from the missile after burn-out); of penetration (despite enemy air defence systems); and of detonation (at the designated target).[19]
- Robust command, control, communication and intelligence systems (C3I). This is critical to ensure that the nuclear assets remain secure in peace-time but can make the shift to fully employable forces when necessary in the shortest possible time for effective retaliation. Such a system comprises personnel, procedures that acquire, collate, analyse and interpret information to assist decision-making, and equipment that enables acquisition and transmission of decisions to different constituents of the force in real-time.

18. Technically, first strike is an attack so powerful so as to leave one's opponents with forces which are insufficient to inflict substantial damage on the attacker.
19. For more on this, see Sundarji, n. 16., p. 76.

- Effective surveillance and early warning capabilities to acquire intelligence on alert status of the adversary. These are necessary to minimise risks of a miscalculated or inadvertent strike based on faulty intelligence or false alarms.
- Comprehensive planning and training for nuclear operations consistent with strategy. Well-trained and motivated human resources are the key to effective operations, especially when dealing with nuclear weapons. The soldier must be thoroughly prepared, technically and psychologically, to handle the responsibility.
- The "political will" to employ such forces if and when required. The actual use of the nuclear weapon is ultimately a political decision. Therefore, for deterrence to be credible, visibility of political will through an organisational set-up reflecting institutional decision-making is crucial. There is dire need of conducting periodic scenario-building exercises and regular threat assessments to educate the political leadership.

No First Use Against Nuclear Weapon States and Non-Use Against Non-Nuclear Weapon States

The central principle that logically flows out of the perception of nuclear weapons as political instruments of deterrence is their no first use in a conflict. Doctrines that ascribe a war-fighting role to nuclear weapons need to adopt aggressive postures that envisage their first use. During the Cold War, the USA and USSR believed that a nuclear war could be fought and won and, hence, went on adding numbers and newer delivery capabilities in order to maintain an edge over the other. For the Americans, crafted as their war strategy was on the Pearl Harbour experience, acting first and maintaining surprise were critical. Not surprisingly, therefore, Washington subscribed to a launch on warning (LOW) and launch under attack (LUA) postures. This was done in the belief that unless the US was able to undertake a preemptive/surprise strike, it stood little chance of being able to destroy all Soviet targets as required in its war plan. And minimising, if not completely eliminating, the enemy's second strike capability was the primary task of the first strike, and, hence, the need for ever increasing

numbers of warheads. NATO too adopted a first use doctrine to deter Soviet conventional might, a logic that Pakistan now uses in support of its nuclear doctrine of first use against India. The Soviet Union, similarly, relied on its capacity to mount preemptive attacks. And, to undertake preemption, both sides built up large, ready counter-force capabilities, supported by a huge infra-structure in the form of C3I, early warning systems, etc.

Doctrines that ascribe a war-fighting role to nuclear weapons need to adopt aggressive postures that envisage their first use.

India's nuclear doctrine, in contrast, has freed itself of many of these requirements by basing its nuclear strategy on a *retaliation only* policy. It implies that India will not be the first to introduce nuclear weapons in any conflict with a nuclear weapon state (NWS) and will not use nuclear weapons in a conflict with a non-nuclear weapon state, unless it is aligned with an NWS. Until now the only other nation to have publicly adopted an NFU has been China, but its NFU does not apply in conflicts over territories claimed by China. Therefore, India's unconditional NFU has no precedent and understandably, it has been greeted with criticism and scepticism.

At the domestic level, there are enough who argue against NFU on the ground that it would jeopardise national security. Some contend that it would lead to a need for building a larger nuclear arsenal than would be required with a first use policy. Others dismiss the NFU doctrine as nothing more than public posturing, not capable of offering any guarantee against first use if the need so arose. While this is true of any declaratory policy, the fact remains that an NFU doctrine makes sense once it gets translated into force postures and in that sense, provides a measure of indication of a country's intentions. While a first use posture requires missiles to be on alert for LOW/LUA and the nuclear warheads to be mated or ready to be instantly mated with the delivery system, NFU offers greater time and a more relaxed posture. In fact, several points of criticism of NFU do not stand up to scrutiny. If analysed dispassionately, as has been attempted in the following paragraphs, NFU offers the best possible choice for India in the present circumstances.

First of all, it must be understood that the adoption of NFU does not in any way adversely impact India's ability to defend itself against nuclear weapons. Given that the country does not foresee any plausible, rational scenario for the actual use of nuclear weapons, and least of all where it might be compelled to use nuclear weapons first, not for coercion and nor for any territorial or political expansionist ambitions, NFU appears most logical. By placing the onus of escalation on the adversary, while retaining the initiative of punitive nuclear retaliation, India has sought to steer away from nuclear brinkmanship in any and every conflict. Meanwhile, by establishing the nuclear weapon as an instrument of punishment, India seeks to prevent deterrence from breaking down, and, thus, aims to minimise, if not prevent, the very use of the nuclear weapon. NFU actually encourages the possibility of 'no use' instead of 'sure use'. This is clearly demonstrated in Table 1.

By placing the onus of escalation on the adversary, while retaining the initiative of punitive nuclear retaliation, India has sought to steer away from nuclear brinkmanship.

There are some who argue that by binding itself to an NFU pledge, India has left the initiative with the adversary. But as is evident from the table, through NFU, coupled with assured retaliation, India has reined in the initiative more in favour of no use of nuclear weapons. Unless the adversary's leadership is completely irrational, has suicidal tendencies or is utterly unmindful of national and international public opinion, the possibility of a nuclear war should not arise and the surety that India would not use nuclear weapons first would ensure that.

Table 1

Nuclear Posture Country 1	Nuclear Posture Country 2	Nuclear Threshold	Chance of Nuclear War
First Use	First Use	Low	Very High
No First Use	No First Use	High	Very Low/Nil
First Use	No First Use	Relatively High	Low

Secondly, it is also questioned whether India should retain NFU even if it gets to know that the adversary is preparing for a nuclear strike? Should not preemption then be the right step? The answer to this lies in understanding that even preparation is no guarantee of a nuclear strike. Rather, it may well be part of a strategy of "coercive diplomacy." It is not a coincidence that all the 51 incidents of threat of use of nuclear weapons actually were intended to conduct coercive diplomacy. Therefore, despite the apparent show of readiness, there will, more likely than not, still be a chance that nuclear weapons would not actually come into use. But by striking first, India would end up inviting certain and massive retaliation. In fact, even if the adversary's first use of nuclear weapon was to be a small demonstration strike, with India's preemptive nuclear strike, it would surely retaliate with all that is available. In such a scenario, therefore, it would be better to indicate own level of nuclear preparedness in order to reinforce deterrence, seek international diplomacy to mount pressure, and, at the same time, maintain ready credible conventional forces.

In fact, NFU is the best answer to those international strategic analysts who believe that nuclear weapons in India and Pakistan lead to a condition of instability.[20] They argue that since both sides have small nuclear forces, they would be tempted to launch a disarming first strike in case of a crisis. But India's no first use posture removes this temptation not just for itself, but also for the adversary. Secondly, NFU necessitates measures for increased survivability in order to reduce vulnerability of the nuclear arsenal and these too mitigate the 'use or lose' syndrome. In fact, NFU goes to alleviate Pakistani insecurity which, in turn, is beneficial to India by relieving pressure on its leaders for launching a preemptive strike. If Pakistan was constantly under the fear that an Indian nuclear strike was imminent, its own temptation to use its nuclear force would be higher. Therefore, for the sake of crisis stability, it is actually in the best interest of India to make its adversary feel more secure, rather than on the defensive and mistrustful of Indian nuclear intentions. This situation was best described by Robert McNamara in the context of the Soviets' hardening their missile sites. He wrote,

20. This has been forcefully argued by Sumit Ganguly and Kent L. Bringer, "Nuclear Crisis Stability in South Asia," in Lowell Dittmer, ed., *South Asia's Nuclear Security Dilemma : India, Pakistan and China* (New Delhi: Pentagon Press, 2005).

> In a period of tension, I wanted the Soviet leaders to have confidence that those forces would survive an American attack and would be capable of retaliating effectively. Then they would not feel a pressure to use them preemptively… I had no desire to face, in a period of tension, an adversary who felt cornered, panicky and desperate and who might be tempted to move irrationally.[21]

Thirdly, by declining a first use stance, India has also removed the need for retaining nuclear forces on hair-trigger alert, a situation not at all conducive to strategic stability, given the geographical realities of the neighbourhood. Having nuclear forces on alert not only raises the possibility of an accidental nuclear war based on a gross miscalculation, but also lowers the threshold of nuclear war in a crisis situation. In the case of India and Pakistan, this would be akin to inviting trouble, given their proximity, low warning time and frequent crises. Therefore, India's NFU actually brings stability to the nuclear equation. It allows for a policy of recessed deterrence that allows nuclear weapons and delivery vehicles to be developed and built, but to be stored separately, ready to be assembled in the event of a crisis.

By declining a first use stance, India has also removed the need for retaining nuclear forces on hair-trigger alert.

It may be recalled that in the early years of the Cold War, superpower warheads were not routinely mated, nor necessarily co-located, with delivery systems. It was the subsequent development of safety features designed into modern warheads and the advent of sophisticated administrative controls on nuclear weapons that made higher alert levels possible. Ironically, however, after keeping their nuclear missiles on hair-trigger alert for years, the two superpowers found the best nuclear risk reduction measures in de-alerting these and separating warheads from delivery systems! De-mating, de-alerting and de-targeting, the three steps taken by the superpowers for nuclear risk reduction and confidence-building, form a natural part of the NFU posture.

21. Robert McNamara, *Blundering into Disaster: Surviving the First Century of the Nuclear Age* (London: Bloomsbury, 1987).

Without having to go through this cycle, India's nuclear doctrine accepts the adoption of NFU as more stabilising since nuclear forces need not be maintained on high alert status. In fact, for deterrence to be credible with a no first use doctrine, it would only be necessary to have available all the relevant nuclear assets, though dispersed, as unassembled nuclear warheads under civilian control, and dedicated delivery systems kept either in storage or in readiness away from their operational areas – as long as they can be brought together as rapidly as required during a supreme emergency.

Fourthly, the NFU also answers another argument made against nuclear weapons causing regional instability. It has been alleged that since the arsenals of India and Pakistan are small and technically primitive, they lack fail-safe devices such as double keys, permissive action links (PAL) or other elaborate procedures insuring against an unintended or accidental attack. The NFU eases this situation since it precludes the need for delegation of authority for launch and, thus, minimises risks of miscalculation and accidental attack. In fact, given that the existent non-proliferation constraints limit the possibility of such devices becoming available to India, NFU makes the task easier.

One situation, however, that could test India's NFU is a scenario where a Taliban type military man or some non-state actors take control of nuclear weapons in Pakistan after a period of political instability.[22] Two responses could arise in this case. Firstly, if the new player has assumed state power and become a political actor, then he would also develop a stake in the political system and powerdom and, hence, would be expected to display some sense of rationality in the use of nuclear weapons. Classical deterrence based on a retaliation policy (or mutually assured destruction – MAD) can be expected to apply in such a scenario. But in case the non-state actor (NSA) has got hold of the nuclear weapon in a situation of political chaos, and threatens to use it against India in a suicide bomber mentality – in order to wreak nuclear havoc without worrying about the consequences of the same for its own state – then nuclear deterrence

22. The prospect of a nuclear capable state losing control of some of its weapons to terrorists has been put forth as a real and immediate danger in the US Quadrennial Defense Review 2006. American options in case of such an eventuality have been well brought out in Thomas Donnelly, "Choosing Among Bad Options: The Pakistani 'Loose Nukes' Conundrum," *National Security Outlook*, American Enterprise Institute for Public Policy Research, May 2006.

becomes more difficult to apply. In fact, this is the problem being faced by nuclear doctrines worldwide.[23] To deal with cases such as this, India needs a multi-pronged strategy: first, it must maintain high conventional capability that can be used preemptively in order to stop a nuclear attack on itself; second, it must declare that WMD terrorism would invoke retaliation against the state known to be sponsoring such activities; third, participate in global/multinational endeavours aiming at controlling proliferation of dual-use materials through strengthened export controls, and enhanced security and safety of nuclear arsenals; and fourth, focus on better intelligence and preparedness levels to mitigate a national disaster.

Evidently then, no first use can hold in a range of situations, and, in fact, the posture that it translates into, offers several advantages for India:

(a) It eliminates the need for forward deployment of nuclear systems, and thus, reduces the likelihood of accidental or unauthorised use. LOW/LUA force postures, by their very nature, require pre-delegation of authority to launch nuclear weapons down a clearly defined chain of command. It may be mentioned in this context that the US and USSR, which for many years relied on tactical nuclear weapons (TNW), were never unaware of the dangers inherent in these postures. It was found that in such a situation, the "fog of war" was abnormally dense. Battles where use of TNW was envisaged were described as "battles of great confusion; [where] casualties would be high; troops would be left isolated and leaderless; and morale would be hard to maintain."[24] Therefore, TNW were amongst the early ones to figure in arms control initiatives once the two superpowers had realised that "the use of nuclear weapons could never be a purely 'tactical' decision, taken by the local commander according to the state of battle. It would be a strategic decision to be taken at the highest level and with reference to the prevailing, overall political and military situation."[25] India has adopted this wisdom without the experimentation.

23. For a comprehensive examination of this, see Manpreet Sethi, "Current Trends in Nuclear Weapons Thinking and Strategies," forthcoming paper in *Asian Defence Review 2007* (New Delhi: Knowledge World, 2007).
24. An assessment of William Kaufmann as cited by Freedman, n.12, p. 104.
25. Ibid., p. 105.

(b) It forecloses the chance of an irrational preemptive strike, as also minimises the risks of an inadvertent or unauthorised nuclear use. In times of crisis, lack of information, misinformation and misjudgments can often be the cause of confrontation without either side having the intention to precipitate one. As McNamara said, "It is correct to say that no well informed, coolly rational political or military leader is likely to initiate the use of nuclear weapons. But political and military leaders, in moments of severe crisis, are likely to be neither well informed nor coolly rational."[26]

(c) It reduces the expectations from the C3I systems. Obviously, first use of nuclear weapons based on LUA/LOW places a greater strain on communications. But recessed deterrence can make do with a less sophisticated, less elaborate and, hence, less costly system.

(d) It takes the pressure off for an immediate response to nuclear attack. As C. Raja Mohan has argued, "India believes its deterrence requirements can be met without time-urgent responses to a nuclear attack."[27] A similar point was made by Gen. K. Sundarji, in the late 1980s:

> The response can be a good few hours or even perhaps a day after the receipt of the first strike. A very highly sophisticated, highly responsive command, control and communication system that functions in real time is not necessary…. Even a very successful decapitating attack by the adversary cannot give him any assurance of the non-launch of the surviving second strike by the recipient of the first strike.

(f) Last but not the least, the presence of the nuclear arsenal in separate places also enhances the survival of the arsenal from a preemptive strike. This is extremely important for upholding the credibility of deterrence with an NFU posture.

Besides the above-mentioned benefits, there can be no disputing the fact that a no first use policy is morally the most correct one. That is, if there can be

26. McNamara, n. 21, pp. 13-14.
27. C. Raja Mohan, "No First Use and India's Nuclear Transition," Pugwash Papers, Pugwash Meeting 279, London, November 15-17, 2002.

anything morally correct about nuclear weapons at all. Nuclear weapons are not just any weapons that could or should be used indiscriminately. They are special in the sense of their immense destructive capability. And therein lies their value as deterrents.

More than anything else, the merit of India's NFU policy lies in challenging the long held nuclear theology of first use as professed by Western nuclear powers. Until now, this has been touted as the only possible approach to use nuclear weapons for safeguarding national security. The Indian adoption of NFU has opened up another focal point at the other end of the spectrum. It offers a counterview to the traditional aggressive and arms race generating doctrines. If this were to be accepted by all NWS, then the world might find itself on its way to a diminishing salience of nuclear weapons, perhaps their delegitimisation, and eventually their abolition.

Assured Retaliation

India's nuclear doctrine frees itself of the compulsion of immediate retaliation and bases deterrence instead on the *certainty* of retaliation that would be *punitive* in nature. Therefore, while the counter-attack may not be prompt, it would be assured and would cause unacceptable damage to the adversary. As has been said, "The ability to retaliate with certainty is more important that the ability to retaliate with speed."[28] In fact, the time taken to retaliate would have to be dependent on technical realities such as the time required to bring together the nuclear weapon and delivery vehicle, the nature of precise command and control and custody arrangements, the state of the country after having absorbed the first strike, as also other domestic and international political factors.

While the counter-attack may not be prompt, it would be assured and would cause unacceptable damage to the adversary.

28. Ashley Tellis, *India's Emerging Nuclear Posture: Between Recessed Deterrent and Ready Arsenal* (Santa Monica, CA: RAND, 2001), p. 326.

Accordingly, therefore, India's doctrine does not specify any time for retaliation. In fact, the NSAB draft did not even define the nature or magnitude of punishment, except for describing it as "punitive". Beyond this, it did not address questions about the character, extent or weight of retaliation. Instead, it followed the French logic that "the adversary must not be able to calculate what would be the reaction to this or that initiative he might take."[29] It only conveyed that retaliation would be certain and it would be devastating irrespective of when or how it was inflicted.

However, while the draft nuclear doctrine mentioned "punitive retaliation", the 2003 official version changed it to "massive retaliation." The reasons for doing so have been conjectured upon by many.[30] But this has not necessarily enhanced the credibility of deterrence because it actually restricts the available response to an adversary's first strike to only an all out nuclear attack. This may appear too drastic for use except in extreme circumstances. While it may be argued that India's nuclear philosophy does not conceive nuclear use except in extreme circumstances, however, a case can be made for greater flexibility in response options. In fact, "punitive retaliation" is credible enough since it provides alternatives relative to the nature of strike and level of provocation. The US too in the 1960s had reached the conclusion that it should have a variety of response options other than massive retaliation against cities. This wisdom was obtained after several US officials, including Robert McNamara as secretary of defence, expressed their dissatisfaction with the inflexibility of a single integrated operation plan (SIOP) that envisaged a preemptive first strike involving 3,423 weapons totalling 7,847 megatons against the Russians and Chinese in case of any conflict, irrespective of the provocation!![31] A more flexible response was, therefore, proposed that envisaged a substantial raising of the nuclear threshold for the critical initial responses to be made by conventional forces alone, keeping the use of nuclear weapons late and limited.

29. This is the logic of the French nuclear doctrine, as explained by Tellis, Ibid., p. 321.
30. See Rajesh Rajagopalan, *Second Strike: Arguments About Nuclear War in South Asia* (London: Penguin Books, 2005) and Tellis, Ibid.
31. For more on this, see Gerard J. DeGroot, *The Bomb: A History of Hell on Earth* (London: Pimlico, 2005), pp. 268-269.

In the Indian context too, especially vis-a-vis Pakistan, as Ashley Tellis argues, by basing deterrence on massive retaliation that forecloses the option of a graduated response, India might end up encouraging its adversary to massively employ its own arsenal in the fear that India's "massive retaliation" to any nuclear use would anyway hold the possibility of disarming it. [32] Thus, India might invite a greater nuclear use upon itself than the enemy might actually have factored into its calculations. This would then rob India of the opportunity to exercise escalation dominance. Meanwhile, in relation with China, given its existing nuclear superiority and higher survivability quotient, Indian threats of massive retaliation after having suffered a first Chinese strike hardly seem credible.

Civilian Control Over Nuclear Weapons

India's nuclear doctrine establishes strict civilian control over any decision to use nuclear weapons in a conflict, as also over the custody of the nuclear warheads in peace-time. This is a clear reflection of the constitutional system of governance where the ultimate decision-making is the responsibility of the prime minister. While the nuclear force is expected to be maintained in the form of separated components, with the responsibilities for the command, custody, integration, and use of the weapons clearly demarcated between the civilians and the military, the command over their use would lie solely with the civilian leadership. In the remote contingency that deterrence does break down and nuclear release orders are issued by the prime minister (or his designated successors), the nuclear components would be integrated into a usable weapon system, with custody to be transferred to the military, which would retain sole responsibility for executing nuclear use options.

India's nuclear doctrine establishes strict civilian control over any decision to use nuclear weapons in a conflict, as also over the custody of the nuclear warheads in peace-time.

32. Tellis, n. 28, p. 340.

Pursuit of Universal Nuclear Disarmament

Ordinarily, one should not expect to find a mention of nuclear disarmament in the nuclear doctrine in the first place since it actually seeks to operationalise a nuclear weapons policy. However, India's nuclear doctrine clearly designates universal nuclear disarmament as a "national security objective." It identified a nuclear weapons free world (NWFW) as the ideal state of affairs but since the world did not seem to be getting any closer to it, the Indian nuclear doctrine was compelled to bring the Indian nuclear strategy more in alignment with the world of *realpolitik*. It may be recalled that while explaining the rationale behind India's overt acquisition of the nuclear capability to the Parliament on August 4 1998, the then Indian prime minister had, in the same breath, also exhorted India's nuclear diplomacy not to lose sight of the objective of an NWFW.

India's nuclear doctrine clearly designates universal nuclear disarmament as a "national security objective."

SUPPORTING STRUCTURES FOR CREDIBLE DETERRENCE

In order to translate the principles of India's nuclear doctrine into workable concepts, certain supporting structures or prerequisites are necessary. The doctrine itself prescribes them as being critical for enhancing the credibility of the kind of nuclear deterrence that India aspires for. These are briefly explained in the following paragraphs.

Survivability

The credibility of nuclear deterrence is wholly dependent on the survivability of a sufficient nuclear force that can assuredly mount a second/retaliatory strike. This necessitates the survival of not only the nuclear warhead, but also the delivery vehicle; the command and control set-up, including not just the primary decision-maker and his entire pre-determined chain of succession, but also the line of command up to the man in the field who is to execute the decision; secure communication systems; targeting coordinates; and, above all, the survival of the

The credibility of nuclear deterrence is wholly dependent on the survivability of a sufficient nuclear force that can assuredly mount a second/retaliatory strike.

political will to stomach the horrendous damage that any nuclear strike would cause.[33] The last element, however, can never be empirically assessed. In fact, President Nixon had once said that international relations are like "stud poker with a hole card," the only covered card being "the will, nerve and unpredictability of the President – his ability to make the enemy think twice about raising the ante."[34] The survivability of this will can be heightened through educating the political leadership about not only how deterrence works and the need to show adequate resolve, but also by ensuring the availability of other well informed advisers to help in times of crisis. Meanwhile, survivability of the other prerequisites can be enhanced through intelligent planning and adequate redundancy measures.

Traditionally, survivability has been assured through dispersion of nuclear forces, use of deception and by maintaining some sort of a relationship, not necessarily of parity, with the enemy's intelligence, surveillance, warheads and more importantly delivery capabilities. Dispersion is a function of mobility and the more mobile the components of the nuclear arsenal are, the greater is the chance of their survivability. But, managing mobility is not an easy task. The challenges include not just organising the frequent movement of actual nuclear warheads and delivery vehicles but also that of dummies so as to weave in adequate deception and camouflage into the survivability strategy.

The determination of survivability is also dependent on the adversary's nuclear doctrine, force posture and strategy. A known counter-force or a counter-value targeting philosophy, or even both, provides some indication of the likely targets to be prioritised and, hence, helps address some of the

33. Several Indian and foreign writers have doubted that the Indian leadership has a "killer instinct." For instance, Aditya Chibber writes, " The *vairagya* syndrome of renunciation has always robbed us of the killer instinct." See Aditya Chibber, *National Security Doctrine: An Indian Imperative* (New Delhi: Lancer, 1990), p. 85 ff. A fiction writer, Humphrey Hawksely, in his book *The Third Global War* too depicts a nuclear stricken Indian leadership unable to bring itself to retaliate with nuclear weapons.
34. Matin Zuberi, unpublished manuscript, chaper entitled, "Nuclear Battlefield."

survivability issues. But these are complex issues that require serious thinking and analysis in peace-time in order to enhance the credibility of deterrence. This is imperative, because survivability is absolutely critical with a no first use posture wherein nuclear deterrence rests squarely on the ability to mount an assured retaliation within a reasonable time period.

Strategic Triad

One effective way of enhancing survivability of the nuclear arsenal is to distribute the nuclear weapons on a triad of land-, air- and sea-based assets. The existence of the triad provides redundancy, mobility and dispersion essential for force survivability and effectiveness. This has been a time-tested formula and from the time the submarine launched ballistic missiles (SLBM) first became available after 1955, it has been considered the most survivable delivery system. A US nuclear submarine captain described the American Polaris submarine as

> ...an extremely survivable assured capability that the Soviets knew they could not destroy and knew if they conducted a first strike, that system would some day be available to retaliate. It might take some time to get the message to them from a destroyed national headquarters, but at some day the missile warheads would come raining in and they would pay the price.[35]

The Indian nuclear doctrine has tapped into the same wisdom by advocating the eventual build-up of a strategic triad as the foundation of its credible deterrence. In fact, the proposal for the triad is a logical consequence of the no first use policy that assures retaliation but is not time-critical. The ability to strike after sustaining a first attack can be best assured with sea-based assets, as the other two, land-based missiles and aircraft and their bases, are more vulnerable to a preemptive strike, especially with the advances that have taken place in space-based surveillance technologies. Of course, sea-based deterrence poses its own challenges, two of which being the acquisition/development of the vessel

35. DeGRoot, n.31, p. 267.

itself and the development of the necessary communication systems for the submarine. For India, the construction of the submarine has not proved easy given that the country has had to undertake a completely indigenous development of the vessel, having been denied import of nuclear and even dual-use materials and technology. Also, since the country's nuclear energy programme has been based on the development of pressurised heavy water reactors instead of pressurised water reactors, the technology best suited for nuclear submarines, the country has had to develop a parallel track of technology. The second challenge arises in the form of establishing secure, constant and reliable channels of communication with nuclear submarines. Normally, underwater communications are possible through extremely low frequency (VLF) bands of the electromagnetic spectrum. These communication channels, however, have a restricted traffic bearing capacity and so are slow. Also their transmitting stations are large, fixed and difficult to harden, making them vulnerable to a first strike. The US resolved this problem by having an airborne VLF system coupled with satellite communications. India too will have to find its own answers to this problem, as also to questions such as how to obviate the possibility of an accidental or unauthorised use once SLBMs are deployed and activation codes made available to captains?

However, till such time as the sea-based deterrent becomes available, India would have to base its nuclear deterrence and manage its survivability challenges with land-based ballistic missiles (by making them more solid fuelled and more rail and road mobile) and air delivered nuclear warheads (by hardening air bases and equipping them with effective air defences). Of these two, too, in the immediate future, the responsibility of India's nuclear deterrence will have to be borne mainly by the air force, since ballistic missiles with required ranges and accuracy are yet not operationally available. In order to ensure flexibility of selection of missile launch sites for enhancing survivability, it would be necessary for India to develop missiles of the ranges of not less than 5,000 km, a capability that will take some time to develop. Even then, air delivered nuclear capability will play a critical role in deterrence since manned nuclear capable aircraft provide an effective means to show strength

and resolve and yet give the political leadership the flexibility of recalling a mission even after it has been launched.

Till such time as the sea-based deterrent becomes available, India would have to base its nuclear deterrence and manage its survivability challenges with land-based ballistic missiles and air delivered nuclear warheads.

Counter-Value Targeting

With a no first use posture, if in the remote contingency that India is to respond to a nuclear attack, it would be most logical to use the weapons on cities instead of on purely military targets. While this sounds barbaric, it is actually the threat over large chunks of population and the productive assets of the country that can constitute unacceptable damage to make deterrence work best. Also, given that the accuracy measure of Indian missiles might be less than optimum in some ranges, Indian nuclear weapons would be most effective in attacks against economic and industrial assets, infrastructure nodes, and population centres. According to Ashley Tellis, "India's relatively small number of low-yield weapons is not optimised for effective direct attacks on opposing nuclear forces (counter-force targets)…."[36] On the other hand, they would be best suited against cities that denote softer targets (easy to pulverise even with a low yield weapon), larger targets (less sensitive to accuracy of delivery systems) and easier to locate targets (even without the help of very sophisticated navigation and targeting systems). The damage inflicted upon life and property would certainly constitute punishment of a magnitude that any country would find unacceptable.

Robust Command and Control

While the exact details of the command and control organisation and operation is not the objective of this paper,[37] it only seeks to highlight its centrality to credible deterrence. In fact, punitive retaliation is possible only if India has a robust

36. Tellis, n. 28, p. 352.
37. For a detailed analysis on this subject, see Gurmeet Kanwal, *Nuclear Defence: Shaping the Arsenal* (New Delhi: Knowledge World, 2001), pp. 143-169.

command and control system that enables efficient and responsive decision-making and has enough redundancies built into it to survive even a worst case disarming strike. While the survivability of C3I2 is critical in case of breakdown of deterrence, the knowledge of its existence and smooth functioning are critical during peace-time for enhancing the credibility of deterrence.

Pre-determination of Unacceptable Damage

Nuclear deterrence as practised by India is based on the retributive utility of nuclear weapons. It clearly establishes that any incidence of nuclear use against the country would bring back assured damage on the user itself and of a kind that would be found unacceptable by the aggressor. It is the fear of this retaliation that is supposed to hold back or deter the adversary from launching a first nuclear strike.

Obviously, this logic calls for India to be clear about the level of damage that its retaliatory strike must cause for it to be unacceptable to the adversary. This assessment can only be made on the basis of an extensive and intensive study of the cultural, socio-political, and strategic factors affecting the likely response of the adversary to nuclear use. The ability of a country to absorb damage is a complex function of its strategic culture, political system, economic state of growth and level of freedom enjoyed by the populace. During the 1950s, China's leader Mao Tse Tung described his country's damage acceptability threshold to be very high. But a more developed and economically advanced China cannot be expected to ascribe to the same philosophy. There is a case to be made that as countries develop, they also become more vulnerable and less open to accepting damage. Economically backward or politically isolated nations, on the other hand, have little to lose and may be able to absorb more damage.

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place is critical. This is also required in order to be able to correctly calculate the number of nuclear weapons India must stockpile and those that must absolutely be made survivable for effective retaliation.

Security and Safety of the Arsenal

The doctrine places a lot of emphasis on ensuring the security and safety of the nuclear arsenal, not just in peace-time but also in war-time. Given that India's nuclear arsenal exists in a de-mated state and in different locations, the risk of unauthorised use or the chance of inadvertent use due to miscalculation is less but it also means having to provide for the physical security of the assets to guard against theft, sabotage or unauthorised access. It also calls for the need to match ease of storage for ensuring safety with ease of availability at the launch site or airfield when required.

CONCLUSION

"Doctrines control the minds of men only in periods of non-emergency. They don't necessarily control the minds of men during periods of emergency. In the moment of truth, when the possibility of major devastation occurs, one is likely to discover sudden changes in doctrine." James Schlesinger stated this in a hearing before the US Senate Committee on Foreign Relations, 93rd Congress, 1974.[38] This statement could be even more true in the case of nuclear doctrines, but, fortunately, since the world has somehow averted the use of nuclear weapons, there are no empirical instances to either prove or disprove this assumption. At the same time, it must also be said that doctrines are not cast in stone. They reflect the realities – political, economic and technological – of the times and could change as these parameters undergo a transformation.

But, for the time that it exists, a nuclear doctrine performs the crucial task of providing a window to how a country perceives its nuclear weapons. It explains why it needs these WMD and how it plans to use them in the achievement of those objectives. India has premised its need for nuclear weapons on its desire to resist nuclear coercion or blackmail and, hence, espies its use only for self-

38. As quoted by Tellis, n. 28, p. 362.

defence. Accordingly, New Delhi has enunciated a nuclear doctrine that perceives a purely political role of deterrence for its nuclear weapons. Flowing therefrom, India's nuclear doctrine ascribes to a no first use posture since it holds that the nuclear weapon has no role in enforcing compellence or staging aggression and, hence, is only considered usable in a situation where an adversary has first used a nuclear weapon against the country. In such a situation, the doctrine prescribes assured retaliation to inflict unacceptable damage. In order to carry out this exercise, the doctrine aspires for a minimum nuclear deterrence whose credibility resides in its survivability.

New Delhi has enunciated a nuclear doctrine that perceives a purely political role of deterrence for its nuclear weapons.

The operational nuclear strategy as flows from India's nuclear doctrine provides the least risk option in a situation where nuclear weapons are present. It premises nuclear deterrence on a small arsenal that is not on hair-trigger alert, and, hence, less open to the possibilities of miscalculation or accidental use. At the same time, given its own orientation towards no first use and punitive retaliation in case of use, the doctrine seeks to minimise the chances of nuclear use in the first place.

Lastly, it must be reiterated that India's nuclear doctrine accords due importance to the attainment of an NWFW as the best insurance of Indian security. In an NWFW, India can be regionally more secure and globally better placed to pursue its objective of assuring strategic autonomy for its pursuit of economic and security objectives. But until such a world may be obtained, India's own brand of nuclear deterrence, as defined by its nuclear doctrine, will have to do the needful.

CHINA'S ASAT TEST: IMPLICATIONS AND OPTIONS

K.K. NAIR

A military about-turn is a fairly tough albeit brisk manoeuvre. China demonstrated a classic turn at 22:26 hrs GMT on January 11, 2007, by abruptly reversing its two decade plus vociferous public stand on peaceful uses of outer space and quietly conducting an anti-satellite (ASAT) test in space. The test sent a variety of messages to nations across the globe and was greeted by general pandemonium and consternation. India's response was an uncharacteristic silence. Whether the silence was studied and deliberate or confused is not clear. What is amply clear is the fact that it took us entirely by surprise. The national media woke up over a week after the test and even now the issue doesn't get the attention it deserves. It is in the above context that a brief attempt to examine the ASAT test, assess its implications, response options and legal position in an Indian context is undertaken as below.

IMPLICATIONS OF THE TEST

China's ASAT was launched from or near the Xichang Space Centre to intercept and destroy an ageing Chinese FY-1C (FengYun/Wind and Cloud) weather satellite at an altitude of around 955-966 km. The type of ASAT vehicle used is yet to be conclusively identified. Most speculation rests around the vehicle being either a DF-21 (Dong Feng/East Wind) IRBM (intermediate-range ballistic missile) or a modified version of the DF-21 referred to variously as the KT-1 (Kaitouzhe/Pioneer) or KT-2. Apart from the type of ASAT, what is of

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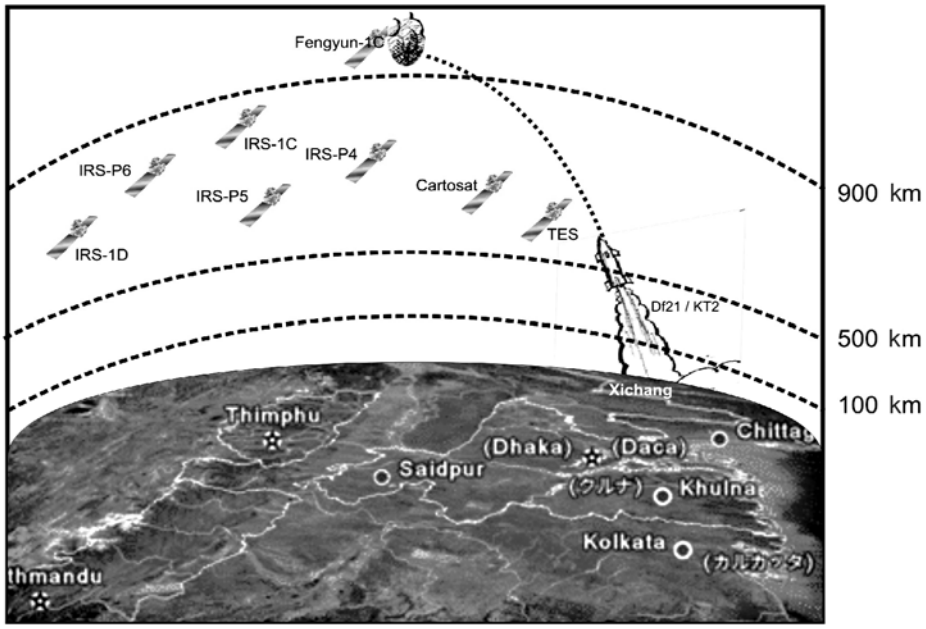
The obvious implication is that China has the capability to selectively destroy any or all of our observation satellites in low earth orbit (LEO).

significance in our context is the altitude of the target satellite. The target satellite was intercepted at an altitude of around 955-966 km, an altitude consistent with the operational altitudes of most earth observation and imagery intelligence satellites, including ours. As a matter of fact, ours are at a lower altitude compared to the FY-1C. Out of our 16 satellites in orbit, all seven of the IRS series are at altitudes between 600-900 km. This also includes India's one and only military satellite, the technological experiment satellite (TES). The obvious implication is that China has the capability to selectively destroy any or all of our observation satellites in low earth orbit (LEO). The less obvious implication is that China has also demonstrated the potential to target our satellites at higher geo-synchronous earth orbit (GEO) altitudes also.

Satellites in GEO, at around 36,000 km, cannot be attacked directly from earth and would need to be targeted from LEO. ASAT vehicles reaching up to LEO can be mated with larger boosters to attack satellites in GEO. China's ASAT test at LEO conclusively demonstrates its potential to target our INSAT series of communication satellites in GEO also. The threat obviously is not confined to satellites in LEO, but applies also to those in GEO.

Apart from the above which relate to the 'hard-kill' method of destroying satellites, China is also known to be sufficiently proficient in the 'soft-kill' method. Soft-kill deals with the use of lasers, high power microwaves, etc to damage, degrade or jam satellites and their links temporarily or permanently. Any laser for ASAT application must deliver at least 1 KW on target for 1 second dwell time to cause any significant damage; perhaps a lower power would do if the target is only the optical/IR (infra-red) sensor. To deliver this power on target through atmospheric absorption and distortions is normally not an easy job. Albeit, the same is very doable in China's case considering that since 1980, under its national 863 programme, China has been developing laser technologies with potential ASAT capabilities like free electron laser (FEL) and chemical

Fig.1: China's ASAT Test



oxygen iodine laser (COIL). As a matter of fact, prior to the ASAT test, in August 2006, China had reportedly "illuminated" an American satellite with a ground-based laser. Laser ASATs are an increasingly attractive concept since they afford the flexibility of damaging or degrading an adversary's satellite temporarily or permanently and also because in some cases, an adversary might not be able to detect and pin-point the cause of damage.

Thus, China's test has actually served to confirm long standing suspicions of its ASAT capabilities. The fact that a debris littering impact instead of a near-miss to warn potential adversaries was undertaken displays China's utter disregard for interests other than its own. As time progresses, the debris cloud would become bigger and disperse further. While India's military satellite is at a much lower altitude of 500-600 km and may not be affected, our civil satellites like the IRS P-6 with higher apogees at around 875 km would most certainly be affected. Further, in more general terms, in case of a conflict, crisis or contingency, with all of one military satellite, the impact on the military may not be incapacitating, but what would be crippled irrevocably would be

In case of a conflict, crisis or contingency, with all of one military satellite, the impact on the military may not be incapacitating, but what would be crippled irrevocably would be national morale and economic development afforded by our civilian satellites.

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BALLISTIC BROUHAHA

Following the test, certain quarters have claimed that the tests were a predictable reaction to Chinese concerns regarding the US' ballistic missile defence (BMD) overdrive and space programmes, aimed at ensuring its global military reach and deterrence. Regardless of the merits and demerits of the pretext for the ASAT launch, the fact is that the test demonstrated China's capability to target US vulnerabilities and obtain an asymmetric advantage. The US' primary indices of power are its military and economic strength, both of which are heavily dependent on satellites and the same can now be threatened. China's "shot across the bow" would have a telling impact on US capabilities. With the bow out of commission, and a quiver full of observation, navigation satellites enabling global reach as well as BMD assets envisaged for defence against attacks from anywhere on the globe would not be of much operational use. The US' global military reach as well as global defence and deterrence capability enabled by space could be severely challenged, if not curtailed during conflicts or crises.

While China continues to be decades away from possessing any credible BMD capability, it has now the demonstrated capability to severely degrade the US' BMD capability. ASAT weapons of the type it tested may not be effective against incoming missiles, but can certainly degrade effectively the components of the BMD system. They could target the space-based sensors and tracking systems which effectively are the spine of the BMD concept. For example, the space-based infra-red system-low (SBIRS-low) envisaged at having 24 satellites in LEO to enable detection and tracking of missiles launched could be targeted and rendered dysfunctional.

Thus, the ASAT test demonstrated the potential to punch fatal holes in an already leaking ''BMD umbrella'' concept. At the exo-atmospheric levels of over 100 km (62 nautical miles – nm), the ASAT test punched holes into the concept, and at the endo-atmospheric levels of below 100 km, the unstoppable barrage of Katyusha rockets during the Hezbollah-Israel conflict drilled holes into the concept. The BMD umbrella concept continues to be enormously desirable, but whether it is presently (or even in the near future) viable and vital to national defence is a moot question. It is in the above context that India's much hyped ''successful BMD test'' and claims of a "big step" in developing a viable BMD need closer rethink, examination, and perhaps some course corrections.

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COMPARING THE CHINESE AND INDIAN TESTS

To begin with, India woke up late to the ASAT test and even a month later, reactions are at best muted or as put by a scribe "characterised by a confused silence."[1] As a matter of fact, certain sections in the media have attempted to belittle China's achievement and tried to hype India's "exo-atmospheric" BMD test of November 27 to a status almost at par with the US' BMD capability[2]. The underlying perception, hence, gaining currency is that China's ASAT test is no big deal, and by June 2007, India's anti-ballistic missile (ABM) capabilities would give it an advantage against regional rivals like Pakistan and China. The above is not correct at present and may not be so for at least a decade. At the same time, India's test is also no mean achievement but significant differences exist between China's ASAT and India's BMD test. Both the tests also aim at two different concepts and, hence, considerable differences exist at both operational and technological levels. The larger differences have been enumerated as below.

1. Quoting from S.S. Yadav, "Assessing Impact of China's Anti-Satellite Test on Indian Strategic Interests," *India Daily*, February 8, 2007.
2. See Vivek Raghuvanshi, "India Plans 2nd ABM Test in June," *Defense News*, January 29, 2007. As per the article, "DRDO sources said New Delhi intends to announce by June that its anti-ballistic-missile defenses are on par with those of the United States."

- Firstly, a difference of more than 800 km of altitude distinctly distinguishes China's ASAT test from India's "exo-atmospheric BMD test" at 50 km. While no clear-cut demarcation of atmosphere and space exists, in common parlance the Karman limit below 62 nm (or 100 km) is considered as ''endo-atmosphere'' and beyond 100 km as ''exo-atmosphere.'' Thus, while the Chinese intercepted their target in outer space or exo-atmosphere at over 900 km, the Defence Research and Development Organisation's (DRDO's) test at 50 km intercepted its target well within the atmosphere or endo-atmosphere at best. An entirely different set of laws of physics as well as technology apply in both cases. The mechanics of targetting orbiting satellites in outer space are patently different and more technologically challenging than intercepting missiles within the atmosphere.
- The next significant difference is the speed of intercept. In the case of China, the targeted vehicle in LEO had enormously high speeds of 7-8 km per second[3], whereas India intercepted its Prithvi missile travelling at a speed of barely 500 metres per second. To put the entire affair of high speed interception in perspective, it would be interesting to note that a bullet fired from a 9 mm pistol travels at a speed of 300 metres per second. Hitting a bullet with a bullet is no mean task, by extension, intercepting a missile travelling at 500 metres per second is also no mean achievement and interception of a satellite orbiting at 7,000-8,000 metres per second with a kinetic-energy ASAT is certainly an achievement.
- In addition, there exist significant differences in technology for conducting ABM tests in the exo-atmosphere. The interceptor vehicle would need an escape velocity of at least 11.2 km per second to escape the earth's gravitational force in addition to the other significant challenges of near real-time orbital surveillance, tracking, accurate homing and interception of targets in outer space or the exo-atmosphere.

In view of the foregoing, India's determination for ABM defence "even if it costs billions of dollars and international criticism"[4] needs a rethink. While BMD capabilities akin to the US' are certainly desirable, it might neither be affordable

3. Unlike in the atmosphere, the speed of a satellite in outer space is determined by its altitude and orbit. Satellites in LEO like the FengYun, our IRS series, etc orbit at typically high speeds of 7-8km per second.
4. Raghuvanshi, quoting an Indian Defence Ministry official in n.2.

nor prudent for India to spend billions of dollars on an untested concept with immature and unproven technology. Secondly, international criticism of the ABM concept is related to destruction of targets in space and consequent debris, space weaponisation concerns. India's stance (and, in particular the Indian Space Research Organisation's – ISRO's) on peaceful uses of space has served it well and, hence, inviting unwanted criticism with projects having uncertain results would not serve much purpose. The above is not to suggest dropping the entire ABM effort mid-way, but to undertake an interdependent balanced approach to the entire effort to bolster DRDO's prevailing isolated endeavour.

ASSESSING PAKISTAN'S BM AND ASAT CAPABILITIES

Nevertheless, a discussion on the subject would be incomplete without due consideration to Pakistan's capabilities and, hence, the same are briefly examined. China's proliferation of BM technology to Pakistan is well established. Pakistan's testing of BMs has acquired a predictable regularity in the last few months. For instance, since November 2006, every month has been witness to one or two consecutive BM tests by Pakistan for reasons best known to them[5]. In view of the same, a broad assessment of the capabilities of Pakistan's BM has been undertaken as below.

From the above rough estimates, it is apparent that extremely short ballistic missile early warning (BMEW) of the order of around seven minutes in the case of short range missiles like the Hatf-2 to twelve minutes in the case of long range missiles like the Hatf-6 would be available in which to take action to counter the threat of BM attacks. Secondly, the maximum apogees of beyond 700 km possible in the case of the longer range missiles also enable an incidental ASAT capability to Pakistan. Pakistan does not have the requisite levels of technological prowess for orbital surveillance, tracking, insertion and homing of the KE-ASAT onto satellites like the Chinese have displayed.

Nonetheless, it certainly possesses the capability to launch nuclear ASAT payloads with its medium range ballistic missiles (MRBMs.) Nuclear-ASATs

5. Pakistan tested the Hatf-5 and Hatf-4 on November 16 and 29, 2006, respectively. It followed it up a few weeks later with a Hatf-3 test on December 9, 2006 and a Shaheen-2 test on February 22, 2007. This was followed by another Hatf-2 test on March 2, 2007.

Table 1 : Estimating Pakistan's Capabilities

Name of Missile/ Original Version	Range/Class	Range Angle υ (rad)	Ballistic Phase Flt Time (Sec)[6]	Total Flt Time (Sec)	Max Apogee (km)
Hatf-2/ French Rocket (Dauphin)	500 km/SRBM	0.078	318	438	247
Hatf-3, (Ghaznavi) /Scud	290 km/SRBM	0.047	247	367	145
Hatf-4, (Shaheen-1) /M-11	750 km/SRBM	0.117	390	510	370
Hatf-5, (Ghauri) /Nodong-1	1500 km/MRBM	0.235	553	673	744
Hatf-5A(Ghauri-2) /Nodong-2	1800 km/MRBM	0.282	605	725	898
Hatf-6 (Shaheen-2) /M-18	2000 km/MRBM	0.313	638	758	997

would not need the same levels of advanced satellite surveillance that KE and other ASAT systems demand and, at the same time, could significantly damage satellites not hardened to withstand the radiation and electromagnetic pulse generated by nuclear blasts. On the other hand, the Outer Space Treaty (OST), 1967, bans nuclear weapons in space and such weapons would damage every satellite as well as the general environment and, hence, do not serve much practical purpose. All said and done, the capability does exist and the same may be used as a weapon of last resort. Hence, it would be essential to explore measures to contain, and attempt to prevail in spite of, the capability.

EXAMINING THE OPTIONS

Prevailing circumstances demand utilisation of the entire aerospace medium for

6. Flight time is for a flat earth approximation and derived as a function of distance and velocity. Total flight time has been approximated as 120 seconds, including 60 seconds of boost and 60 seconds for reentry.

an elementary ABM capability which would draw on the expertise, resources and assets, of the ISRO, the Indian Air Force (IAF) and DRDO and, at the same time, would neither be a drain on the public exchequer nor violate existing legislation on the use of outer space.

A balanced approach to the exploitation and distribution of resources available in the endo and exo-atmosphere would be essential for protection of national assets as well as for conventional military force enhancement. With regards to security and protection of national assets from threats using the realm of air and space, the technology and investment for a comprehensive and all effective BMD system would continue to elude us for decades in the near future also. Hence, it would be imperative to obtain a near-term solution which would suffice for the present and on which incremental progressions could be carried out in the future. The point is, a patchwork umbrella would be better than no umbrella and the patches could be worked and improved upon towards obtaining the envisaged leak-proof capability.

Exploiting the Aerospace Dimension for ABM Defence in the Near-Term

To begin with, a comprehensive aerospace surveillance capability is the bedrock of any capability for defending against threats from the vertical dimension. The prevailing system aimed at air space management as well as detection and tracking of only airborne threats like aircraft is clearly inadequate for threats of the new millennium. Aerospace threats of the new millennium range from passenger aircraft being rammed into buildings to high speed manoeuvring missiles to ASATs launched from ground and airborne platforms. A composite aerospace picture to enable detection and tracking of the wide variety of threats from the vertical dimension and consequently enable evasion or interception would be essential. Such an endeavour would

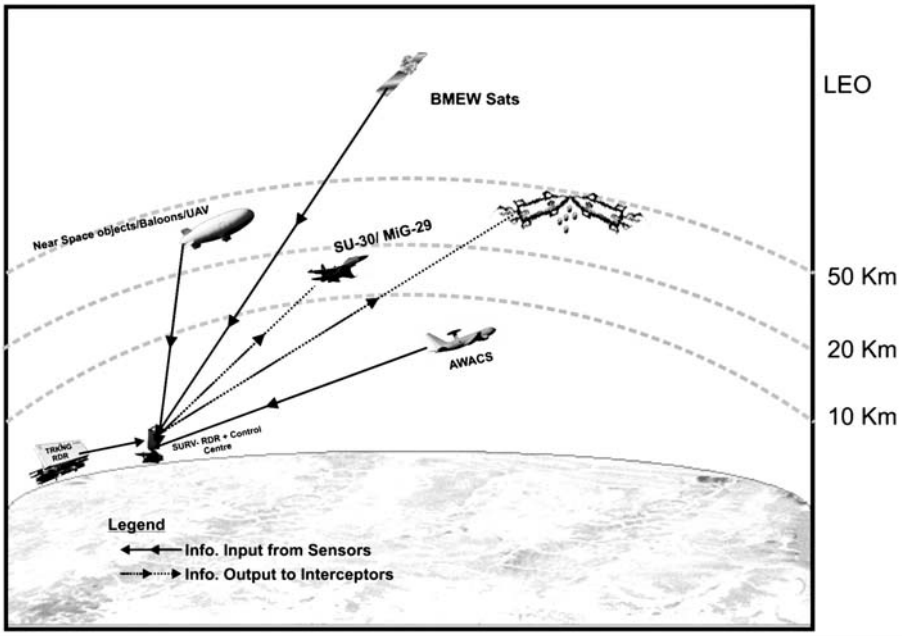
Aerospace threats of the new millennium range from passenger aircraft being rammed into buildings to high speed manoeuvring missiles to ASATs launched from ground and airborne platforms.

demand a cooperative approach wherein information from a variety of ground, air and space-based sensors would be made available. Such a picture could be obtained by fusing the information made available by sensors of the IAF and ISRO. For example, in addition to the information fed in by Green Pine tracking radars, information from sensors of the IAF like its ST-68 radars as well as modern surveillance platforms like the airborne warning and control system (AWACS) and BMEW satellites could also feed missile launch, detection and tracking information. The entire information could then be utilised for evasion or for interception of targets and launch pads with aircraft or missiles, etc, as the case may be. Conceptually, within the endo-atmospheric limits, interception of targets and launch pads by missiles and aircraft could be conducted with the available information.

Unlike the unproven and untested BMD concept, versions of the above concept had been operationally validated during the US' Operation Desert Storm over a decade ago. During the above operation, interception of tactical ballistic missiles was enabled by a combination of inputs from three BMEW satellites, AWACS and ground-based radars. The DSP satellites detected Scud missile launches within two minutes of a missile leaving its launcher, providing up to five minutes of warning time out of a total of seven minutes from launch to warhead impact. Additionally, the typical requirement of AWACS to detect small targets against cluttered background provided the incidental capability to detect missile launches. BMEW satellites, AWACS aircraft and air force radars could detect and pass on information on missile launches to fighter aircraft to destroy the launchers and their launch sites. The broad concept has been depicted pictorially in Fig.2.

In our case, radars of the IAF like the ST-68, THD-1955, etc have a certain amount of capability to track missiles, AWACS are on the anvil and since our BM threat is contiguous, a couple of BMEW satellites would suffice for detection and tracking of the BM. A satellite placed in GEO typically covers up to 35-40 per cent of the earth and the same would suffice in the near-term for persistent coverage of BM launch in our area of interest. A second satellite to cater for redundancy, greater accuracy of detection, cloud cover, etc could

Fig 2: The Aerospace Defence Concept



follow later on. BMEW satellites would almost immediately detect BMs on launch,[7] the enormous IR signature would also be detected by sensors on AWACS and the same could be picked up, compared and tracked by ground sensors like the aforementioned conventional surveillance radars spread across our borders as well as missile acquisition radars like the Green Pine. Overall, the challenges of defeating a BM attack within a short period of up to seven or twelve minutes would be enormous, but incremental refinements could be made to obtain a credible early warning for affecting an interception or mitigating a disaster. A multiple detection and tracking system on a variety of ground, air and space-based sensors would be accompanied by a variety of coordination and inter-operability challenges, but the system could undergo refinements over a period of time for optimal results.

Broadly assuming an ambitious scenario of BM launch detection and cueing

7. During Desert-Storm, the US' DSP satellites reportedly were capable of "identifying the likely target within 120 seconds of a Scud leaving its mobile launcher." Ref "Scud Warning," *Aviation Week & Space Technology*, January 21, 1991, pp. 60-61.

by BMEW satellites within 30 seconds, detection and augmentation of data by AWACS and other ground-based sensors in another 30 seconds, and transmission of data to control centres within the next 120 seconds, one is left with 187 seconds to decide, allocate and affect an interception in the case of short range tactical BMs like the Hatf-3. Hence, the obvious implication would be that response options for such short warning time would have to be either pre-determined or inherent and automatic in the ABM system.

Apprehensions of an accidental nuclear exchange due to an automatic response system would be largely unfounded in view of India's stated ''no first use" nuclear doctrine. Nevertheless, the possibility of averting an adversary's first as well as second nuclear strike would be more credible. By extension, a greater deterrence capability would accrue. The above would not contain the BM threat altogether, but would endow a formidable capability in the near-term. Defences against the Katyusha variety of rockets would continue to be a problem and could at best be met with a reciprocal barrage of missiles.

However, at the exo-atmospheric levels, the scenario is more promising. With regards the exo-atmosphere, the information on launch of vehicles carrying ASAT systems could be relayed to own satellites for undertaking evasive measures. In the near-term, critical information on launch of ASAT vehicles from the ground or air to enable manoeuvre and evasion measures to secure own satellites would suffice to counter China's ASAT capability. There exists a huge gap between technology demonstration tests and actual intercepts. The ASAT test was basically a deliberately designed collision of non-manoeuvring targets on known positions. Intercepting a target on an arbitrary orbit would be a much more technologically challenging and difficult proposition. The difficulty levels would multiply in the case of a target able to manoeuvre and evade the ASAT. Thus, China's ASAT capability could be effectively countered by manoeuvring own satellite out of the ASAT's path, provided timely information is available. Hence, in the foreseeable future, aiming at the capability to obtain information on ASAT launches and undertake evasive measures, while at the same time, attempting to destroy the launchers, whether ground or air-based, would be more prudent.

The imperatives of destroying airborne ASAT launch platforms would assume

enormous significance in the near future in view of China's increasing interest and proficiency in developing air launched ASATs. China's planned development of *"airborne carrier* rockets" to enable mobile, flexible and fast launch of mini-satellites[8] would make it imperative to possess the ability to intercept the highly mobile and flexible airborne platforms prior to ASAT launch.

The imperatives of destroying airborne ASAT launch platforms would assume enormous significance in the near future in view of China's increasing interest and proficiency in developing air launched ASATs.

On the other hand, attempting to intercept ASAT vehicles in outer space would not only be beyond the scope of available technologies for a long while but would also amount to adding on to the debris in space and inviting international opprobrium, criticism, sanctions, etc. It would also conflict with India's stand on peaceful uses of outer space. India's needs for securing its assets in space and on earth as well as for conventional military force enhancement could be fulfilled within the scope of prevailing legalities and legislation on peaceful uses of outer space and, hence, it would be prudent to build capabilities within the same.

MILITARY USE OF SPACE WITHIN SCOPE OF EXISTING LEGISLATION

The term "peaceful uses" has not been legally defined in international law or any other space related treaty in vogue and constitutes a legal gray area till date. During the 13th session of the United Nations General Assembly, 1958, the term was used as an antonym to military and the common understanding was to avoid any military use whatsoever. However, by 1959, the US changed its legal position and interpreted it as meaning "non-aggressive" rather than "non-military". Accordingly, all military uses of space were permitted and lawful as long as they were non-aggressive. While the Soviets initially contested the interpretation, by 1960, they also adopted the same

8. For details on the development of airborne carrier rockets, see Ministry of Science and Technology of the People's Republic of China, Science and Technology Newsletter No. 366, dated May 10, 2004, at http://www.most.gov. cn/eng/newsletters/2004/t20041130_17766.htm

interpretation and the rest of the globe too accepted the interpretation. The prevailing interpretation, hence, is that non-aggressive military uses are peaceful. No nation has contested the interpretation till date and the same is in vogue.

Space-based systems aimed at military force enhancement like navigation, observation, communication, etc have no direct destructive capability, and, hence, are classified as non-aggressive. Most satellites enabling military force enhancement have no capability to interfere, damage, degrade or destroy, hence, are largely of a non-military nature. Civil and even commercial satellites enable military force enhancement in terms of communication, observation, etc. The above explains the legal non-military status accorded to navigation, observation, communication satellites, etc aimed at military force enhancement.

Based on the principles of non-aggression, ever since the first Sputnik was launched in 1957, the entire spectrum of dedicated military satellites aimed at military force enhancement was already in place within less than a decade. Towards the end of the decade, in 1967, by the time the OST was inked, both the Soviets and Americans had already developed ASAT capabilities for attempting to control the realm of space. The above explains why the OST in no way bans non-nuclear ASATs or anti-missile capabilities in spite of their aggressive nature. Thus, militarisation of space had occurred within the first decade of the Sputnik being launched.

Most of the legal framework, hence, attempts to restrict the weaponisation of space, which implies the placement of destructive capabilities, or application of military force from space or using the realm of space for military war-fighting, etc. Global weaponisation concerns have become more vociferous following the US' withdrawal from the ABM Treaty and embarking on endeavours like the transformational flight plan which aims at a whole range of products for space warfare ranging from air launched ASAT missiles to air and spaceborne lasers, hypervelocity rod bundles, etc. The law, hence, is circumvented by developing the aforementioned space weaponry which can neither be classified as nuclear weapons nor weapons of mass destruction (WMD) and yet is equally or perhaps, more potent.

VIEWING MILITARY UTILITY OF SPACE IN OUR CONTEXT

In our unique context, the aim is to use space for protection of our assets as well as conventional military force enhancement and not for military force application from the realm of space or for military manoeuvres in space or space-based war-fighting. Article 51 of the UN Charter codifies the right of self-defence in case of aggression and, hence, legalises the use of military force for self-defence against hostile action. Under the aegis of the above, self-defence measures like aerospace surveillance which have ''no direct destructive capability'' and yet enable a certain level of self-defence could be undertaken. The above would in no way militate against our established stance of peaceful uses of outer space and yet would be in sharp contrast to China which develops and employs ASATs, lasers, etc with ''direct destructive capability,'' thereby, causing debris and leading to '' space weaponisation''. Secondly, no treaty or legislation bans the use of navigational, communication, observation and other satellites aimed at enabling optimal utilisation of military force or "force-enhancement."

In our unique context, the aim is to use space for protection of our assets as well as conventional military force enhancement and not for military force application from the realm of space or for military manoeuvres in space or space-based war-fighting.

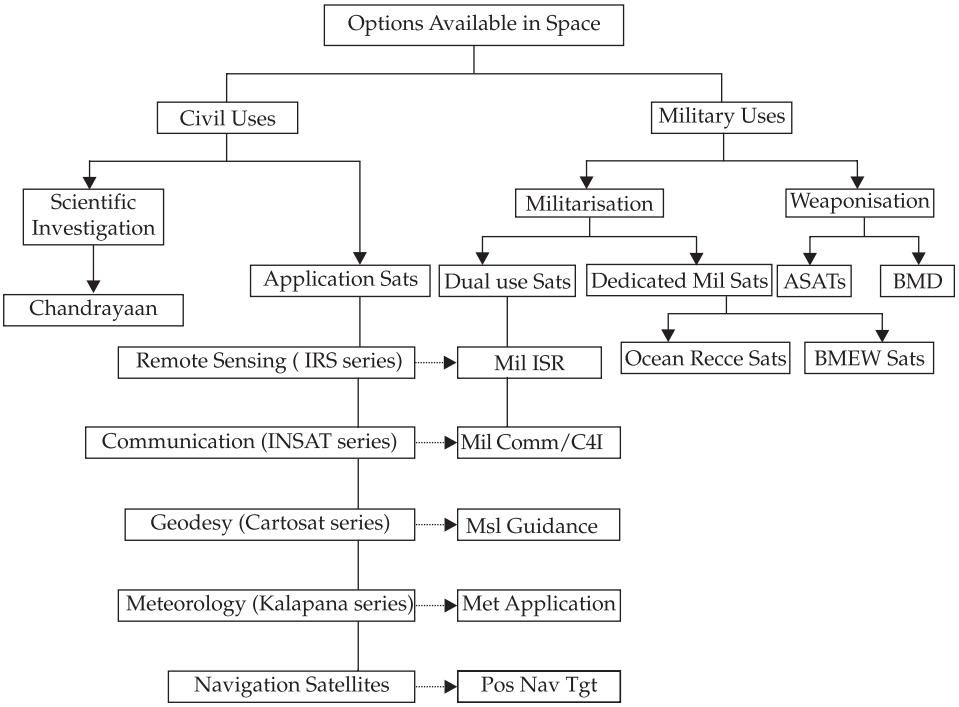
Thus, our envisaged military utility of space would in no manner violate existing space legislation and would be a continuation of our policy of peaceful use of space. As a matter of fact, the above suggested approach would enable us to fulfill our requirements without any question of stepping outside the realm of prevailing legislation on space.

Fig.3 would enable better comprehension of the militarisation and weaponisation aspects of space.

THE LEGAL POSITION OF CHINA'S ASAT TEST

As evident from Fig.3, China's ASAT test amounts to weaponisation of outer space and by no stretch of the imagination can constitute a ''peaceful use of outer

Fig. 3



space.'' Nonetheless, China's ASAT test has capitalised on the prevailing lacunae in outer space laws. Apart from international outrage caused by the debris, the test validated the fact that prevailing laws and legalities with respect to outer space are in need of dire reform. Most aspects ranging from the delimitation of outer space to the definitional issues surrounding "peaceful uses of outer space" are yet to be resolved in some acceptable manner. As a matter of fact, capitalising on the prevailing lacunae has become the norm rather than the exception. The Chinese have apparently capitalised on the legal lacunae of Article 4 of the OST-1967 which states that "...States party to the treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction....."

Thus, since the Chinese have neither used a nuclear weapon nor any other

weapon of mass destruction, in strictly legal terms, the test violates no existing legislation. Secondly, the Chinese have destroyed their own Feng Yun satellite and, hence, cannot be charged under Article 7 of the OST which states that "...States are internationally liable for damage to another state (and its citizens) caused by its space objects..." Since no international property (space assets belonging to other nations) has as yet been damaged by the test, it cannot be charged under the same. The liability convention would apply in case of damage to property of other nations. The Chinese, in this case have destroyed their own property (to start with), but any other space assets getting damaged or degraded due to the consequent debris would cause the Chinese to be held accountable for their actions.

Nevertheless, the Chinese can be held accountable for not having fulfilled the provisions of Article 9 of the OST. Article 9 states that "States must conduct international consultations before proceeding with activities that would cause potentially harmful interference with activities of other parties....." In this case, the Chinese Academy of Launch Vehicle Technology (CALT) is responsible for the manufacture and design of launch vehicles and ballistic missiles. All space launch and tracking is controlled by the General Armaments Department (GAD) of the People's Liberation Army (PLA) and FY satellites are a product of China's Central Meteorological Bureau and the Shanghai Academy of Space Technology (SAST). All in all, the entire interception and destruction is a deliberate Chinese state endeavour. China is not known to have conducted any international consultation prior to the ASAT test which littered debris with enough potential to harm the activities of other parties with assets at the same or contiguous altitudes. Secondly, the premise that China underestimated the impact of harmful debris littering LEO is not plausible in view of the fact that in an earlier instance, on October 4, 1990, the upper stage of China's Long March 4A carrying a FY1-2 weather satellite had exploded, littering debris around the altitude of 880-895 km. Of

The Chinese can be held accountable for not having fulfilled the provisions of Article 9 of the OST.

the 84 pieces of debris catalogued on account of the above, up to 68 continue in orbit[9]. Thereafter, in 1995, China had joined the Inter Agency Space Debris Coordination Committee and, hence, the possibility of China having underestimated the impact and effect of the test is remote.

CONCLUSION

In view of the foregoing, it is now imperative that we take measures to secure our interests within the realm of our capabilities and legalities in vogue. The fact that we were blissfully unaware of China's ASAT test until the general pandemonium makes the matter even more serious. While a comprehensive ABM system would continue to elude us for a few more decades, a scaled down and yet effective system could be explored, and with due refinements, would serve our purpose. At the same time, it would be essential to develop capabilities within the scope of technologies, finances as well as legalities applicable to our unique context.

It is now imperative that we take measures to secure our interests within the realm of our capabilities and legalities in vogue.

To begin with, the recommendations of the 7th report of the Parliamentary Standing Committee on Defence presented to the 13th Lok Sabha on December 18, 2000, as well as the 14th report may be acted upon to track and protect our assets in space by forming an agency like the standing committee's recommended Aerospace Command under the Indian Air Force. Such an agency would be essential for undertaking comprehensive aerospace surveillance and for enabling development of a comprehensive framework for protection against the ever-increasing multitude of threats from air and space.

9. Debris figures sourced from NASA's Orbital Debris Programme Offices 13th Edition on "History of On-orbit Satellite Fragmentation," May 2004, p. 27, Table2.1

FORCE MULTIPLIERS AND TRANSFORMATION OF AIR DEFENCE

ATUL KUMAR SINGH

Perpetual optimism is a force multiplier.

– Colin Powell

Since the inception of the Indian Air Force (IAF) in October 1932, like other air forces, it has constantly struggled between requirements and resources. The IAF's involvement in a series of air operations starting from the Afghanistan border in 1937[1] to Kargil in 1999 has given it a unique place in the history of air forces which have constantly evolved through air operations. The frequency of air operations led to the focus on acquiring more aircraft, a larger number of squadrons, airlift capability, and on building up the offensive capability. On the other hand, the compulsions of the IAF retarded the growth of one of its most important components, air defence (AD). There was virtually no air defence until after the 1962 War, when it received some vintage radars from the erstwhile Soviet Union, and subsequent installation of the 500 series radars (AN-FPS 89 & AN-FPS 100) by the Americans in the mid and late Sixties. Integration of air defence assets had not started as late as 1995, when George K. Tanham wrote, "The Indian Air Force is unable to or unwilling to acquire force multipliers. The nation's integrated air defence is not complete."[2] There could have been many reasons for the slow evolution of air defence.

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1. Air Chief Marshal P. C. Lal, *My Years with the IAF* (New Delhi: Lancer International, 1986), pp. 12-13

2. George K. Tanham and Marcy Agmon, *Indian Air Force: Trends and Prospects*, A Monograph Report (Santa Monica: RAND Corporation 1995), p.84. Downloaded from www.rand.org/pubs/ monograph_reports/ MR424 on February 20, 2007.

In a talk organised by the Centre for Air Power Studies on March 16, 2007, at the Defence Research and Development Organisation (DRDO) Bhawan, former Chief of the Air Staff, Air Chief Marshal S.P. Tyagi spoke about the strategic nature of air power, the growing need for an Aerospace Command, the propulsion of economic growth and the footprint of India's larger strategic interest, thrusting the IAF into becoming a continental air force and, thus, the increasing necessity for an expeditionary force. The confidence and belief of the air chief emanate from many larger issues with a bearing on national defence, the acquisition of force multipliers being one of them. The IAF is transiting through a phase of transformation that may last another 15 years, wherein it needs to review its operational philosophies, organisational structures and training patterns to adapt to the nature of a truly continental force with strategic reach. In the light of the evolving organisational transformation, the core concept of air defence also needs to be reexamined to enhance the survivability of our offensive capability when operating within and beyond our territorial bounds.

In the last decade, the air defence infrastructure in the IAF has received significant attention, starting with induction of the SU-30 MKI, upgraded MiG-21 (BISON), induction of new radars and upgrade of existing radars, automation programmes, aerial refuelling (AR), unmanned aerial vehicles (UAVs), missiles, aerostat radars and airborne warning and control system (AWACS) that have afforded the capability to start thinking strategically, and, most importantly, of the strategic role of the IAF beyond the borders. This is where the significance of force multipliers becomes more visible on our minds, thinking and attitudes and that's where Colin Powell's statement fits in appropriately, "*Perpetual optimism is a force multiplier*."

POINT DEFENCE TO AREA DEFENCE

A number of reasons had led to the point defence policy followed by the IAF till the late Eighties. The biggest disadvantage of point defence is that it allows the hostile aircraft to reach its target before it is engaged with a combination of weapon systems in very close proximity or right overhead the target; in almost all cases, point defence will allow hostile forces to do the damage before they are engaged.

The biggest disadvantage of point defence is that it allows the hostile aircraft to reach its target before it is engaged.

These problems have been identified and efforts are underway to resolve these issues at strategic, operational and tactical levels. The area defence concept intends to engage the enemy at the earliest after detection and destroy or divert the hostile aircraft before they reach their weapon release line (WRL). Hence, the requirement of early warning over a larger area; fighters with long range advanced technology airborne intercepts (AI) radars; beyond visual range air-to-air missiles (BVRAAM), etc. The force multipliers like AWACS, aerostat radars, precision weapons, and multi-role combat aircraft (MRCA), UAVs, and AR address all the major problems of air defence operations, thus, bringing in a rapid transformation in the way air defence operations are perceived. Active air defence components are playing an increasingly vital role in air dominance operations. For example, the roles of aerostat radar, AR, Su-30 MKI armed with BVRAAM have given a definitive meaning to how offensive sweep and free escort missions are to be conducted in the battle for air dominance. This will blur the line between offensive and defensive counter-air roles. Force multipliers have enhanced the reach and offensive capabilities of air defence operations, thus, bringing in the shift in the concept of AD operations. In the long term, this capability will further enhance once all the force multipliers are integrated on a net-centric platform which would be capable of integrating army and naval air defence operations in real-time and in entirety.

FORCE MULTIPLIERS

The US Department of Defence has defined force multipliers as, "A capability that, when added to, or employed by, a combat force, significantly increases the combat potential of that force and, thus, enhances the probability of successful mission accomplishment."[3] Force multipliers enhance the combat power of a smaller force, accordingly, the increase in combat power is made possible through various processes which include increased radius of action

3. Definition of *force multipliers* by US Department of Defence, as cited on http://usmilitary.about.com. Downloaded on November 19, 2006.

Force multipliers, when added, to or employed by, a combat force, significantly increase the combat potential of that force and, thus, enhance the probability of successful mission accomplishment.

of attack platforms, increased time on station for operations, precision attacks and information dominance. The systems that enable the achievement of the above include airborne early warning (AEW), aerial refuelling, electronic warfare, intelligence, command and control, communications and computers (C4), precision, navigation, and reconnaissance. Therefore, the force multipliers would necessarily have to address the folowing issues:[4]

(a) Time and operational tempo.
(b) Information.
(c) Concentration of force.
(d) Mass.
(e) Economy of effort.

From the Stone Age to the Space Age, technologies and innovative ideas for application of technology in warfare have contributed to enhancing the war-fighting capabilities of mankind. Be it slings, ships, cannons, aircraft, radars, rocket science or satellites, mankind has always innovated to exploit these technologies to advance his war-fighting abilities. However, technology alone, without the doctrinal concepts and organisational adaptations, does little to win wars. The pace of evolutionary technological developments in the 19th and 20th centuries and particularly after the emergence of air power, has changed the nature of war. "Technology has led to change of organisational and doctrinal concepts of war-fighting and the combined effect of technological developments, doctrinal innovations and organisational adaptations have enabled full realisation of the revolution in military affairs (RMA)."[5] The war-fighting

4. Air Commodore M. Matheswaran, "Integrating Force Multipliers and Operations" in Air Commodore Jasjit Singh, ed., *Aerospace Power and India's Defence* (New Delhi: Knowledge World, 2007), p. 223.
5. Air Vice Marshal Kapil Kak (Retd), "Revolution in Military Affairs: An Appraisal," *Strategic Analysis* vol. XXIV, no. 1, April 2000. Downloaded from www.ciaonet.org on November 12, 2006.

platforms, weapon systems, doctrines and command and control structures are the by-products of technology. Constantly inventive technology has given many platforms which, when employed by a force or its components, have contributed in enhancing the combat potential of the force, thus, increasing the probability of mission accomplishment. "The stunning victory of the Western armed forces and their allies in the Gulf War in 1991 could doubtless be ascribed to the .employment of significant force multipliers like airborne warning and control system (AWACS), joint surveillance target attack radar system (JSTARS), joint tactical information distribution system (JTIDS), in-flight refuelling, satellite aided navigation, precision-force technologies, etc."[6]

RADARS

Next to the atomic bomb, radar was the most decisive weapon of the war.

– Grand Admiral Karl Doenitz, German Navy

Air power would top the list of force multipliers in the history of warfare and the radar will stand only second to it. Radar was probably the biggest force multiplier of World War II and the *raison d'être* for British success in the Battle of Britain. This was followed by other force multipliers like AEW, UAVs, and command, control, communications, intelligence (C31) systems. In their short history of 70 years, radars have traversed the path of development from chain home (CH) radars to space-based radars. The multiplicity of functions extends from surveillance, target tracking, airborne intercept (AI), meteorological radars, synthetic aperture radars (SAR) and through the wall surveillance radars (TWS) – the list is endless. In addition to upgrading its existing high powered and medium powered radars (HPR and MPR), the IAF is in the process of improving its surveillance and weapon guidance capability by acquiring indigenous systems like the Indian doppler radar (INDRA),

Radar was probably the biggest force multiplier of World War II and the *raison d'être* for British success in the Battle of Britain.

6. Kak, Ibid.

central acquisition radar (CAR) and induction of foreign systems like aerostats and Green Pine radars. The technological developments in radar like mono pulse technique, digital signal processing, phased array trans-receiver modules and recent development of active electronically scanned array (AESA) radars have enabled a quantum jump in the performance and utilisation of radars in surface, air, naval and space-based operations. Information technology has enabled integration and networking of surveillance systems to provide a composite air picture for more efficient command and control and battlefield management. The enhanced capacity and capability of the data handling system (DHS) to integrate different types of radars, simultaneously process and display digital track data on thousands of tracks with improved quality of resolution on LCD or plasma operator work stations (OWS) has had a remarkable impact on situational awareness and quality of controlling.

AWACS AND AEROSTAT RADARS

Radar had the effect of forcing air operations down to lower levels to stay below the radar horizon and, thus, evade detection. The next logical step was to mount the radar on an airborne platform, thereby, nullifying the benefits of a low level approach. This technological leap has been, perhaps, the single greatest force multiplier in air operations.[7] The role, employment and capabilities of AWACS have transformed the nature of warfare because of its strategic nature and operational capabilities. In the 1980s, AWACS assumed a broader role as a tactical adviser for a greater number of fighter aircraft operating within its radar coverage. By assisting the interceptor aircraft in controlling the defensive intercepts, AWACS assumed the role of augmentation platform for ground-based radar units. In the 1990s, during the Gulf War, AWACS provided control and battle management support to offensive counter-air forces in a theatre-wide offensive.[8] The subsequent technological upgrades like advanced computer technology, secure communication, maritime surveillance capability,

7. Squadron Leader Ajai Singh, "The Air War with AWACS Symmetry," *The Indian Defence Review*, 1995. Downloaded from http://www.bharat-rakshak.com/LANCER/index.html on November 25, 2006.
8. Major Thomas W. Nine, "The Future of USAF Airborne Warning & Control; A Conceptual Approach." Downloaded from www.fas.org/man/dod-101/sys on January 3, 2007.

improvement in radar, radio and display systems have further enhanced the role of AWACS as a command and control platform. As a tool of power projection, the US has used AWACS for coercive politics. Air Commodore Jasjit Singh wrote in 1987, "…the US has made increasing use of AWACS for political purposes, leading, in fact, to some people coining the term **'AWACS diplomacy'** to describe the phenomenon."[9]

The strategic importance of AWACS emanates from its ability to extend multiple functions like early warning, surveillance, ESM (electronic suppression measures), SIGINT (signals intelligence) capability, command and control and battle management from one airborne platform. As a strategic asset, AWACS will be employed to achieve overall military objectives and the operational roles in the theatres of war would have to be prioritised. Air dominance operations will remain a primary mission along with integrated operations with the army and navy to attain time critical military objectives. Initiative, surprise, concentration of firepower, shock effect and attaining operational advantage over adversaries would remain the guiding principles for employment of AWACS. It could play a crucial role in enhancing the survivability and credibility of our nuclear delivery capability in a retaliatory strike. The strategic role of AWACS rests in its ability for power projection and the pivotal role that it plays in air dominance, thus, providing the increased survivability of offensive elements. In addition, AWACS, in conjunction with other force multipliers, could be used as an instrument of coercive diplomacy or the good old "gunboat diplomacy" exercised by powerful navies of the world.

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At the operational level, increased reaction time and enhanced early warning

9. Air Commodore Jasjit Singh, *AWACS: The New Destabiliser* (New Delhi: Lancer Press, 1987), p. 33.

by gap-free radar coverage at low and medium altitudes extending up to the range of 400-450 km, is the singular characteristic of AWACS which would address major problems of the air defence system. Taking into consideration the safety aspects, if an AWACS is flown 150 km inside own territory, it will provide gap-free low and medium level radar cover at least 250 km inside the adversary's territory, enhancing the functional capability of AD. This would be of significant importance, considering the lack of depth in the case of India's western adversary as this would facilitate constant monitoring of operational activity and flying tactics from most of the main and satellite airfields. As an ESM platform, SIGINT from AWACS would augment the existing intelligence resources, and the electronic ORBAT (order of battle) of the adversary would become transparent to a large extent. The enhanced radar pick-up ranges would give an impetus to the area defence concept and offensive capability to carry air defence into the enemy's territory.

Aerostat radars would augment the ground-based radars. These radars have greater capabilities in terms of detection ranges, V/UHF RT range, SIGINT, etc. Mounted on tethered balloons, the radars, could be hoisted to a height of 10,000 to 15,000 feet, depending upon the payload. The radar overcomes the limitation of line of sight and provides gap-free low and medium altitude coverage at ranges greater than 300 km. However, as compared to AWACS, aerostat radars have limitations in terms of range, operator work stations (OWS) and communication facilities which preclude their role as a command and control platform. But these will play a very vital role in providing low level radar cover, tactical control of aircraft and SIGINT. Therefore, the importance of aerostat radars should be seen as complementary to AWACS. As mentioned earlier, AWACS could be used to achieve overall military objectives and may not be available exclusively for air defence operations, therefore, the aerostats would fill this gap in the absence of AWACS. In the overall analysis, both AWACS and aerostat radars will significantly boost the air defence capability of air forces. The effect of AWACS and aerostat radars would be seen in the conduct of the following operations:

- Air dominance operations.

- Tactical control of offensive sweep (OS) and free escorts.
- Navigational assistance, threat updates and recovery of strike aircraft where necessary.
- Suppression of enemy air defence (SEAD) and battlefield air interdiction (BAI), air transport support operations, special heliborne operations (SHBO), assistance in combat SAR and UAV missions.
- Radar assistance to air combat support operations like aerial refuelling (AR) and ELINT (electronic intelligence) missions.

AERIAL REFUELLING (AR)

The endurance of combat aircraft is limited by the amount of fuel it carries, its weapon configuration, operating altitude and speed at which it flies. In air defence operations, fighters maintain a very high state of operational readiness for prolonged durations, and depending upon the threat perception or early warning, combat air patrol (CAP) missions are launched to deter and / or intercept the enemy strike aircraft before it reaches its weapon release line (WRL). Assuming that an aircraft on an air defence mission has an endurance of 45 minutes, then, based, on this figure, a simple calculation would indicate that to maintain a 24-hour CAP in a given area, a minimum of eight aircraft are required without any unserviceability; 36 missions (54 sorties) would have to be flown in a period of 24 hours, and each aircraft would fly six or seven sorties, and eleven pilots would be required at the rate of five sorties per pilot, considering that no engagement takes place and only one mission remains in the air at any given time. This is the most simplistic scenario but an enormous task to achieve because it is virtually impossible to maintain 100 per cent serviceability and this requirement will increase manifold if engagements take place and two or more missions are in the air simultaneously. Such resources are not available even with the best of air forces to be tied down to one task of CAP. While the task may be important, it is still a wasteful method of using scarce resources. If one could assume that aerial refuelling will increase the endurance of such an aircraft to two hours, the figures would alter to show incredible savings of 50-60 per cent in all areas. "By extending the on station time of combat air patrol (CAP) formation or by extending the radius

of action for the strike formation, or by increasing the on station time of the command and control platform such as AWACS, the aerial refuelling contributes immensely to the economy of force as well as maximisation of force application."[10]

Enhanced early warning from AEW systems may obviate the requirement of launching CAP missions, but in the absence of such warning or to protect high value assets (HVA) like AWACS, aerostats or tankers, a CAP may still be required in a given area. Therefore, if there is an operational imperative of launching CAP aircraft, the task would be achieved with fewer aircraft and with more efficiency. Aerial refuelling will also enhance the endurance of the command and control platform like AWACS. An AEW system on the IL-76, reportedly has an endurance of four hours or more; depending upon the distance to the area of operations from launching base, transit time, etc, this endurance could be doubled with aerial refuelling. A command and control platform in a given area for 7-8 hours could be a deciding factor between the success and failure of an operation. Similarly, multi-role fighters like the SU-30 or Mirage 2000, capable of carrying a large number of air-to-air missiles (AAMs) could be used in the role of offensive sweep or free escorts in the enemy territory, and on their return leg, the same aircraft could refuel in the air and carry out a CAP mission. Notwithstanding the capability, this kind of flexibility could be exercised subject to limitation of crew fatigue and other technically limiting factors like temperatures, oil, lubricants, greasing of the aircraft.

UNMANNED AERIAL VEHICLES (UAVS)

Designed to obtain enemy intelligence and enhanced situational awareness, UAVs have grown into indispensable instruments of intelligence, surveillance, reconnaissance (ISR), weapon delivery, target lasing and SEAD and many other roles unthought of earlier. In the times of rising costs and restrictive defence budgets, the UAV serves as an effective force multiplier for air power. The unprecedented success of the UAV emerges from its higher survivability owing to its small radar, acoustic and infrared signatures and ability to perform a number of missions. However, the basic premises are rapidly changing; UAVs like the

10. Matheswaran, n.4, p. 223.

Predator, Global Hawk, Harpy, etc. have transformed the entire concept of a UAV into that of an unmanned combat aerial vehicle (UCAV). The operational concepts of the UAV and UCAV are catching up fast simply because of the multiplicity of roles that could be performed by the UAV without risking human life, and even with increasing costs, it is still considered expendable as compared to manned aircraft. Israel learned the true value of UAVs in the 1973 Yom Kippur War, and the Israeli strike against Syrian missile batteries in the Bekaa Valley operation in 1982 provides several examples of effective UAV use in combat.[11]

Interceptor UCAVs

In air-to-air combat, where awareness, responsiveness, reach, speed and agility are likely to be the determining factors, the removal of the pilot will remove the consideration for human physiological limits while designing and developing the UCAV; it would also reduce the risk of casualties. A UAV will reduce the radar cross-section, greatly increase acceleration limits, and a low observable UCAV could perform the air-to-air combat role by executing 12-30g turns to present minimum RCS to the threat and evade missiles. UAVs with stealth characteristics could loiter undetected for prolonged durations which could be further enhanced with aerial refuelling. The UCAV replacing an AD fighter is a promising prospect, but a distant reality in the Indian context. The removal of the pilot from the cockpit may sound a lucrative proposal but the practical difficulties of a UAV controller doing the job of a pilot and that of a fighter controller are yet to be assessed; secondly, artificial intelligence is still nowhere compared to human brains when it come to faster thinking and instinctive reactions when faced with adversity and uncertainty.

UAVs in ISR Role

In the foreseeable future, ISR is likely to remain the primary role for UAVs in all three Services. The Bekaa Valley is the most comprehensive example of exploitation of the UAV in the ISR role. Months before the attack, Israeli UAVs "fingerprinted"

11. Capt Brian P. Tice, USAF, "Unmanned Aerial Vehicles: The Force Multipliers of 1990s," *Air Power Journal*, Spring 1991. Downloaded from www.airpower.maxwell.af.milairchroniclesapj.htm on January 8, 2007.

Syrian surface-to-air radars by gathering the electronic frequencies of those radars and programming them into Israeli anti-radiation missiles for use during an attack; using the electronic frequency signatures gathered earlier, Israeli fighters, carrying anti-radiation missiles, closed in, and along with artillery fire, destroyed the surface-to-air missiles (SAMs).[12] The real-time SIGINT and data transfers or live video images make the enemy's electronic ORBAT transparent even before the hostilities have commenced, and assist in planning offensive operations and SEAD. The Israeli Air Force also used UAVs in the surveillance role by positioning them over three major airfields deep within Syria to gather data on when and how many aircraft were taking off from Syrian airfields. This information was given immediately to the E-2C AWACS aircraft, which vectored Israeli fighters against the Syrian MiGs. UAVs made matters worse by jamming Syrian ground control intercept (GCI) communications with MiG fighters, which were highly dependent on GCI. In yet another role, UAVs acted as laser designators for laser-guided weapons launched by fighters against the SAMs.[13]

Data and Communication Relay Station

A low cost UAV loitering at 15,000-20,000 feet can be used as a platform to relay surveillance data, U/VHF RT, ELINT information, etc. between two stations operating beyond line of sight. The constraints of aerial surveillance platforms would often demand platforms which could be used as relay stations between the aircraft and the radar station or between the AWACS and the command and control centre. Broadband communications, advanced computing, micromechanical devices, and human-machine interface are key technologies that would be used on such a platform.

Employment of UAVs for AWACS/AEW Augmentation

In the mountainous terrain of Jammu and Kashmir (J&K) and the northeast, the performance of ground-based radars is extremely restricted; even AWACS and other airborne platforms will perform sub-optimally due to radar shadows. The

12. Tice, Ibid.
13. Tice, Ibid.

problem could be resolved if UAVs could be equipped with smaller airborne radars with limited ranges of 100 km or thereabout, and could perform the role of gap filler in the valleys and radar shadow areas. Data link with AD fighters and AWACS for real time-target information will augment the radar picture of AWACS/AEW systems. Conventional radars have not been mounted on UAVs as yet, although the technological feasibility is not in doubt. Northrop Grumman and Raytheon are developing the Multi-Platform Radar Technology Insertion Programme (MP-RTIP) for the JSTAR upgrade of the USAF (US Air Force). The MP-RTIP is an active electronically scanned array (AESA) radar that can be scaled in size for different platforms.[14] The MP-RTIP uses an active AESA radar for high resolution images and is also capable of detecting moving vehicles through the ground moving target indicator (MTI). Similar technology could be modified to install active AESA radars for detection of aircraft.

In the mountainous terrain of Jammu and Kashmir (J&K) and the northeast, the performance of ground-based radars is extremely restricted; even AWACS and other airborne platforms will perform sub-optimally due to radar shadows.

UAVs in Naval Air Defence

UAVs play a major role as an ELINT platform in the naval air defence. Surveillance and early warning on radar emissions, frequencies of communication and tracking systems provide early warning and add to the reaction time of AD forces. The Indian Navy is already operating the Heron and Searcher Mk II UAVs and plans to induct rotary wing UAVs. Although a VTOL UAV operating from the deck will provide more operational efficiency, a shore-based HALE UAV would be more suitable for carrying radar payload to extend the early warning on flying objects.

THE FIFTH GENERATION: MULTI-ROLE COMBAT AIRCRAFT (MRCA)

The fifth generation aircraft technology is focussed on the system of integrated

14. Tom Kington, "Next Stop for Synthetic Aperture Radar," *Defence News*, February 19, 2007.

systems. There is greater emphasis on situational awareness (SA) of the pilot in the cockpit, through AESA radar, electro-optical/infrared (EO/IR); focal plan array[15], data and information fusion, human and weapon interface and net-enabled targeting. For example, there will be a vast gap between the SA of pilots in the MiG -21, MiG-29 and the SU-30 MKI. The fourth and fifth generation fighters have been classified as force multipliers because of the current cutting edge technologies such as composite materials, thrust vectoring, extreme manoeuvrability, advanced radar and sensors, and integrated avionics designed to reduce the pilot's workload, vastly improving situational awareness. Super cruise and stealth technology are the key features of fifth generation aircraft. "The key to the future air warfare lies in excellent pilot SA and effective pilot vehicle interface (net-centricity); balanced multi-role capability with operational flexibility and precise targeting and rapid kill chain for increased lethality and survivability."[16] In January 2007, India and Russia reached an agreement to jointly develop a fifth generation aircraft. Designated as the PAK-FA, the programme envisages a fighter with all fifth generation capabilities. These include advanced stealth features, a full composite airframe, a crucial AESA radar, advanced integrated onboard sensors, vectored thrust nozzles for superior manoeuvrability, the ability to launch beyond visual range and ground attack missiles, and, importantly, the ability to fly at supersonic velocities without the use of engine afterburners known as super cruise.[17]

The SU-30 MKI is a fourth generation aircraft with additional features; it has been produced to order and meets the requirements of all users, and particularly that of air defence. The integral aerodynamic configuration, combined with thrust vectoring, results in practically unlimited manoeuvrability and unique

15. A matrix of detector cells attached to a semiconductor chip. The detector cells are responsive in IR wavelengths, in which they absorb IR radiation, convert it into electrons, and send a voltage signal in response to form an image. Technically, FPAs operate much like a charged coupled device (CCD), which is used in the visible light portion of the spectrum and is found in video cameras. IR imaging FPA detector cells are composed of materials sensitive to IR radiation. Downloaded from www.xenics.com/Products/Glossary.php on February 22, 2007.

16 Christopher M. Chadwick, vice president, Global Strike Systems Boeing, "The Future of Air Warfare," a presentation on the capabilities of fifth generation aircraft at the Centre for Air Power Studies on July 13, 2006.

17. Shiv Aroor, "Advanced Stealth Fighter Aircraft India-Russia's new Joint Venture," *The Indian Express* (New Delhi) January 24, 2007.

take-off and landing characteristics. Aircraft can carry 12 air-to-air missiles of different categories. Indian Su-30 MKI fighters are also to be armed with the Brahmos cruise missile, under joint development by India and Russia. The Brahmos has a range of 290 km and a warhead of up to 350kg.[18] An excellent long range radar (with flexible azimuth and elevation coverage) married with other target acquisition systems, the ability to network within the formation and with platforms like AWACS, ability to carry a mix of weapon systems, high endurance (nine tons of internal fuel) and ability to refuel in the air, make it a formidable force multiplier for AD operations.

PRECISION WEAPONS

Precision weapons have ushered in a new paradigm of air power application: effect-based operations (EBO). Operational planning now targets key nodes of the system to achieve the desired objective rather than target the entire system for destruction. While targeting the Iraqi Air Defence System (IADS), planners designated the desired mean point of impact (DMPI) that when struck, would disable the command and control functions of the sector operations centres (SOC). As a result, the operational objective of disabling the sector integrated air defence system (IADS) was achieved without having to destroy the entire SOC. The effect-based planning reduced the required number of weapons from eight to two 2,000-pound precision guided munitions (PGMs) directed at SOC on the first night of the war.[19]

Precision weapons directly impinge upon the survivability of ground-based air defence systems. A study of all recent air wars would indicate increasing emphasis and importance of SEAD operations to achieve the desired level of command in the air. In the modern air wars, high value assets (HVA) like aerostats, ground-based radars, command and

Precision weapons have ushered a new paradigm of air power application: effect-based operations (EBO).

18. Su-30MKI: "Multi-Role Two-Seater Fighter Aircraft, Russia." Downloaded from www.airforce-technology.com on January 11, 2006.
19. Col. Edward Mann, Lt. Col. Gary Endersby and Tom Searle, "Dominant Effects: Effect-Based Joint Operations," *Aerospace Power Journal*, Fall, 2001.

control centres, communication hubs, missile sites, etc. would receive the first wave of cruise missiles, laser guided bombs (LGBs), joint direct attack munitions (JDAMS) and anti-radiation missiles (ARMs). A high value asset like an aerostat radar will need a very dense terminal defence protection against concerted air attacks. For example, it has been reported that H2 and H4 bombs in India's neighbourhood have been converted into precision weapons with the add-on kit of the global positioning system (GPS) and inertial navigation system. These bombs are reported to have stand-off ranges of 60 and 120 km respectively and could prove to be very effective against high value assets like aerostat radars, CRCs and UAV control stations. India's potential adversaries have acquired precision weapons of Russian origin such as the Kh-29 air-to-surface missile, Kh-31 anti-shipping and ARM, Kh-59 long range land attack missiles, KAB 1500 and KAB 500Kr laser and TV guided bombs.

NET-CENTRIC WARFARE (NCW)

"As compared to all other force multipliers, the NCW capability, when put in place, will create the most astounding force multiplying effect for any force. The NCW concept revolves on exploitation of force structure by networking each and every sensor and platform so as to achieve exceptional levels of situational levels awareness and, thereby, optimize command and control and decision-making systems and, thus, achieve optimal, economic and efficient application of force."[20] The command, control, communications, computers, intelligence, surveillance, reconnaissance (C4ISR) capabilities of a nation integrated on a net-centric platform would be the biggest force multiplier in the AD network because a net-centric platform is truly an integrated system of systems.

The criticality of the air defence system rests in short reaction times between detection, identification and tactical action. Therefore, sharing of information, improved situational awareness and expeditious decisions are fundamental to air defence operations. In the AD organisation, NCW would mean networking of ground-based radars, AEW platforms, communication hubs, AD fighters, SAM and artillery systems, electronic warfare and integration of army and naval AD

20. Matheswaran, n.4, p.228

assets. The resultant battlefield SA arrives at decisions and a suitable response mechanism based on the networked weapon system. It is an extremely complex process and more so in our case because of the variety of sensors that range from an observer on the border post to AWACS. These sensors are from different countries and of different vintage. Problems of interoperability would also surface while integrating weapon platforms, communication systems and the concept of operations of the sister Services. "Translating this concept into a real operational capability requires far more than just injecting information technology in the form of an information infrastructure or info structure. It requires concepts of operation, C2 approaches, organizational forms, doctrine, force structure, support services and the like all working together to leverage the available information."[21]

The criticality of the air defence system rests in short reaction times between detection, identification and tactical action.

Difficulties notwithstanding, the net-centric platform is imperative for air defence, because it enables the capability of geographically dispersed forces to operate as one integrated force. The entire cycle of air defence functions from detection of threat to its identification as friend or foe, confirm the availability and state of readiness of weapon systems; and the decision to commit the weapon system and control the fighters to intercept the strike aircraft requires extensive communication. Control and coordination among sensors, weapon systems and command and control centres is so time critical that even a small delay or wrong decision could result in achieving or not achieving a kill on enemy forces. Therefore, the timeliness and correctness of decisions becomes critical. A networked force would function more efficiently because of high situational awareness and resultant coordination. In short, NCW will enable the rapidity of operations due to a faster observe, orient, decide, and act (OODA) cycle.[22] The other advantages of net-centric warfare are:

21. Davis S. Albert, John J. Garstka, Frederick P. Stein, *Net-Centric Warfare: Developing and Leveraging Information Superiority* (CCRP Publication Series, second edition, February 2000) on http://www.dod.mil/ nii/NCW.
22. Matheswaran, n.4, p.229.

- Information superiority enabled concept of operations.
- Higher speed of decision-making and effective command and control.
- Greater coordination in conduct of interception.
- Timely and precise information for engagement by terminal weapons.
- Reduced sensor to shooter cycle.
- Possibilities of inflicting higher attrition on enemy forces.
- Increased survivability of key assets like airfields, critical bridges, dams, civil and military installations.

SURVIVABILITY VS VULNERABILITY

The operational potential and enhanced combat efficiency extended by force multipliers enhance the survivability of key assets and offensive elements but make them vulnerable to hostile attacks. The exorbitant cost, overarching role in air operations and the psychological impact of losing one force multiplier could have public and political implications which multiply owing to extensive media coverage of all wars. The cost of such force multipliers is an overriding factor; for example, three AWACS could cost upward of $ 1.1 billion and reports indicate that one aerostat system is likely to cost nearly $ 40 million. Such platforms will require additional protection and air defence measures such as CAP, and surface-to-air missile systems. The vulnerability of force multipliers, therefore, becomes a critical factor in operational planning, deciding the home base, area of operations and, most importantly, air defence resources consumed by force multipliers.

The vulnerability of force multipliers also imposes certain restrictions on the operational exploitation. The vulnerability of AWACS to a hostile intercept, anti-radiation weapon system or simply a long range surface-to-air missile compels the operational planners to operate such a crucial force multiplier 150 km inside own territory, thus, losing out on the major part of the operational advantage. Also, there has been an ensuing debate on AWACS busting and it has been extensively discussed in the air force and the civilian circle of think-tanks. Though history would tell us that not even one AWACS has been shot down till date, the air wars involving AWACS were fought in conditions of asymmetry of forces, which may not be the case with India. The third issue pertains to economy of air effort – the

extensive early warning may obviate the requirement of CAP; some might argue that the air effort which was saved from CAP missions will now be utilised for AWACS protection. This argument may be right but it is to be seen in the light of the following factors:

- The stage of operations: the extent of air dominance the forces enjoy will decide the extent of protection required by AWACS.
- Except for high mountainous terrain, AWACS provides a minimum 250 km of warning of hostile aircraft, therefore, terrain and geographical location of air operations become very important in the case of AWACS.
- The air effort required to defend an AWACS for eight to ten hours would be much less compared to 24 hours CAP.

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Similar arguments are extended as regards utilisation of air-to-air refuelling. During operations, demands for tankers will outnumber the availability; therefore, aerial refuelling between various ongoing operations will have to be prioritised. The SU-30 and M-2000 class of aircraft will primarily carry out the air dominance missions and they will require aerial refuelling in the course of their operations, and outbound strike missions would prefer the tankers being positioned en route, to refuel shortly before leaving own territory. Similarly, missions recovering from hostile territory may require emergency refuelling to divert or recover at another base in greater depth. Hence, the air-to-air refueller will have to operate as close to the border as its safety will allow. The safety of the tanker will also be a consideration for operational planning, selection of a safe tow line beyond the adversary's radar coverage and at adequate depth from the border at which the tanker would be safe from a surprise attack. Location of launch bases and routing of offensive missions and air defence aircraft cover, the control and safety of receivers and a separate V/UHF RT channel for effective

control of the tanker are the major planning factors for aerial refuelling.

The success or failure of air defence operations hinges on the ability to operate in an integrated and coherent fashion, capable of applying firepower on hostile airborne objects, from detection to destruction. The advantages of a net-centric platform have already been covered earlier but the vulnerability of net-centric warfare lies in cyber warfare. Like any other information technology-based platform, net-centric warfare is also vulnerable to leakage of information, hacking, viruses, sabotage and subversions. While it gives significant advantage in maintaining the speed of information sharing, decision-making and force application, the collapse of the NCW platform could have the opposite effects. The security and survival of the NCW platform is, therefore, of prime importance, and planners may have to build in redundancy by planning multiple communication routes, alternate servers, building storage capacities, adherence to information security procedures, etc.

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The study of the air wars in the last three decades would suggest that the vulnerability of a force multiplier is a significant factor only in the case of force symmetry and absence of air superiority. Air forces that won their battle of air superiority / dominance could afford to exploit the force multipliers with greater freedom without miscalculating the vulnerability aspects.

FORCE MULTIPLIERS AND AUTOMATION

A force multiplier in isolation will address specific problems like early warning, reaction time, endurance or firepower but without a proper command and control system which can orchestrate and synergise the entire operation, the force multiplier would be utilised sub-optimally. The IAF continues to build on its past experience and indigenous research and development in collaboration with public and private sector companies, to develop a fully automated and integrated system. The complete potential of force multipliers could be best exploited when integrated

on a net-centric platform to generate a combined effect of surprise, speed, flexibility, concentration of firepower, and mass with economy of effort.

Airborne early warning and command and control platforms like AWACS and aerostat radars would resolve the problem of detection and reaction time. The radar integration will facilitate a composite air picture and rapid flow of information on data channels will significantly improve situational awareness. This alone will have a far-reaching impact on all the other functions of air defence. The reaction time would be adequate to obviate any error in identification and ensure that friendly forces are warned of an impending threat, and our own force, if in enemy territory, could be identified and recovered safely at alternate locations. This would also give adequate time to warn the air bases and upgrade the readiness state of terminal weapons. Army formations in TBA and air defence elements of the strike and holding corps will have access to the composite air picture which will improve control and coordination of army air defence weapons. The situational awareness and improved coordination will give more precise information to terminal weapons of vulnerable areas/ vulnerable points (VAs/VPs) on strike direction, number of aircraft, etc; thus, the task of allocation and engagement of hostile tracks to AD artillery and short range air defence systems (SHORADS) would become more streamlined and achieve higher attrition on hostile forces.

Integration of force multipliers on an automated platform would play a significant role in SEAD operations. ELINT and COMINT gathered by AEW platforms and UAVs will provide vital information on the deployment pattern and electronic ORBAT of the adversary. This information will be used for planning, guidance and delivery of precision weapons against two to three tier chains of low level radars or one could simply avoid these radars and low-level air defence weapon systems by flying medium levels under own radar cover.

THE DOCTRINAL IMPACT

It needs to be reiterated that force multipliers demonstrate their impact on the entire force and not on a particular operation. Therefore, force multipliers will have an all encompassing impact on the way the IAF will apply aerospace power in the future. The overwhelming impact of force multipliers in Bekaa Valley,

Desert Storm and Operation Iraqi Freedom (OIF) needs no emphasis and the lack of AEW capabilities and its fallout in the Falklands War are also well known. To understand the impact of force multipliers, we need to study the strategic, operational and tactical implications for air defence operations.

Strategic Aspects

The air force strategic doctrine would be to achieve "control of the air" because ultimately that will decide the effectiveness of the rest of the air operations. At the strategic level, the impact of force multipliers will be felt in the planning, execution and success of air force strategy. The air dominance operations would be the most critical part of "control of the air," and force multipliers would play a vital role. A force multiplier by itself is not capable of winning a battle; it is the integration and synergy with conventional forces that would bring in the desired results. An aggressive approach and synchronised proactive actions will best exploit the capabilities of force multipliers. Active air defence components will play a significant role in overall execution of air dominance operations, integrated employment of terrestrial, airborne and space-based systems will enhance security and survivability of own offensive elements which generates the force multiplication effect. However, for this entire strategic vision to work successfully, broad doctrinal guidelines and policy instructions would have to be issued top down, which would lead to revision of the existing Air Staff Orders (ASO), standard operating procedures (SOPs), and a more flexible approach for innovative tactical options.

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Operational Aspects

At the operational level, the biggest impact of force multipliers on AD would be to alter the way we have been conducting our AD operations. Higher situational awareness, self-synergistic actions and ability to share data would

shift the emphasis from concepts of point defence to area defence. Command and control platforms, enhanced communication facilities and integration of systems will make it obligatory to review the existing organisational structure. Force multipliers will engender more flexibility to shift the command and control responsibilities from ADDCs to AWACS and vice versa on an as required basis.

We also need to consider shifting our launch bases in greater depth to increase their survivability, and be beyond the range of the adversary's AEW/ESM systems. It is a long-term and capital intensive process, therefore, a plan to gradually shift launch bases in a phased manner may work over a period of the next 10-15 years. Launch bases in depth give more time to react and intercept / destroy the impending threat. Higher survivability of our launch platforms would ensure retaliatory capability in both conventional and unconventional conflicts. Similarly, after the fructification of all modernisation plans, there will be a case for review of the air defence organisation.

Force multipliers provide round the clock surveillance capability in depth of the adversary's territory, to monitor and instantly counter-attack its offensive elements. Israel and the Coalition forces used UAVs, AWACS and JSTARS with enormous success for constant surveillance and offensive operations in Bekaa Valley and the Gulf War respectively. Hence, there will be more stress on offensive sweep and free escorts as compared to combat air patrol. The offensive potential of air defence elements will have a significant impact on the planning of counter-air operations and the cumulative impact of force multipliers would actually blur the line between offensive and defensive counter-air operations. Long and medium range engagement by surface-to-air missiles would become the main features of area defence.

AD assets will also be taken into consideration in the planning and execution of air transport support and airborne assault operations. This is not to say that they were not taken into consideration till now, but not much assistance could be extended hitherto. Force multipliers, however, will provide positive radar cover, threat warning, protection by AD fighters and assistance in recovery from the area of operations.

Tactical Doctrines

The entire premise of tree top low-level tactics will become redundant in the face of gap-free low level cover and more so in the case of AWACS symmetry. In Operation Desert Storm as well as Operation Iraqi Freedom, the USAF flew all their missions at medium levels under the extensive radar cover provided by AWACS and also reduced their attrition from low level air defence systems (LLADS). On the other hand, British Tornados were constrained to fly at low level and suffered heavy attrition because their weapons could be delivered only at low level. The IAF needs to reexamine its operational philosophy in the future, because the shift from low level to medium level would require a change in training patterns, weapon systems and weapon delivery profiles. Besides higher survivability, the medium level approach also affords a larger radius, longer range and freedom of manoeuvrability.

The IAF needs to reexamine its operational philosophy in the future, because the shift from low level to medium level would require a change in training patterns, weapon systems and weapon delivery profiles.

There will be a substantial change in the employment of weapon systems and support operations in the battlefield. Aerial combat will completely shift from visual to beyond visual range interceptions. The dependence on ground control intercept (GCI) will reduce and after initial input on target, interception will become increasingly autonomous. Threat location, target parameters and control instructions will be passed on data link, reducing voice communication and susceptibility to electronic interference.

Extended low level radar cover would facilitate positive radar cover, threat update, routing through safe routes and quick identification and safe recovery of counter-air and battlefield air interdiction (BAI) missions, combat search and rescue (CSAR), special heliborne operations (SHBO), ELINT missions, etc.

Coordination between the army and air force will improve with better situational awareness. Air space management in TBA will lay greater emphasis on real-time, positive control which hitherto was not possible owing to poor SA

and communications. Procedural controls are more restrictive in nature and considered suitable only in the case of unreliable / poor communication. The communication network of the army and air force has been modernised and continues to improve. Therefore, the safety of friendly forces will increase, and the perpetual fear of being shot down by friendly fire will diminish considerably, if not vanish. In most cases, the inability to identify a friend from foe, grossly inadequate reaction time and the fear of being attacked are factors that lead to fratricide. The surveillance and intelligence elements of force multipliers normally give adequate reaction time to identify and follow the procedures. Steady radar pick up, ability to handle a large number of tracks and maintain an identified air picture will improve the quality of air space management over TBA.

Coordination between the army and air force will improve with better situational awareness.

FORCE MULTIPLIERS AND FORCE STRUCTURE

It is widely believed that induction of force multipliers and automation of air defence operations would help reduce manpower. With an increasing number of computers and networking, databases and automation, manpower reduction may sound very logical, but the experience in the recent past has indicated otherwise. Specifically with regard to the air defence system, one could cite two examples, the first being the automated display of the air picture – a typical manual air defence organisation would require observers and plotters to display the air picture an plotting boards, and in a semi-automated environment, an observer and a feeder are still required to feed the information into computers to display and update the air picture. Similarly, on a mobile observation post, we would still require two personnel to observe and feed the observation data on the communication

Induction of force multipliers and modernisation of the air defence infrastructure will demand considerable emphasis on the quality of manpower required.

network although the display at the far end may be automated. With computerisation and automation more and more specialised, trained personnel will be required to maintain the expected standards of efficiency. Therefore, the existing standards of automation and networking have not resulted in the expected reduction in manpower.

On similar lines, any expectations of instant reduction of manpower with the induction of force multipliers may not stand the test of time. However, once we achieve the levels of total integration on a net-centric platform and all three Services achieve the same levels of automation in their operations, it may be possible to reduce manpower by 15-20 per cent, but that may take another decade and a half. Hence, the major alterations in force structure may still seem distant but there are other more important issues pertaining to recruitment of quality manpower, specialised training and, most importantly, bringing in the attitudinal changes and awareness by educating the leadership at all levels on the impact of force multipliers, their performance capabilities and limitations, and how they will impinge upon the requirement of manpower.

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MANPOWER AND ORGANISATIONAL ASPECTS

Air Vice Marshal Kapil Kak has very aptly brought out, "Meeting the challenge of RMA may demand substantial changes in doctrines, organisations, maintenance philosophies and, most of all, attitudes."[23] To develop a coherent and integrated operational philosophy for optimal exploitation of force multipliers in AD operations, there is a need for organisational restructuring, better command and control and utilisation of resources. Force multipliers are technology intensive; therefore, training on operations, exploitation and maintenance of the systems is an imperative. There are several examples where radars, data handling systems or even

23. Kak, n.5.

aircraft have not been fully exploited or have been underutilised due to lack of training or understanding. Operational exploitation of the systems would also mean attitudinal flexibility apart from inventive and ingenious ideas for exploitation of technology to generate asymmetry of forces. Along with intensive on the job training, the concept of operations and doctrinal changes will have to be made to adapt to the revolutionary changes.

Induction of force multipliers and transformation of the air defence infrastructure will demand considerable emphasis on the quality of manpower that is required to man, operate and exploit these systems. Advance technology platforms like AWACS, fifth generation fighters, etc will require technology-savvy manpower, with appropriate educational qualifications. This specialised manpower then would have to train on specific systems and, more importantly, be educated on the utilisation and operational exploitation of force multipliers in modern air warfare. Lessons from the Arab-Israel War in 1973, a study of the air wars in Bekaa Valley, Falkland Islands, Gulf War, Kosovo Campaign, Iraq War and the war in Lebanon in 2006 give a very good idea of how force multipliers have impacted the outcome of wars, where they can be used successfully to swiftly attain military objectives, as well as in other areas where technological superiority has not helped achieve the desired results. For example, post-war stability and peaceful transfer of power in Iraq and the failure of the Israeli Air Force to achieve operational objectives in the Lebanon War of 2006. The leadership at all levels will need to understand the implications of force multipliers and their effect on war-fighting capabilities and the required changes in doctrine.

The problem of recruiting the right quality manpower is mired in complications. Economic growth and rapid changes in social values have altered many parameters affecting the quality of manpower for the defence forces.[24] In last three-four years, the IAF has experienced the problem of retaining the skilled and trained manpower, losing them to more lucrative offers by private and public sector enterprises. Money, stability of residence,

24. Air Commodore Jasjit Singh, *India's Defence Spending*, Second Edition (New Delhi: Knowledge World in association with IDSA, 2001), p. 103.

children's education and family commitments have been the main reasons. Former Chief of the Air Staff, Air Chief Marshal S. P. Tyagi (in a talk at DRDO Bhavan on March 16, 2007), spoke of retaining the trained manpower as the biggest challenge for the aerospace leadership. While it is true that the increasing cost of manpower, pay and allowances and the burden of pensions will remain a nagging issue, at the same time, the requirement of technology-savvy, information technology-oriented manpower is imperative for a modernised air defence force. If anything, the changing socio-economic scenario will only increase the burden of pay and allowances for the armed forces to remain competitive in the order of priority of jobs. Some of the possibilities that may be considered to ease the pressures of retaining and recruiting the potential manpower are as follows:

(a) **Civil-Military Interface.** Consequent to economic development and growth of the defence industry in the civil sector, it may be a viable idea to use civilian employees of the private and public sectors in the high-tech environment, especially in maintenance activities. However, the pros and cons are to be weighed in the context of quality of services provided, financial implications and security issues, etc.

(b) **Review the Term of Service.** The major aspect of the manpower problem in the armed forces is the opportunities of growth in terms of promotions, pay packages, early retirement and rehabilitation post-retirement. The term of service needs to be reviewed to meet this challenge. A shorter term of seven to eight years, followed by five years of reserve liability, may serve the purpose of the armed forces and the aspirations of the youth. At the end of this 12-year commitment, instead of a life-time pension, personnel may be extended nominal facilities like membership of messes, canteens and medical facilities up to a certain period or age.

(c) **Educational Qualifications**. In a high-tech environment, general education is not good enough; we need specialists in specific areas. If engineers are required for maintenance, servicing and overhauling, even operators need to have a technical bent of mind to understand, study and exploit the systems to

maximise their potential. As in the civil enterprise, there are MBAs in every stream of corporate functioning. We also need to induct specially trained personnel with appropriate backgrounds in air traffic control (ATC), fighter controlling, logistics and accounts. For example, a maths and physics background may help a fighter controller or a radar operator to understand the technological aspects of radar, communication and aircraft.

(d) **Information Technology Orientation.** The entire process of modernisation of the armed forces revolves around automation, transparency of information, reducing paper work, more efficient data handling and time management. Thus, all spheres of activities are being computerised, and networking and integration of systems has become inevitable. In the last decade, the IAF has made significant progress in spreading awareness and education on information technology (IT) equipment, networking and communication processes. However, very few air warriors carry the enormous burden of making the IAF IT-savvy. Although progress is being made, inclusion of IT courses and diplomas in educational qualifications for all personnel will accelerate the process and meet the future requirements.

(e) **Role of Simulators**. Irrespective of how they are used and whom they actually fight, the armed forces of a nation are established to fight full-fledged conventional war against a known and identified enemy. Such full scale conventional wars are becoming rare in the changing politico-economic scenario. In the absence of conventional wars, and with rising costs, simulators will play a very important role in the training of personnel. Simulation of real-time war scenarios and generating specific conditions to meet the expected threat scenarios will help prepare the forces for actual operations while keeping the costs under control. While one may argue that simulators never give the realistic feeling of operations and more often than not, simulated scenarios are generated to suit own perceptions of threat and weapon systems, war-gaming simulators can, however, help appreciate many aspects of air warfare that will not be realised otherwise.

In an important announcement, Chief of the Air Staff, Air Chief Marshal F. H.

Major has said that the IAF will concentrate on human resource issues.[25] All aspects of manpower management recruitment, training, follow-up training, retention and retrenchment need to be comprehensively reviewed to maintain competent, professional force levels in all streams of the IAF. Gone are the days of recruiting personnel with basic graduation/post-graduation degrees, retaining them for 20 years and retiring them just when they are transiting through mid-life crises. The focus should be on getting the right quality of manpower, with relevant educational qualifications, and educating the lower and middle level leadership on the significance of transformation brought in by force multipliers and the way they will impact the future of air wars.

CONCLUSION

The force multipliers are not replacing the conventional ground-based air defence systems; rather, these assets will provide a more synergistic, efficient and responsive air defence network. While operating inland, these assets will provide a redundancy to existing ground-based systems and while operating beyond our territorial boundaries, force multipliers will provide added capability to the IAF, which hitherto was not available – to carry their AD assets along with them for out-of-country contingencies.

Developments in the fields of information, communication and networking have transformed aerospace power into an inherently expansive force multiplier to the military power of the nation.

The impact of force multipliers on air defence operations cannot be quantified in terms of the number of VAs/VPs defended or the percentage of attrition imposed on hostile forces. The impact of force multipliers is more apparent on AD operations because of enhanced survivability and offensive potential. "The developments in the fields of information, communication and networking have transformed aerospace power into an

25. By Special Correspondent, "LTTE Air Strike an Irritant, not Threat," *The Asian Age*, April 10, 2007, at http://203.197.197.71/presentation/leftnavigation/news/india.

inherently expansive force multiplier to the military power of the nation."[26] On similar lines, acquisition of AWACS, aerostats, and UAVs will tremendously boost the ISR capability, AR will multiply the reach and flexibility, precision weapons are more destructive with economy of effort, and net-centric operations will harness the potential of all force multipliers into one platform. Effective air defence involves integration of sensors, weapon systems, communications, electronic warfare and real-time transfer of data and technology. The combined potential of all the force multipliers could be enumerated as:

- Greater line of sight; extensive early warning.
- Enduring observation window; 24x7 SIGINT operations.
- High situational awareness and self-synchronisation.
- Smaller OODA loop.
- Reduced sensor-to-shooter cycle.
- Enhanced reach and flexibility.
- Higher survivability.
- Redundancy for conventional control and reporting organisation.
- Concentration of firepower, with precision and economy of effort.
- Capability to inflict greater attrition on the adversary's air power.

Now, the following questions may arise: are these capabilities exclusive to AD operations alone? Will defensive operations with force multipliers lead to air dominance? The answer is "NO". However, the point being driven home is that the offensive elements of AD can now create a situation which will help achieve air dominance. There is a much larger role for air defence in supporting offensive operations. The AD aircraft can be positioned beyond our borders and territorial waters, and need not be reactive; SAMs can engage hostile aircraft before they cross over. The other air operations, including offensive air operations, which were earlier conducted without or with negligible support of AD systems, now have a larger stake in the success of the expanding role of air defence elements. The impact of all these capabilities will be seen in the prosecution of an air war and the role of air defence in achieving the objectives of the air war. Nonetheless, the most important aspect is that the role of force multipliers in AD operations is definitely

26. Matheswaran, n.4, p. 233.

changing the defensive and reactive image of air defence. At least in the Indian context, increasing use of force multipliers, space-based capabilities, and multi-role fighters in all type air operations, in the long-term, will remove the defining lines of offensive, defensive, tactical and strategic operations, and integrated on a net-centric platform, all missions will just have one task – "air operations".

MILITARY POWER AND STRATEGY OF IRAN

SHELLY JOHNY

The series of events which followed the September 11, 2001, terrorist attacks in the US have finally resulted in the strengthening of Iran's position in West Asia. Iran always had the potential to become a big regional power in West Asia because of its geographical size, population and resources. But because of a number of reasons, it was denied this opportunity during much of the 20th century. The closest that Iran came to securing such a position was during the time of Reza Shah Pahlavi during the 1960s and 1970s. In the context of the British withdrawal from the Gulf region during this period, Iran saw itself as responsible for filling the void left over by Britain and maintaining stability and security in the region from a position of strength.

The Iranian Revolution disrupted the plans of the Shah and Iran entered a period of isolation in international politics when its relations with the two superpowers and most of the states in West Asia were strained. The Iran-Iraq War which followed almost immediately after the revolution severely undermined Iran's economy. At the same time, the conflict helped unify Iran politically under Ayatollah Khomeini. Iran's strained relations with the major powers did not prevent it from involvement in the politics of the wider West Asian region, especially in Lebanon. In fact, as will be discussed later in this paper, Iran's activities in West Asia during the 1980s, paid rich dividends in the 1990s and the period following the September 11 attacks. Militarily, Iran's capabilities were very much weakened due to the eight-year war. During the

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1990s, Iran got the opportunity to rebuild its military strength because of its lack of involvement in any major conflict. A major factor that worked in favour of Iran was the destruction of Iraq's military might. During the Iraqi invasion of Kuwait in 1990, Iraq had the fourth largest army in the world. That war, the subsequent decade-long sanctions and, finally, the US invasion and occupation of Iraq in 2003, completely decimated the Iraqi armed forces. This has left Iran as an influential regional military power in the Gulf region, besides the US which is basically an external power.

This paper will assess Iran's military strength by studying its force structure which includes the Regular Iranian Armed Forces and the Islamic Revolutionary Guards Corps (IRGC) which is also called the Pasdaran in Farsi. An attempt will be made to understand the differences in the duties and responsibilities of these two forces and, thereby, their impact on Iran's defensive and offensive military capabilities. This paper will also study Iran's nuclear and missile capabilities and look into its links with radical Islamist guerrilla movements like Hezbollah, Hamas and Palestinian Islamic Jihad. Iran's links with Hezbollah are important not only because of Iran's role in creating that movement but also because of its ability to use Hezbollah to attain its strategic objectives. Besides analysing these factors, Iran's strategy, operations and tactics during the Iran-Iraq War will be looked into as this was the only major conflict that Iran fought during the last century. Such an analysis will help us to understand how Iran is likely to act in any future conflict in that region.

IRAN'S MILITARY STRATEGY AND TACTICS (IRAN-IRAQ WAR)

The objective in this section of the paper is not to go into the history of the Iran-Iraq War or the reasons for its outbreak. It will merely look into the military strategy and tactics deployed by Iran during the war. At the time of the Iraqi invasion, the Iranian armed forces had a standing strength of 413,000 men. The army strength was about 285,000 men. The Iranian Navy was 28,000 strong and the air force strength was about 100,000. The combat formations of the army basically consisted of three armoured divisions and an armoured brigade. This consisted of about 2,000 tanks, 800 armoured personnel carriers and 1,000 guns.

There were three infantry divisions, one special forces brigade, and an airborne one. The Army Aviation Command had about 58 aircraft and over 200 helicopters. There were four battalions of United States Hawk surface-to-air missiles. Tanks included the United States M-47, M-48 and M-60, as well as British modified Chieftains. Light armoured vehicles included the British Scorpion, Fox and Ferret, the American M-113, and the Soviet BTR series. The guns included the 75mm, 85mm, 105mm, 155mm, 175mm and 203mm. The anti-tank missiles included the French ENTAC and SS-11, and the United States Dragon and tube-launched, optically tracked, wire-guided missile (TOW). Iran also had many of the latest American helicopters.

The Iranian Navy had 11 destroyers, frigates and corvettes, and 23 other surface craft, together with 16 hovercrafts; but no submarines. The destroyers were armed with British Sea Cat missiles. The Naval Air Service had about 24 aircraft for maritime reconnaissance, and used about 30 helicopters in an anti-submarine warfare role. There were also three battalions of marines. The Iranian Air Force had about 460 combat aircraft, mainly F-4 Phantoms and F-5s, but more modern ones included 79 F-14 Tomcats, and 16 RF-4Es, backed by a tanker squadron, and squadrons of transport aircraft. Missiles included the Phoenix, Sidewinder, Sparrow, Maverick and Condor. Airfield installations were protected by the British Rapiers and US Tigercats. The air force had about 164 helicopters, mainly American, but also 16 French Super Frelons. The biggest weakness of the Iranian armed forces was that they had not completely absorbed all this hardware. About 40,000 military advisors, training staff and technicians, mainly American and British, were in Iran to aid this absorption process.[1] This process was brought to an abrupt halt due to the Iranian Revolution.

MILITARY STRATEGY

Iraq had invaded Iranian territory when Iran was barely recovering from the revolution that had taken place earlier. Iran was also facing sanctions from the international community, especially since the beginning of the American hostage crisis in Tehran at the end of 1979. While Iraq had mostly relied on armour and

1. Edgar O' Balance, *The Gulf War* (London: Brassey's Defence Publishers, 1988), pp.14-15.

The IRGC was a paramilitary force that had been created and developed by the ruling Shia clergy as a political and ideological force immediately after the revolution.

artillery during its invasion, Iran was badly in need of weapons spare parts. The Iranian Regular Armed Forces were not trusted by the Iranian revolutionary authorities and many purges had been conducted, leading to the execution of several senior officers. Many more of the officers had been arrested and imprisoned on suspicion of plotting against the government. There was a severe shortage of technically qualified people to operate battle tanks and fighter planes. In such circumstances, the Iranian preference was to rely on its excessive manpower in the form of the IRGC infantry and thousands of Basij volunteers. The IRGC was a paramilitary force that had been created and developed by the ruling Shia clergy as a political and ideological force immediately after the revolution.

As most of the Iranian leadership did not expect an invasion from Iraq, they did not have any proper military strategy at the beginning of the war. But Khomeini's call for converting every occupied city and town into a "Stalingrad" was heeded by the Iranian fighters and brought a halt to the advance of the Iraqis. The Iraqis' blunder of excessively relying on armour with insufficient infantry helped the Revolutionary Guards to effectively engage the Iraqis in urban warfare.[2] During the rainy season of 1980, the Iranian military strategy was to use this period to prepare their armed forces for the offensive drive in the spring until which the Iraqis were not expected to act. In the following period, the Iranians successfully used their superiority in numbers by launching "human-wave" attacks against the Iraqis and dislodged them from Iranian territory. In a battle, the Iranians would launch successive human-waves of infantry against Iraqi positions, overwhelming them in the process. From the Iranian viewpoint, it was possible to gain a large number of recruits for such heavy-casualty operations because of the Islamist revolutionary fervour that was prevalent in Iranian society. After the Iraqis had been evicted from

2. Chaim Herzog, "A Military-Strategic Overview," in Efraim Karsh, ed., *The Iran-Iraq War: Impact and Implication* (London: Macmillan Press Ltd., Jaffee Centre for Strategic Studies, 1989), p. 260.

most of the areas occupied in 1980, Iran invaded Iraq with the objective of capturing Basra as the Iranian leadership believed that the fall of that city would prompt the Iraqi Shias to revolt against Saddam's government.

Except for a few exceptions like the battle of the Fao Peninsula in 1986, Iran's strategy of human-wave attacks did not work against well defended Iraqi positions. After the initial defeats, the political leadership in Iran decided to fight a war of attrition against Iraq with no grand offensives in 1983.[3] But after winning some victories, a debate ensued between the Iranian leaders who were either the supporters of the Regular Armed Forces or the Revolutionary Guards. The Regular Armed Forces and their political supporters favoured fighting a war of attrition against Iraq where Iran's superiority in numbers would wear down the Iraqis. But the supporters of the Revolutionary Guards or Pasdaran, like the Speaker of the Iranian Majlis, Hashemi Rafsanjani, believed that the best strategy was to continue to launch human-wave attacks and push into Iraqi territory. What really came to be implemented was the latter strategy which paid no major dividends after the Fao victory. Finally, after rebuilding their armoured forces, the Iraqis pushed back the Iranians and advanced almost twenty-five miles into Iranian territory, forcing the Iranians to call a ceasefire. During the course of the war, the Iranians had greater success in the northern mountainous region where they effectively used Kurdish fighters from the Kurdish Democratic Party (KDP) and commando units from the Regular Armed Forces to push into Iraqi territory.

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The military strategy with regard to the air force was to prevent it from being used in operations where it was likely to suffer huge losses because of Iran's lack of access to technology. These assets were mostly used against less-defended and vulnerable economic targets like oil refineries and oil tankers. There were few instances of the Iranian Air Force engaging in dog-fights with the Iraqis, and

3. Dilip Hiro, *The Longest War: The Iran-Iraq Military Conflict* (London: Grafton Books, 1989), p. 96.

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Iranian fighters did not take part in many tactical missions or provide much support to ground troops during battle. The Iranians conducted air strikes and fired missiles at Iraqi urban centres in retaliation for Iraq's bombing of Iranian cities. The naval strategy was perhaps in certain ways much more important to Iran than the ground or air strategies as this was the only area where Iran could economically hurt Iraq's supporters in the Gulf and possibly influence the international community to put pressure on Iraq in a manner favourable to Iran. This was because of the vast quantities of energy supplies that were passing through the Straits of Hormuz in the Gulf. In the later phases of the war, Iran threatened to close these straits if Iraq conducted attacks on Iranian ports or oil installations. Iran also conducted attacks against shipping in the Gulf without claiming any responsibility in the hope that Iraq would be blamed for them. These strategies were employed along with the expected ones of denying Iraq access to the Gulf while making sure that Iranian ports remained opened.

MILITARY OPERATIONS

As Iranian military operations were heavily dependent on the infantry, the Iranians used anti-tank infantry weapons like the RPG-7 and Sagger anti-tank rockets. This was to compensate for Iran's lack of enough operational battle tanks to fend off Iraq's armoured columns. Later on during the war, Iran received even the more advanced TOWs from the US for the release of American hostages in Lebanon. These missiles were then reported to be used against the Iraqis during the war. Iranian soldiers were mostly armed with West German G-3 and Russian Kalashnikov rifles. Besides the British Chieftain tanks, the Iranians used Libyan supplied Soviet T-54, T-55 and T-62 tanks. Iranian artillery played a major role from the very beginning of the conflict. A majority of the Iranian fighter planes which were used in combat were F-4 Phantoms. More than the fighters, Cobra helicopter-

gunships saw action in the form of providing ground support, especially during the early stages of the war. The Iranians had SAM-7 missiles in their stocks which they received from Syria and Libya.[4] Negotiations with the Americans helped Iran obtain Hawk anti-aircraft missiles. The missiles that were launched against Iraqi cities were of the Scud-B type which they had received from the Libyans.

Most of the Iranian air attacks on Gulf shipping had been launched from the airfield on Lavan Island, in the Straits of Hormuz, roughly opposite Qatar, and had been carried out in the southern part of the Gulf. In June 1985, the Iranians positioned airworthy Phantom aircraft at Bushehr, enabling them to attack shipping much further north in the Gulf than before.[5] Iran further improved its capability to hit vessels in the lower Gulf by building a helicopter base on its offshore oil platform at Reshadat which is 75 miles from the Qatari coast. [6]The Iranian Revolutionary Guards Navy used Swedish Boghammer boats against targets at sea.

MILITARY TACTICS

During a typical human-wave attack, the infantry would attack in rows, with armour and artillery providing flank support which would fire a rolling barrage over the heads of the advancing troops. This cover would last only for a short distance. Then the infantry would move in distances of about two miles each time. After covering such a distance each time, the Iranians would halt and consolidate before making the next rush forward, often in the face of artillery and machine-gun fire. During Operation Fatah al-Mobin in March 1982, the Iranians managed to encircle the Iraqis and squeeze them in a pincer movement. Through their local intelligence, the Iranians identified and located Popular Army detachments between regular formations. They then targeted these formations and destroyed them so that the flanks of the Iraqi regular brigades would be exposed. In this manner, the Iranians encircled the Iraqis and cut them off from their supply lines.[7] The Iranians also used the nature of the terrain to stop the

4. O' Balance, n. 1, p. 73.
5. O' Balance, Ibid., p. 171.
6. Hiro, n. 3, p. 146.
7. Hiro, Ibid., p. 80.

advance of the Iraqi invasion force. For example, the Iranians opened the sluice-gates on the Kharkheh River, caused flooding to stop the advance of the Iraqi Army in 1980.

The Iranians effectively used commando tactics during Operation Wal-Fajr-8 when they infiltrated frogmen to the west of the Shatt al-Arab waterway to secure the Fao Peninsula. They had used the same tactics in the Haweizeh Marshes when they utilised small crafts and rubber boats to ferry troops. The Iraqis could not completely take back the Majnoon Island complex then as the Iranians controlled the floating roads and platforms that criss-crossed the reed filled marshes. They used helicopters, motorcycles, and boats to move about and fight. The Iraqis could not use their artillery and tanks in the narrow roads to counter-attack.[8] The Iraqis found it hard to recapture the Majnoon Islands as Iran had by then established specialised amphibious commando units of about 1,000 men.

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In the sea, the Iranians began to respond to the tactics used by the Iraqis while bombing the Kharg Island terminal. The Iraqi fighters flew at very low altitudes, evading Iranian radar, and then rose sharply near the target. This enabled them to fly directly over the Iranians' air defence equipment, take effective electronic counter-measures (such as jamming the radars of the enemy missiles) and direct their anti-radiation air-to-surface missiles with active radars at their targets. This was the task of the first wave of attacking Iraqi jet fighters. The succeeding waves fired stand-off air-to-surface missiles at the range of 3.5 to 5 miles. This caused considerable damage to the Kharg terminal. The Iranians soon learned to identify the flight profiles of the Iraqi warplanes. They reinforced their short range air defence to compel the Iraqi attackers to stick to higher altitudes. They refurbished their electronic counter-counter-measures and they adopted radar

8. Hiro, Ibid., p. 104.

emission tactics which made it difficult for Iraqi anti-radiation missiles to home in on their targets. The Iranians modified some of the key oil facilities to reduce their radar emissions and used decoys or radar reflectors to mislead Exocet anti-ship missiles.

The Iranians began to shift their oil transportation facilities when attacks against Kharg increased. They ferried crude oil in Iranian tankers from Kharg to Sirri Island, 340 miles to the south and out of the range of Iraqi warplanes. There it was stored in "mother ships" for transfer to the customer's tankers. This route came to be known as the "Sirri Shuttle."[9] The Iranian Navy began providing protection to oil tankers and ships coming to the Kharg Island and Bandar Khomeini ports by arranging them into convoys and making them sail close to the Iranian coastline to obtain maximum protection from land-based aircraft, guns and missiles. Some of these convoys also towed rafts on which large radar reflectors were fixed to attract enemy missiles away from the ships themselves. The Iranians also diverted Exocet missiles fired by the Iraqis away from ships by tethering gigantic balloons to barges towed behind the convoy.[10]This was in a situation when the Iraqis declared a "Naval Exclusion Zone" in the Gulf area to prevent the functioning of Iranian ports.

In 1984, Iran decided to strike at shipping visiting Saudi Arabian and Kuwaiti ports and oil ports without claiming responsibility in the hope that the blame would be put on Iraq. In such an attack, first a 'spotter' plane would locate the target and then a single F-4 Phantom aircraft would appear, release its Maverick missiles and quickly disappear.[11] From 1986 onwards, the Iranians began to increasingly use helicopters to carry out missile attacks on ships in the Gulf as they had a shortage of fixed-wing aircraft and also because by flying low over the water, they minimised radar detection.[12] Because of lack of aircraft, aircrew, spares and air-to-surface weapons, the responsibility for anti-shipping operations were increasingly shifted from the air force to the navy.[13] Iranian

9. Hiro, Ibid., pp. 144-145.
10. O' Balance, n. 1, p.170.
11. Martin S. Navias and E.R. Hooton, *Tanker Wars: The Assault on Merchant Shipping During the Iran-Iraq Crisis: 1980-1988* (London: I.B. Tauris and Co. Ltd., 1996), p. 77.
12. O' Balance, n. 1, p. 183.
13. Navias and Hootonn, n.11, p. 87.

frigates began to fire Sea Killer missiles at ships from September 1986 and the naval branch of the Revolutionary Guards used small craft to release mines into the Gulf waters. Towards the end of the war, the Revolutionary Guards began to use fast-attack craft to strike at oil tankers and US Navy ships. These Boghammer Marin fast patrol boats were fitted with posts for heavy machine-guns and were usually manned by 2 or 3 Pasdaran who also used RPGs.[14] The US retaliation for such strikes led to the loss of many Iranian naval assets. On rare occasions, the Iranians also fired their HY-2 Silkworm missiles at oil tankers and oil terminals in Kuwait.

DRAWBACKS IN MILITARY STRATEGY AND TACTICS

The Iranians managed to drive back the Iraqis from their territory using human-wave attacks but when it came to invading Iraq itself, the same method failed to achieve the objectives for the Iranians. The main reason for this was Iran's excessive reliance on infantry, with little armour or air support. While such attacks worked effectively on Iranian territory, they did not produce the same results on Iraqi soil because of the Iraqis' use of the strategy of static defence. This method which had not allowed the Iraqis to advance much into Iranian territory, helped in the development of a strong defence network of miles of trenches, sand bars, mines, sensors and barbed wire on the Iraqi frontier. Such a network stopped further advance of human-waves into Iraqi territory.[15] During Operation Ramadan in 1982, armoured units were placed well behind the advancing Basij and Pasdaran troops, making the attack ineffective.[16] The same mistake was repeated during Operation Muslim Ibn Aqil which was also conducted in 1982. During this operation, human-wave attacks were not very effective because of the mountainous nature of the terrain. On the other hand, during Operation Wal Fajr-1 in 1983, an Iranian armoured division advanced steadily into Iraqi territory without any infantry support. The Iraqi counter-attack by its armoured units resulted in the

14. John Bulloch and Harvey Morris, *The Gulf War: Its Origins, History and Consequences* (London: Methuen London, 1989), p. 194.
15. Herzog, n. 2, p. 263.
16. O' Balance, n. 1, p. 96.

complete decimation of the Iranian division. The failure to provide infantry support and exploit the earlier successes was attributed to the political rivalry between the Revolutionary Guards and the Regular Armed Forces.

Politics was also responsible for the launch of a disastrous operation by the Iranians in 1981. When the Regular Armed Forces were criticised by the religious clergy for lack of action, President Bani Sadr, who was also the commander-in-chief, launched a premature offensive led by tanks across the Kharkheh Plain. As it was the rainy season, most of the tanks got stuck in the mud and a complete armoured division was lost. It took a long time for the Iranians to recover from this loss. The Iranians could achieve spectacular breakthroughs only by exploiting the gaps in the Iraqi defence network. The Iranians could capture the Fao Peninsula and Majnoon Island complex in the Haweizeh Marshes by crossing geographical obstacles considered to be impassable by the Iraqis. The Iraqis had not made much preparation to defend against attacks from these sectors. The Iranians used the cover of night and rough weather to ferry thousands of troops across such areas. But once Iranian troops were on firm ground, they could advance little because of the lack of armour and air support.[17] This situation had a bearing on events that occurred during the last year of the Iran-Iraq War. The Iraqis managed to push back the Iranians and advance well into Iranian territory. Even at sea, the Iranians underestimated the lengths to which the Americans would go to protect commercial shipping in the Gulf. In 1988 alone, the Americans sank six naval vessels which constituted one-third of the Iranian Navy in response to attacks by the Iranian Navy. Finally, an American cruiser, the USS *Vincennes* shot down an Iranian passenger plane, thinking it to be a fighter aircraft, and killed all 290 abroad.[18] The Iranian inability to advance further, along with the Iraqis' use of chemical weapons and American retaliation on the Iranian Navy, created panic among the Iranian troops and shattered their confidence. This resulted in their failure to stop the Iraqi onslaught, resulting in the ceasefire of 1988.

17. Shahram Chubin, "Iran and the War: From Stalemate to Ceasefire," in Karsh, ed., n.2, p. 15.
18. Patrick Clawson and Michael Rubin, *Eternal Iran: Continuity and Chaos* (New York: Palgrave Macmillan, 2005), p. 113.

IRAN'S ARMED FORCES STRUCTURE

Since the end of the war, Iran has focussed on filling the various gaps in its military capabilities which turned the war against Iran's favour. According to the latest International Institute for Strategic Studies (IISS) estimates, Iran has active forces of some 420,000 men. Iran's land forces comprise 350,000 men organised into four corps, with four armoured divisions, six infantry divisions, two commando divisions, an airborne brigade, and other smaller independent formations. It has some 1,613 main battle tanks, more than 725 other armoured fighting vehicles, 640 armoured personnel carriers, 2,010 towed artillery weapons, 310+ self-propelled weapons, 876+ multiple rocket launchers, some 1,700 air defence guns, large numbers of light anti-aircraft missiles, large numbers of anti-tank weapons and guided missiles, and some 50 attack helicopters.[19] Iran had an army reserve of some 350,000 men.[20] Even after the end of the war, Iran still faces the challenge of obtaining enough defence equipment to match its superiority in manpower. In reality, only one Iranian division (the 92nd) is equipped well enough in practice to be a true armoured division and two of the armoured divisions are notably larger than the others. Two of the infantry divisions (28th and 84th) are more heavily mechanised than the others.

The lighter and smaller formations in the regular army include the 23rd Special Forces Division, which was formed in 1993-94, and the 55th Para troop Division.[21] The regular army has a number of independent brigades and groups. These include some small armoured units, one infantry brigade, one airborne and 2-3 special forces brigades, coastal defence units, a growing number of air defence groups, 5 artillery brigades/regiments, 4-6 army aviation units, and a growing number of logistic and supply formations. With regard to armour, Iran has enough operational main battle tank holdings to sufficiently arm only 5 to 7 divisions according to Western standards. At present, these tanks are dispersed in relatively small groups among all of its regular army and some of the Revolutionary Guard combat units. Iran only has about half of the total holdings

19. The International Institute for Strategic Studies, T*he Military Balance: 2005-2006* (Routledge, Oxfordshire, 2005).
20. Zvi Shtauber and Yiftah S. Shapir, eds., *The Middle East Strategic Balance: 2004-2005* (Brighton: Sussex Academic Press, Jaffee Centre for Strategic Studies), p. 121.
21. Anthony H. Cordesman, *The Military Balance in the Middle East* (Westport: Praeger Publishers, 2004), p. 254.

of armoured infantry fighting vehicles and armoured personnel carriers it would need to fully mechanise its forces. Iran also has a good number of TOW and Dragon anti-tank guided missile launchers.

Iran's 120,000 Islamic Revolutionary Guards include 100,000 ground forces, 20,000 naval forces and a small air force.[22] It has bases on islands and coastal areas in the Gulf like Al-Farisyah, Sirri, Abu Musa, Khorramshahr, Latrak, and Bandar-e-Abbas, and on Halul (an offshore oil platform). The air branch is supposed to operate Iran's three Shahab-3 IRBM (intermediate-range ballistic missile) units, and may have custody of its chemical and any biological weapons. The IRGC now has command of Iran's Marine Brigade of some 5,000 men. The IRGC reportedly has 2 armoured, 5 mechanised, 10 infantry, and 1 special forces division, plus 15-20 independent brigades, including some armed and paratrooper units. The IRGC or Pasdaran has separate organisational elements for its land, naval, and air units. The Basij voluntary force and tribal units of the Revolutionary Guards are subordinated to its land unit command, although the commander of the Basij often seems to report directly to the commander-in-chief and the minister of the Pasdaran. The IRGC has close relations to the foreign operations branch of the Iranian Ministry of Security and Intelligence (MOIS), particularly through the IRGC's Quds force. Intelligence operations are usually managed by a ministerial committee called "Special Operations Council" which includes the supreme leader of Iran, the president, the minister of intelligence and security, and other members of the Supreme Council for National Defence.[23]

The IRGC has the largest control over Iran's military industries as it is in the forefront of Iran's efforts to acquire non-conventional military capabilities. Though formally the IRGC, along with the Regular Armed Forces, is under the same command at the general staff level, the IRGC maintains its own separate independent command chain below this level. At least, 5,000 men of the IRGC are assigned for unconventional warfare and intelligence operations. The IRGC has a special Quds force that plays a major role in giving Iran the ability to conduct unconventional warfare overseas using various foreign movements like

22. n. 19, p. 121.
23. Shtauber and Shapir, n.20, p. 263.

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Hezbollah as proxies. The budget for this force is classified and directly controlled by Ayatollah Khamenei, the supreme leader, and is not reflected in the Iranian general budget. The Quds troops are divided into specific groups or "corps" for each area or country they operate in. There are directorates for Iraq; Lebanon, Palestine and Jordan; Afghanistan, Pakistan and India; Turkey and the Arabian Peninsula; and the Central Asian Republics, Western Nations (Europe and North America); and North Africa (Egypt, Tunisia, Algeria, Sudan and Morocco). The Quds has offices or "sections" in many Iranian Embassies, which operate as closed sections.

The Quds force controls Iran's training camps for unconventional warfare, extremists, and terrorists in Iran and countries like Sudan and Lebanon. The Quds force has a main training centre at Imam Ali University in northern Tehran, and there are training camps in the Qom, Tabriz, and Mashhad governorates, beside camps in Sudan and Lebanon. The Basij force is a paramilitary force with an active strength of up to 300,000, with the capability to mobilise one million men. It consists largely of youths, men who have completed their military service, and the elderly. It has up to 740 regional battalions with about 300-350 men each, which are composed of three companies or four platoons plus support. The Basij is increasingly being used for riot control purposes since 1994 and being given such training. Iran has created 36 specialised Ashura battalions for internal security missions.[24] The primary mission of the Basij now seems to be internal security, monitoring the activities of Iranian citizens, acting as replacements for the military services, and serving as a static militia force for local defence missions.

The Iranian Navy has some 18,000 men. The Naval Headquarters is located at Bandar-e-Abbas. The navy has 3 submarines, 3 frigates, 2 corvettes, 5 mine warfare ships, and 12 amphibious ships. Its naval aviation branch is one of the

24. Shtauber and Shapir, Ibid., pp. 264-265.

few air elements in any Gulf navy. It has a two-brigade marine force of some 2,600 men and a 2,000-man naval aviation force. The other naval bases are located at Bushehr, Kharg Island, Bandar-e-Anzelli, Chah Bahar, Bandar-e-Mahashahr, and Bandar-e-Khomeini. The Iranian Air Force has some 281 combat aircraft. Most of these aircraft are not operational or combat worthy. Iran has 9 fighter ground attack squadrons with more than 126 aircraft; 5 fighter squadrons with 74 aircraft; a reconnaissance unit with more than 6 aircraft; and a number of transport aircraft, helicopters, and special purpose aircraft.[25] The Iranian Air Force has its headquarters in Tehran with training, administration, and logistics branches, and a major central Air Defence Operations Centre. It has three major regional headquarters: Northern Zone (Badl Sar), Central Zone (Hamaden), and Southern Zone (Bushehr). Each regional zone seems to control a major air defence sector with subordinate air bases and facilities. The key air defence sub-zones and related bases in the Northern Zone are at Badl Sar, Mashhad, and Shahbad Kord. The sub-zones and bases in the Central Zone are at Hamadan and Dezful. Finally, the sub-zones and bases in the Southern Zone are at Bushehr, Bandar-e-Abbas, and Jask. Iran has large combat air bases at Mehrabad, Tabriz, Hamadan, Dezful, Bushehr, Shiraz, Isfahan, and Bandar-e-Abbas.[26]

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NUCLEAR CAPABILITIES

It is not known if Iran really possesses the capability to produce a nuclear bomb but over the years, it has substantially developed its nuclear capabilities. Many motives have been attributed to Iran's efforts to develop such a capability. During the period of the Shah, it was believed that Iran was trying to attain a great power status in West Asia by procuring or developing nuclear technology. In the post-revolution phase, it was thought that Iran wanted such technology because of the danger that Iraq might develop such capabilities. When Iraq underwent a decade of sanctions and its

25. Clawson and Rubin, n. 18, pp. 189-190.
26. Shtauber and Shapir, n. 20, p. 275.

technological capabilities severely declined, Iran's effort in this area was seen as an attempt to deter the Israeli nuclear threat though Iran publicly claimed that it was solely for peaceful purposes. In the present situation, excluding the threat from Iraq, all the other reasons can be considered to be motives behind Iran's effort to achieve nuclear power status. The objective here is to understand what nuclear capabilities Iran has today and how it can widen its military options.

According to IISS, Iran has significantly developed its uranium enrichment capabilities since the time of the Shah when it first got access to nuclear technology from the West for being an ally and signing the Non-Proliferation Treaty (NPT). During the 1990s, Iran received substantial help from Russia to develop the Bushehr nuclear power reactor and from China in the development of an industrial-scale uranium conversion facility. Iran also received assistance from both countries in the different areas of development of nuclear technology development like uranium mining, uranium milling, heavy-water production plants, heavy-water research reactors, laser enrichment, etc. until American pressure brought an end to such aid. Centrifuge assistance from the A.Q. Khan network of Pakistan helped Iran to begin the construction of an industrial-scale enrichment facility at Natanz around 2000. The exposure of Iran's nuclear capabilities by an opposition group led to negotiations between Iran and the European Union (EU) and the present crisis over Iran's nuclear programme.

Iran is developing uranium mining and milling facilities to produce natural uranium in the form of yellowcake. At the Uranium Conversion Facility (UCF) which is located at the Esfahan Nuclear Technology Centre (ENTC), Iran has begun testing the capability to convert uranium yellowcake into uranium hexafluoride (UF6) which is the feed material for Iran's pilot-scale and industrial-scale centrifuge enrichment facilities under construction at the Natanz enrichment facility.[27] If the suspension of nuclear related activities is lifted, the pilot scale enrichment facility at Natanz could be completed within a few years, but the larger industrial-scale enrichment plant is probably a decade or so from full operation. The completed Natanz facility could produce low enriched

27. The International Institute for Strategic Studies, *Iran's Strategic Weapons Programme: A Net Assesment* (Routledge: Oxfordshire, 2005), pp. 33-34.

uranium (LEU) to fuel light-water power reactors or highly-enriched uranium (HEU) to fuel nuclear weapons. Iran has begun construction of a 40MW heavy-water research reactor at Arak which is scheduled for completion in 2014. On completion, this reactor could produce enough plutonium for military use.[28] It is generally believed that Iran would try to opt for a simple implosion device with a core of fissile material which will either be plutonium or highly enriched uranium.[29] Based on available information, it would take Iran several more years to develop nuclear weapons capability.

CHEMICAL AND BIOLOGICAL WEAPONS CAPABILITIES

Less information is available on Iran's chemical and biological weapons capabilities than on its nuclear programme. The first time that Iran seriously started thinking about acquiring chemical weapons was after facing Iraqi chemical attacks during the Iran-Iraq War. Iran claimed that it produced World War I era blood and blister agents but never actually used them. These were reportedly destroyed after the end of the war. It is suspected that Iran has developed dual-use civilian chemical and biotechnical civilian infrastructures which provide it the option of resorting to a chemical and biological weapons (CBW) development in a short period of time, according to its needs. This lessens the risks associated with developing and maintaining an exclusive CBW arsenal. Both the US and Russia have claimed that Iran continues to produce nerve agents and blister agents. Both these countries have accused Iran of weaponising these agents. According to the IISS, Iran's chemical weapons stockpile is not likely to have included nerve agents because of the technical complexities involved in their manufacture. When it comes to the development of biological weapons capabilities, it is much more difficult to monitor such activities because of the inability to distinguish between research and development on protection against biological weapons (allowed under the Biological Weapons Convention that Iran has signed) and research and development of offensive biological weapons. As Iran has a fairly developed

28. Al J. Venter, *Iran's Nuclear Option: Tehran's Quest for the Atom Bomb* (New Delhi: Manas Publications, 2005), p. 127.
29. Shtauber and Shapir, n. 20, p. 63.

biomedical and biotechnological sector, it probably has the capability to develop biological weapons in a short period of time.[30]

BALLISTIC MISSILE CAPABILITIES

Being in a region where ballistic missiles were not widely used in conflicts till at least the beginning of the 1980s, Iran did not feel the need to acquire such a capability when it was building its armed forces during the 1960s and 1970s. The scenario changed with Iraq using Scud missiles to bomb Iranian cities during the war. Iran did not have much operational aircraft to strike deep into Iraqi territory. That is when Iran began to build up its ballistic missile capability. By the mid-1980s, with help from China, Iran developed the capacity to produce short-range, unguided solid propellant artillery rockets – the Oghab (Eagle) with a 40 km range and Iran-130 with a 130 km range. As mentioned before, in the same decade, Iran obtained a small number of Soviet produced Scud-B (280-300 km) missiles from Libya and Syria.[31] Towards the end of the war, Iran purchased a large number of Scud-B missiles from North Korea. Iran used its experiences gained from the development of the Oghab and the Iran-130 to further improve its ballistic missiles programme. Iran is presently continuing in its efforts to produce solid propellant motors for longer-range missiles. This is because solid propellant systems have many operational advantages over liquid propellant systems, including a much shorter launch sequence time. Iran has a significant stock of short-ranged solid-fuelled rockets.

By the mid-1980s, with help from China, Iran developed the capacity to produce short-range, unguided solid propellant artillery rockets – the Oghab (Eagle) with a 40km range and Iran-130 with a 130 km range.

The Oghab artillery rocket is capable of carrying a 70 kg warhead to distances of 40-45 km. Iran is capable of producing 600-1000 Oghabs per year. The Fajr-3 is likely to be based on the North Korean 240mm M-1985 multiple rocket launcher,

30. Shtauber and Shapir, Ibid, pp. 69-78.
31. Navias and Hooton, n. 11, p. 21.

which was exported to Iran in the late 1980s. The Iran-130 or Nazeat rocket can place a 150 kg warhead to ranges of 90-120km. The Zelzal (Earthquake)-2 rocket is very likely an indigenous version of the Luna-M or FROG-7 with a range of 150-200 km. In 1999, Iran claimed that Zelzal was in mass production. The Fateh-110 rocket has a range of 170 km. Iran also possesses about 30 launchers for around 175 Chinese-origin CSS-8 missiles, which are armed with a 190 kg high-explosive warhead deliverable to a range of 150 km.[32]

In the area of liquid propellant systems, Iran, with North Korean assistance, developed an indigenous capability to produce Scud type missiles. The Shahab (Shooting Star)-1 and Shahab-2 missiles are reverse-engineering copies of the Scud-B and Scud-C systems. The Shahab-1 can deliver a 1,000 kg payload to approximately 300 km and the Shahab-2, which carries a payload of about 800 kg, can reach 500 km. Iran likely possesses a few hundred Shahab-1 Shahab-2 missiles distributed among at least three and possibly five missile battalions, each outfitted with around three to five transporter-erector-launchers (TELs) or mobile erecter-launchers. According to the IISS estimates, Iran deploys a single Shahab-1/2 missile brigade comprising three or four battalions, for a total of 12-18 mobile missile launchers and 48-72 missiles in the field and about 200 additional missiles held in reserve, assuming that Iran (like North Korea) organises its missile forces along Soviet lines. In the 1990s, Iran purchased limited supplies of No-dong components, production equipment and technical assistance from North Korea. The No-dong is a liquid-fuelled missile derived from Russian technology with a range of approximately 1,300-1,500 km.[33] It is reported that Iran deploys at least a single Shahab-3 missile battalion, which would typically consist of 6 launchers and 24 missiles in the field, with an unknown number of missiles in reserve.

On two occasions, in 2004, Iran successfully test launched a new version of the Shahab-3 with a 'baby-bottle' nose and named the Shahab-3M. It has been noticed that the base of the conical nose has the same diameter as that of the Shahab-1/2 missile body. A matching warhead diameter would allow Iran to

32. Shtauber and Shapir, n. 20, pp. 91-92.
33. Shtauber and Shapir, Ibid., p. 89.

develop a single warhead design for all of its Shahab missiles. The position of the instrumentation raceway points to the fact that the instrumentation package which includes the navigation, guidance and control equipment may be designed to remain with the warhead after separation from the main missile body. This points to the possibility that the Shahab-3M may be intended to perform several new missions, including airburst detonations, at a specified altitude, or the effective and efficient dispersal of submunition packages. Either of these new capabilities would enhance the dispersal of chemical or biological agent. If the option is to mount a nuclear weapon on the missile, a sophisticated safety-arming and fusing system – capable of initiating before the warhead impacts the ground – would be needed to maximise the effect of such a weapon.[34]

IRAN'S LESSONS FROM THE IRAN-IRAQ WAR AND THE 1990-91 GULF WAR

One of the lessons that Iran learnt from the Iran-Iraq War was the futility of directly taking on the might of the US Navy. As mentioned before, such a step resulted in the loss of one-third of Iranian naval assets. But what naval strategy is Iran bound to use in the future and is it making attempts to acquire capabilities in accordance with its intentions? In the event of a probable attack on Iran, it is bound to attack commercial shipping in the Gulf without directly engaging the navy of the US or any other powerful external actor. The commercial importance of the Straits of Hormuz has not declined even now, almost two decades after the end of the conflict. Besides its shore-based anti-ship Silkworm missiles, Iran has acquired Chinese Hudong-class missile patrol boats which can carry four anti-ship CS-801 and CS-802 missiles.[35]

One of the lessons that Iran learnt from the Iran-Iraq War was the futility of directly taking on the might of the US Navy.

The navy has a large number of patrol craft and fast attack craft. Iran has considerable mine warfare capabilities in the form of mine-laying ships and

34. Shtauber and Shapir, Ibid., p. 101.
35. Shtauber and Shapir, Ibid., p. 270.

different varieties of mines. Iran has three Kilo-class submarines which were acquired from the Russians. In April 2006, Iran test-fired rocket-powered torpedoes thought to be based on the Russian-made Shkval. This torpedo is capable of reaching 359km/h, four times the speed of conventional torpedoes and it has a range of seven kilometres.[36] It is noticeable that Iran has concentrated its anti-ship capabilities in its naval arm. This might be because of its inability to upgrade its air force due to the lack of accessibility to advanced defence hardware. At the same time, Iran's development of unconventional naval capabilities, coupled with experience gained from the "Tanker-War" of the 1980s, has given it considerable capability to harass commercial shipping and wage a kind of guerrilla war at sea in the Gulf.

During the Iran-Iraq War, the Iranians had used the strategy of launching human-wave attacks because of their lack of military technology. But such a strategy did not ensure victory and was highly dependent on the revolutionary fervour and motivation that existed in Iranian society during that time. As the political and social conditions in Iran have changed a lot since then, the Iranian leadership has realised the lack of practicability in solely depending on such sentiments to fight future conflicts. The need to invest in sophisticated military hardware dawned on the Iranian leadership in the ending years of the war itself. Events in the wider region have also contributed to such a change in the thinking of the Iranian political and military leadership. Since the end of the Iran-Iraq War in 1988, the region has witnessed two major conflicts, the 1990-1991 Gulf War and the 2003 Iraq War.

As both the conflicts were fought in the neighbourhood of Iran and involved Iran's erstwhile foe – Iraq – Iran is understood to have watched them closely. If the Iran-Iraq War convinced the Iranians of the need to attain the technological advantage of the Iraqis, the Gulf War of 1990-1991 proved that even that capability was not enough to face the technological superiority of the US. The United States' command and control, communications, intelligence and joint operations capabilities had helped it to win the war and not just superiority in the number of tanks and planes. Far from attaining such capabilities, Iran has not

36. http://www.globalsecurity.org/wmd/library/news/iran/2006/iran-060404-voa01.htm

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even been able to arm its forces up to the level of the Iraqi armed forces on the eve of the Gulf War. Though the focus of the international community shifted to Iraq because of its invasion of Kuwait and weapon of mass destruction (WMD) programmes, Iran was not given the freedom to develop its armed forces. In such circumstances, Iran tried to acquire not just the weapon systems but even the capability to indigenously produce them from countries like Russia, China and North Korea.

There are serious problems of compatibility between the Western hardware acquired during the time of the Shah and the Russian and Chinese weapon systems which Iran got after the revolution. Most of the American and British weapon systems have not been upgraded because of the lack of spare parts and have, therefore, become outdated. The division of the armed forces between the Regular Armed Forces and the Revolutionary Guards has created further problems. Iran has to divide its scarce number of weapon systems between these two forces which decreases its combat effectiveness and makes integration all the more difficult. These factors have seriously downgraded efforts to develop a joint operations capability among not just the three Services but even among the ground forces. Though Iran has the capability to fight and sustain a war with any country from the same region, it doesn't have much worth in a situation in which the US is in occupation of Iraq and any Iranian attack on a West Asian country can result in US intervention.

But the 1990-1991 Gulf War also proved the inability of the US Patriot anti-ballistic missile system to defend against Scud missile attacks by Iraq. This despite the fact that the Scud was a primitive ballistic missile system.[37] The conflict also proved the deterrence value of chemical and biological weapons due to the amount of panic that was caused in Israeli urban centres because of the

37. Theodore A. Postol, "Lessons of the Gulf War: Experience with Patriot," *International Security*, vol. 16, no. 3, 1991, p. 170.

fear of the use of chemical weapons by Iraq. The lack of any real defence against ballistic missiles, which was proved by the Iraq War and Iran's own experience, convinced Iran to build up its own ballistic missile programme, as mentioned earlier in this paper. The defeat of Iraq in that war did not lessen Iran's threat perception. The conflict signalled the growing involvement of the US in the affairs of the Gulf and the emergence of an increasing threat to Iran in the form of Israel. While Iran has had strained relations with the US since the revolution, Israel is a political and ideological rival of Iran. Therefore, Iran's missile programme has the objective of deterring not just one rival but two. The Shahab-3 has the capability to strike targets in Israel. This has put Iran in a place where it can use the same tactic as the one used by the Iraqis who fired missiles at the Israelis in order to instigate retaliation and secure the support of Muslim countries. Though the Iraqi tactic failed, it is hard to predict how things would move if Iran uses the same tactic, particularly when it faces the threat of an attack from the US. Iran has also decentralised its nuclear programme keeping in mind the Israeli attack against Iraq's nuclear reactor. As the gap between the US and Iran in terms of command and control, communications and intelligence is not bound to go away, Iran's attempts to acquire WMD capabilities are aimed at compensating for its lack of conventional military capabilities vis-à-vis the United States.

WARS IN IRAQ AND LEBANON

One of the other means of deterring Israel from Iran is the presence of the Islamic resistance movement, Hezbollah, in Lebanon. Starting with the dispatching of 1,500 Revolutionary Guards to Lebanon to develop a Shia resistance movement to the regular airlifting of arms and ammunition to Hezbollah, Iran has had, and continues to have, a significant influence over Hezbollah. Iran had created Hezbollah because of political and ideological reasons which was to fight a guerrilla war against the Israeli occupation of Lebanon and create conditions for the establishment of an Islamic republic in that country. It is not important here to go into the feasibility of achieving Iran's second objective. But the 2006 conflict between Israel and Hezbollah has signalled a marked change in the attitude of

Iran towards the resistance movement. Hezbollah launched as many as 3,970 to 4,228 rockets at targets inside Israel. Nearly 92 per cent of these were Katyusha type artillery rockets with ranges of 20 km. This was the first time that rockets were used on such a massive scale against Israel.

On the second day of the war, the Israeli Air Force destroyed 59 medium range missile launchers inside Lebanon. This accounted for as much as 70-90 per cent of Hezbollah's medium range ballistic missile arsenal. The Lebanese satellite TV station Al-Manar reported that the attacks had included a Fajr-3 and a Raad-1, both liquid-fuelled missiles developed by Iran. Hezbollah also used Chinese made, Iranian modified C-802 anti-ship sea skimming missiles and crippled an Israeli Navy corvette and sank a Cambodian merchant ship.[38] It is obvious that there has been a dramatic increase in the quantity and quality of weapons that Iran has supplied to Hezbollah. But what does this imply with regard to Iranian strategy in Lebanon? The military-strategic reasons for the Iranian support for Hezbollah are becoming as crucial as the political-ideological factors. Such a transformation could have taken place in the aftermath of the Israeli withdrawal from Lebanon in 2000 when the capability of Hezbollah became more evident and access to southern Lebanon made Israeli urban centres more vulnerable to missile attacks. The 2006 conflict has proved that Hezbollah will be taken into account when Iran prepares a strategy to deal with a probable Israeli attack.

The military-strategic reasons for the Iranian support for Hezbollah are becoming as crucial as the political-ideological factors.

In the context of Iran's military strengths and weaknesses, the Iraq War of 2003 and events after that should have been more interesting to the Iranians than the Kuwait crisis. As expected, the Iraqi armed forces crumbled in a short period of time in the face of the American military might. But what followed the American occupation of Iraq was a violent and bloody resistance movement targeting US troops. The situation in Iraq has now almost turned into an all out civil war between the Shias and the Sunnis. From the military point of view,

38. Air Commodore Jasjit Singh, "Interpreting the Lebanon War of 2006," *Air Power*, vol.1, no. 2, 2006, pp. 38-40.

what must have been interesting to the Iranians is the vulnerability of US troops to guerrilla movements in urban warfare. This is where Iran's links with Hezbollah and other extremist resistance movements and the Lebanese War become relevant once again.

There have been other wars like the Vietnam and Afghan Wars where relatively weaker forces have defeated superpowers using guerrilla tactics. But what makes the success of Hezbollah over Israel in the Lebanese civil war special for Iran is the fact that Hezbollah was created by Iran. As the Revolutionary Guards continue to be responsible for the training of the Hezbollah cadres, the Iranian armed forces will have considerable insight into the tactics used by Hezbollah in its war against Israel. The Revolutionary Guards have provided training, arms and ammunition to Hamas and the Palestinian Islamic Jihad. In fact, the Palestinian Islamic Jihad is close to Iran in political and ideological terms. Syria continues to be an important ally of Iran. Today, Iran has considerable influence among the Shia political and militant groups in Iraq. The Supreme Council for Islamic Revolution in Iraq (SCIRI) and the Dawaa Party were provided shelter by Tehran during the 1980s and 1990s. The SCIRI, whose armed wing is the Badr Corps, is an important force in the Iraqi government. There are reports of Revolutionary Guards and Hezbollah cadres actively assisting the Shia militant groups. The US and Britain have accused Iran of using Hezbollah cadres to train Shia militants in the making of improvised explosive devices (IEDs). In the event of any US attack on Iran, the latter can use its links with these various forces to stir up trouble not just in West Asia but also for US troops in Iraq.

CONCLUSION

From a military point of view, it is often believed that the Iranian Revolution prevented Iran from reaching its full potential and becoming a regional military power. But an Iran under the Shah would have become a regional power only in the Gulf. The revolution gave Iran the opportunity to assume the mantle of Islam and spread its influence even in the Levant and Mesopotamia among the Shia Muslims. In the event of an attack, Iran is likely to use a number of different options to retaliate, including its naval assets in the Gulf, ballistic missiles and

In the event of an attack, Iran is likely to use a number of different options to retaliate, including its naval assets in the Gulf, ballistic missiles and militant groups in West Asia.

militant groups in West Asia. This is far different from the situation in 1980 when Iraq invaded Iran. Moreover, Iran is a huge country, making it difficult for any power that makes an attempt to invade and occupy it. Iranians have strong nationalist sentiments and the country has a vibrant political system unlike most of the neighbouring Arab states. Iranians are likely to defend their country against any external attack regardless of who is in power. Such factors add to Iran's strengths besides its conventional and unconventional military capabilities.

US DEFENCE INDUSTRY TRENDS

ASHOK SHARMA

The United States of America is a leading manufacturer and exporter of the major weapons systems of the world. But the United States has never been a traditional arms exporter to India because of the geo-political compulsions of the Cold War period. India has always looked to the erstwhile Soviet Union and now Russia for meeting its arms requirement. However, the end of the Cold War and demise of the Soviet Union opened up new vistas, and economic prudence has come to dominate the political considerations in arms exports. The terms of the arms trade conform more to the dictates of market dynamics and economic realities than political considerations. Amidst these, the relationship between India and the US has seen a positive trend in the post-Cold War and significant cooperation between these two nations can be seen in the defence and military sector. Most global defence industries, including the US defence industry, are looking towards India as an outsourcing hub for the development for technology as well as markets. With a robust economic growth, India's military modernisation has got a fillip in recent years with affordability to import major weapons systems at an accelerated pace. The modernisation needs of the Indian armed forces and improvement of overall standards; India's long-term goal of capacity to design, manufacture and develop arms; the need of adding more fighter aircraft to the Indian Air Force; the Indian defence sector allowing 100 per cent private sector participation, with foreign direct investment (FDI) capped at 26 per cent and US defence companies' eagerness to access India's profitable defence market; India,

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on its part, also not averse to the idea of getting US arms, given its new obligations and pursuits in the Asian region; and improving Indo-US defence ties all augur well for India's closer ties with the US defence industry in the future. Hence, it becomes important to explore the ongoing trends and challenges confronting the US defence industry.

The US defence industry is the largest in the world. But the massive decline in defence spending since the end of the Cold War has altered the landscape of the American defence industry. Despite maintaining its supremacy in the global defence industry, the US defence industry is coping and transforming amidst the challenges emanating from the changing political environment, the resulting economic dislocations, and the rapid technological advances.

In the global context, the defence industry has been transformed over the last decade by trends in military expenditure and technology. The fixed costs of research and development (R&D) for major systems continue to grow, for both platforms and the infrastructure (such as satellites, strategic air assets) and information systems needed to support network-centred warfare. All countries except the US face structural disarmament as they are unable to afford the fixed costs needed to replace conventional military capability with modern systems comparable to those of the US. The decline in the total size of the market and the growing R&D requirements for major weapon systems has resulted in mergers and acquisitions (M&A), leading to consolidation in the defence industry.

All countries except the US face structural disarmament as they are unable to afford the fixed costs needed to replace conventional military capability with modern systems.

The trends of the US defence industry show that since the end of the Cold War, there has been continuous decline in the US defence budget in recent years. Since before the beginning of World War II, in terms of share of gross domestic product (GDP), the share devoted to defence is less than 3 per cent. As a portion of the federal budget, it is at its lowest point in modern history. As a benchmark, during the Kennedy Administration, defence represented about one-half of the federal

budget. Today, it is about one-seventh. After the end of the Cold War, the US defence industry got its marching orders in 1993 from Defence Secretary Les Aspin and Deputy Secretary William Perry at the now-famous "Last Supper": "consolidate or evaporate" was the message. In the last 15 years, the US defence industry has witnessed significant transformation. Thus, an insight into the trends and challenges that the US defence industry is facing is required.

This research paper aims at exploring the trends and challenges in the post-Cold War era that have been shaping the global defence industry in general and the US defence industry in particular. While exploring the trends of the global defence industry during the Cold War and post-Cold War eras, this paper's central objective is to look at developments in the US defence industry that have been dominant in the post-Cold War era amidst the increasing internationalisation of production, the growing importance of information technology (IT) companies within the defence sector, and the privatisation of services that were once provided by the military. In the end, briefly touching the US defence industrial base, this paper highlights the trends and the challenges within which the US defence industry will have to operate to maintain its preeminence in the global defence industry.

DEFENCE INDUSTRY DURING THE COLD WAR PERIOD

Before looking into the major trends of the defence industry in the post-Cold War era, it would be worthwhile to take a glance at the trends of the defence industry during the Cold War era.

The Cold War confrontation between the US and Soviet Union compelled the countries on each side to enhance their nuclear and conventional military capabilities. As a result, the nations increased their military spending substantially. This happened in spite of sluggish and uneven growth in the global economy, especially during the 1970s and 1980s. While the average annual real growth of world military expenditure between 1975 and 1980 registered 1.5 per cent, the figure had leapt to 3.2 per cent in the succeeding half decade, and did so despite a rate of increase in world GDP of only 2.4 per cent. These aggregate figures, however obscure, offer considerable geographical variations.

For the developing countries as a whole, the GDP grew at an annual rate of 1.8 per cent whereas military expenditure grew at 3.1 per cent. However, the North Atlantic Treaty Organisation (NATO) and the Warsaw Pact were responsible for 73.5 per cent of global defence outlays in roughly equal proportions.[1] A principal outcome was the increase in the share of defence outlays earmarked for equipment. Another trend being the incessant drive on the part of the advanced industrial countries to generate and maintain the technological advantage and its corresponding response – the desire of the newly industrialising countries to acquire as much defence production capabilities as possible. Thus, the post-World War II division of labour in defence production, marked by the overwhelming dominance of the USA and the USSR, had given way to a more stratified division among a great number of new producers.[2] During the early and till the late 1980s, considered the peak time of the Cold War, the global defence industry witnessed the culmination of an era marked by an unprecedented level of military efforts by the two rival superpowers, the cumulative impacts of which were felt the world over. A few indicators are in order for illustration for a single year, 1987, when global military expenditure touched an all time high of $1,260 billion after witnessing a near double digit real-term increase since the late 1970s, resources devoted to military research and development (R&D) were pegged at $50 billion, cumulative military procurement expenditure by NATO nations was $115.5 billion, and trade in major conventional weapons touched $39 billion (nearly 25 per cent increase from $30 billion in 1980).[3]

This period saw enormous effort by countries to build up their arsenals to meet the challenges posed by the Cold War. Consequently, defence budgets were increased substantially, millions of men and women were in the armed forces, constantly training for the high-tech demands of modern warfare; thousands of

1. Deba Mohanty, "Defence Industries in a Changing World: Trends and Options," *Strategic Analysis*, vol. XXIII no.10, January 2000. Also see Daniel Todd, *Defence Industries: A Global Perspective* (London: Routledge; 1988), pp. 1-37.
2. See the introductory comments in J.E. Katz, ed., *The Implications of Third World Military Industrialization* (Lexington, Massachusetts: Lexington Books, 1986).
3. For detail, see different volumes of annual publications of SIPRI. See chapters "Military Expenditure," "Conventional Arms Transfers" and Military Production" in *SIPRI Yearbook 1991* (Oxford: Oxford University Press, 1991).

nuclear-tipped missiles and nuclear-stocked bombers were kept in constant readiness for instantaneous launch; massive tank battalions and fighter plane squadrons were poised on both sides of the Central European dividing line; and defence industries pressed ahead, producing still greater quantities of more advanced weapons. The year 1987 was the peak year of the global military efforts: till this time, the military industry was full of business, production and sale of arms in which the two superpowers played a preeminent role.

However, by the end of the Cold War, the changed political climate in Europe culminating in the dismantling of the Warsaw Pact and the collapse of the Soviet Union challenged the flourishing defence industry trends that lasted for over four decades. In the changed international scenario, the following trends were significant in the global defence industry:[4]

- Disarmament efforts and reduction in armed forces, which till the early 1990s were modest, turned out to be the catchphrase.
- Economic constraints became quite obvious from the decline in value of military budgets in real terms. This is perhaps due to the fact that other economic priorities seem to be competing successfully against the military needs. Reversals of growth rates also forced the defence industry to reduce capacity.
- Arms exports reduction is another trend which the world witnessed after the end of the Cold War. There is every indication that the volume of arms exports have been going down since 1987. The period between 1987 and 1992 witnessed a major decrease in the volume of major conventional weapons exports and since then it has shown a fluctuating trend, with the year 1997 showing a considerable upward jump.
- The defence industry witnessed a consolidation process. During the Cold War, the international arms industry was not as consolidated as some other high-technology industries such as commercial aerospace or pharmaceuticals.

CHALLENGES AT THE END OF THE COLD WAR

In the post-Cold War era, the defence industry faced challenges emerging from the reductions in both domestic and international demand for arms. Political and

4. *SIPRI Yearbook 1998*, pp. 318-319.

economic factors contributed to a drastically changed international environment, with reduced business prospects for the defence industry. This is witnessed in several core areas like shrinking arms sales, loss of jobs, and reduced profit opportunities. Rapid transformation in military technology rendered existing military technology obsolete that necessitated new dimensions in arms production. In fact, fundamental changes in the defence industry were required to tackle the situation arising out of inconsistent performance coupled with considerable decrease in demands for military equipment. In such a scenario, several steps like downsizing, restructuring, conversion and diversion were pursued.

However, an adjustment process which was instituted by most countries and most companies, to deal with the changed international environment, started moving from the initial phase of rapid downsizing, rationalisation, and concentration into a phase in which top individual companies that maintained a strong defence orientation, were positioning themselves in the smaller market for their survival. Among the developed countries, downsizing and consolidation have been most distinct in the United States. The subsequent consolidation of the industry resulted in the elimination of more than 1.5 million jobs. These efficiencies allowed US companies alone to begin to pass along savings of approximately $2.6 billion per year to their customers, primarily to the Department of Defence (DoD). And those savings continue to help hold down the costs of products in the future.

The United States consolidation of the industry resulted in the elimination of more than 1.5 million jobs.

Consolidation resulted in the formation of a few very large conglomerates in the US and West European countries. However, this process was slow in the European countries. Another important development has been that the defence industries of the European nations have been striving for cross-border consolidation to strengthen their position vis-à-vis the US and other industries and to remain competitive at the international level.[5] In recent years, a number of

5. Vance D. Coffman, CEO of Lockheed Martin, "The Future of the US Defense Industry," October 1, 1998, available at http://www.cfr.org/publication/3117/future_of_the_us_defense_industry.html?breadcrumb=%2Fissue%2F10%2Findustrial_policy.

trans-Atlantic cooperative armament programmes have taken place within the framework of NATO, with special emphasis on standardisation, and harmonisation, primarily of military equipment.

Defence industrial capabilities of major states have shown fluctuations in accordance with their shifting security priorities. Declining military expenditure led to a continuing reduction in the demand for military equipment, especially in the domestic sector. Likewise, arms exports declined. For example, arms sales by major European countries fell by nearly 30 per cent during the period 1991-2000. Arms exports to Third World nations fell by nearly 40 per cent during the same period. The number of arms manufacturing units as well as employment in them declined, putting the defence industry under severe stress. Arms producers adopted different strategies to cope with the changing times – rationalisation, concentration and internationalisation, to name a few. The West was the quickest to respond, followed by Russia, China and second-tier producers. While the US witnessed unprecedented changes in its defence industrial sector, Europe was the next to follow.

Arms sales by major European countries fell by nearly 30 per cent during the period 1991-2000.

Apart from top arms producing companies which are generally concentrated in the US and West Europe, there are several companies in the Organisation for Economic Cooperation and Development (OECD) and developing countries that have been active in the international weapons market. The issues of size and competitiveness are now found on their agendas. Consolidation, standardisation, and privatisation of large state-owned military industrial units are now being contemplated in many countries like Australia, Israel, Greece, and Spain. Also indicative is a trend in the reverse direction by countries like Finland which has combined major domestic arms industrial units into a newly established state-owned holding company. [6]

In fact, many developing countries' main concerns have been threats to internal security and, thus, there has been little need to create sophisticated

6. *SIPRI Yearbook 1998*, p. 204.

military industries. But many developing states also face possible external threats, from regional neighbours or outside forces. It is these threats which are most likely to generate a demand for advanced military capabilities and expanded military bases.

US DEFENCE INDUSTRIAL BASE

Probing the significance of the productive and technological base in Great Power rivalry, Paul Kennedy in *The Rise and Fall of the Great Powers* says:

> The history suggests that there is a very clear connection in the long run between an individual Great Power's economic rise and fall and its growth and decline as an important military power. . . . Technological and organizational breakthroughs . . . bring greater advantage to one society than another.

The Cold War, in large part, turned out to be a contest between the superpowers' productive and technological bases. While the United States experienced steady growth, the declining Soviet productive base could not support both the demands of the military establishment and those of the Soviet people. However, US economic and technological prowess is under pressure to maintain its preeminence.

Concerns have been shown about the impact on business conditions in the United States from the investment in new capacity that is not being made here but in China and elsewhere. The money is going overseas to build competitors' capabilities, while at the same time, the US is losing that capability, and there are greater societal costs that are difficult to measure.

Another significant trend being witnessed in the US defence industrial base is the foreign investment. This trend is quite visible in the case of the US aerospace sector, which is among the most attractive sectors in the United States for foreign direct investment – in both aerospace firms and the facilities that they build from the ground up in the United States. Global suppliers are increasing investments in the US defence industrial base and from the viewpoint of the global industrial base, the US defence industry is one of the most attractive sites for direct investment.

Also a blurring of the line between commercial industry and defence industry has become a visible trend, and seems likely to continue into the future. In the present scenario, it is difficult to classify exactly where commercial industry ends and the defence industrial base starts. This is mostly visible in the organisations that produce aircraft, space systems, command, control, and communications systems and the infrastructure and support systems associated with them.

Blurring of the line between commercial industry and defence industry has become a visible trend, and seems likely to continue in the future.

Pressure is mounting on the Pentagon to begin developing strategies to avert the loss of strategic industries.[7] There is growing concern over the broader US industrial base upon which the defence industrial base depends. The DoD is dependent on the health of these industries to generate revenues to fund R&D for the next generation of technology.

In fact, massive decline in defence spending since the mid-1980s, has transformed the landscape of the American defence industry. With now only half as much in real-terms to spend on defence equipment, the Pentagon is finding that it has to make crucial procurement decisions to keep key strategic production lines open. A number of programmes such as the F-15E Strike Eagle, are reaching the end of their lives and direct replacements are still some time from entering production. Where the next generation of combat aircraft and helicopters are built over the next decade will determine the fate of a number of large airframe assembly facilities. The need to cut costs to boost corporate share prices and reduce unit prices is likely to collide head-on with the influence of several Congressional leaders who want defence jobs and dollars to remain in their districts.

The two main armoured vehicle manufacturers, General Dynamics and United Defense, have large order books for upgrade work on existing platforms, but apart from the Crusader self-propelled artillery system and some specialist

7. "What Is The Real Health of The Defense Industrial Base?" at http://www.manufacturingnews.com/news/05/0222/art1.html

engineer vehicles, there are no major new builds of armoured vehicles planned until well into the second decade of this century.

The tremble in the share price of a number of major US defence contractors in the last few years indicated that internal consolidation is likely to be high on the agenda to reduce real costs from companies' balance sheets. How the Pentagon reacts to further plant closures and losses of real capabilities will be a major issue over the coming year.

In the present scenario, more relevant questions appear to be whether the industrial base can, on an ongoing basis, supply the new technologies and weapons that will ensure an overwhelming advantage for the US and allied forces, and whether the military can incorporate these new technologies into its inventory on a timely basis. Given the present national security concern of the United States and the role it intends to play in the international arena and the threats it might face requires on-hand weapons and munitions, obviating the need for a massive industrial mobilisation.

The US defence industrial base has survived amidst the challenges emanating after the end of the Cold War and, by most measures, it is innovative and healthy. The US defence industry is competing globally to have economic prowess and is carefully focussing on the most critical and demanding of war-fighting capabilities in order to have war-fighting prowess.

The US defence industry is the largest in the world. It produces every type of weapon system known to man, from nuclear weapons down to combat knives. Major players involved in the manufacturing of weapons include AAI Corporation, BAE Systems Inc., Boeing, Carlyle Group, Colt's Manufacturing Company, General Atomics, General Electric (primarily through GEAE), General Dynamics, Honeywell, Lockheed-Martin, Northrop Grumman Corporation, Raytheon Corporation, and United Defense (now BAE Systems Land and Armaments). The US defence companies maintain their lead in the global defence market. (See Table 1.)

Table 1 shows the major US arms companies. In 2003, the US firms accounted for the top 4 companies in the top 5, and 6 in the top 10 arms companies in the SIPRI list of the top 100 arms companies. Overall arms

Table 1: Major US Arms Companies

US Company	Arms sales (US $ million)	Arms as share of total company sale (%)
Lockheed Martin	24,910	78
Boeing	24,370	48
Northrop Grumman	22,720	87
Raytheon	15,450	85
General Dynamics	13,100	79
United Technologies	6,210	20

Source: *SIPRI Yearbook*, 2005.

companies comprised 37 of the top 100 and the European Union's (EU's), 36 of the top 100.

The US defence industry base is quite strong and maintains its superiority in comparison to its foreign competitors. Yet, the base is constantly changing. The major forces affecting the base include:[8]

- A sharp rise in the service sector coupled with a steady growth in manufacturing production.
- A greater reliance upon trade as a source of national income.
- Increased globalisation of information, manufacturing, and finance.
- Expansion of the role of international firms in world affairs.
- The rise of information technology dominated by the United States.
- Reduced defence expenditures for R&D and procurement, resulting in a smaller defence industrial base.
- A significant change in defence acquisition focussed toward increased use of commercial items and technology.

The task for the United States will be to exploit the economic growth capacity of new technologies and industries to remain the world's premier power. The ability of the US military to maintain its leading edge will increasingly depend on its success in adapting the rapid advances in sensor,

8. Gerald Abbott and Stuart Johnson, "The Changing US Defence Industrial Base," http://www.ndu.edu/inss/strforum/SF_96/forum96.html

computing, and telecommunications technologies in the commercial sector to military requirements.

TRENDS IN THE US DEFENCE INDUSTRY IN THE POST-COLD WAR PERIOD

Like many other industries, the US defence industry witnessed rapid changes during the past decade. The factor that has been responsible for the rapid transformation could be traced to events such as the enactment of the Competition and Contracting Act (CICA) in 1984 and the demise of the Soviet Union, leading to the end of the Cold War.

Most large aerospace companies began to experience real challenges for follow-on-procurement, which had often awarded on a single –source basis prior to CICA. After the demise of the Soviet Union, the United States had to face a changed world order which was engulfed with:[9]

- "Peace dividend" expectations.
- Rising costs of weapons.
- Loss of economies of scale.
- New national security challenges with a radically different threat that caused the reassessment of the entire defence strategy.
- A threat that is more tactical and less strategic.
- The need to more rapidly respond to localised threats.
- No need for as large a military force.
- An opportunity to significantly reduce the defence budget.

As a result, the declining trend in the demand for military equipment has been noted for quite some time, especially since 1994. It appeared to have slowed down during the period 1995-96. Yet, the level of demand was significantly lower than what it was in the pre-1987 period. This trend has had a major impact on arms producing companies. The vast arms industry, for decades nurtured by the Cold War, faced unprecedented contractions in arms procurement orders.

The overcapacity of the industrial base problem was alleviated in large part by the consolidation of companies. As a result of the significant reduction in the

9. Barry G. Campbell, "Challenges Confronting the Defence Industry Today: To Become More Competitive Often Requires Painful Changes," at www.dau.mil/pubs/pm/pmpdf96/campbell.pdf.

defence budget, especially the procurement budget, the numbers of employees working in the defence industry were reduced drastically when compared with the mid-Eighties period. The industry may take many more years to stabilise as it has been in the process of adjusting its production to a situation which is fundamentally different from that of the late 1980s.

The overall decline in the defence market resulted in reduced arms sales by most companies. The combined arms sales of the US companies slowed down in 1996. As a result of the completion of a large number of major mergers and acquisitions initiated during 1996 and 1997, both the shares of arms sales and the number of companies are likely to go down in the near future. In comparison, the West European companies have shown a better result primarily due to significant growth in the sales of the British and German companies. Other OECD companies have suffered as their total share has also fallen by nearly 0.3 per cent. However, the United States completely dominated the international market, providing about two-fifths of all weapons transferred to the developing countries in the 1992-99 period (measured in dollar terms).[10]

The overall decline in the defence market resulted in reduced arms sales by most companies.

Another trend in the US defence industry in the post-Cold War period can be seen in the context of the 1991 Gulf War which affected US arms sales abroad. The US Administration approved a number of major military sales abroad, claiming they served to enhance US security by bolstering the forces of friendly nations in strategic areas, especially the Middle East. On the pretext that the United States had vital security interests in the Middle East – notably the free flow of oil – and that countries such as Kuwait, Saudi Arabia, and the United Arab Emirates (UAE) would be of help in any future encounter with Iraq or Iran. The US government authorised the transfer of $46.5 billion worth of military hardware to the Middle East in 1993 -2000, an amount that represented about three-fourths of the total value of all US military transfers to the developing world. Saudi Arabia was the principal beneficiary of this largesse, obtaining 72

10. "Arms Transfers and Trade," at http://www.answers.com/topic/arms-industry-1

advanced F-15XP Eagle jet fighters, 150 M-1A2 Abrams tanks, 12 Patriot air-defence missile batteries, and thousands of missiles of various types; Kuwait obtained 6 Patriot missile units, 256 M-1A2 Abrams tanks, and 16 AH-64 Apache attack helicopters; and the UAE obtained 10 AH-64s and 80 F-16 fighters.[11]

Mergers and Acquisitions

The US defence industry witnessed rapid consolidation efforts. It was restructuring initiatives in which mergers and acquisitions (M&A) took place, leading to the consolidation of the US defence industry. This resulted in overall reduction in the size and overall structure of the US defence industry. The consolidation efforts in the US defence industry were most prominent in the aerospace sector, which continued till the late 1990s. Another trend was the tilt towards the military electronics sector from the mid-1990s onwards. The purchase of Bath Iron Works by General Dynamics was the only major deal outside the aerospace and electronic sectors. There has been an outstanding concentration of the volume of production in the US military aerospace industry. During years 1990-95, military aircraft sales declined by 32 per cent in real terms and missile sales by 54 per cent.[12] Notwithstanding these downward trends, the US aerospace industry performed reasonably well. The profit margins in the aerospace industry, after registering two years of record profits in 1992-94, declined in 1995. But, it bounced back again since 1995-96 to register profit margins.[13]

The consolidation efforts in the US defence industry were most prominent in the aerospace sector, which continued till the late 1990s.

In fact, the M&A process was adopted because this was the established way to expand a business and succeed in the post-Cold War defence environment. Industry leaders gave substantial amounts of their time in

11. Ibid.
12. For details, see Harvey M. Sapolsky and Eugene Gholz, "Private Arsenals: America's Post-Cold War Burden," in Ann R. Markusen and Sean S. Costigen, eds., *Arming the Future: A Defence Industry for the 21st Century* (New York: Council on Foreign Relations Press, 1999), pp. 191-206. Also see, *SIPRI Yearbook 2004.*
13. Sapolsky and Gholz, Ibid.

thoroughly carrying out the M&A process, and in downsizing and consolidating operations than ever before. In this environment, only the fittest and most competitive could survive.

The US DoD supported the consolidation efforts[14] with the objective of achieving savings in weapons cost through rationalisation of production. In fact, it was since 1993 that DoD had provided the opportunity for companies to write off their restructuring costs against military contracts. During 1993-97, the US DoD share of certified restructuring costs for seven major M&A deals was $765 million, with the forecast that this would result in US DoD savings in weapon acquisition of more than $4 billion over a period of five years. However , these positive developments have been challenged on the ground that rationalisation of production through M&A would lead to monopolistic pricing and the dominant market position of single arms producers is likely to increase their strength in relation to the US DoD. This was evident from the fact that five companies receiving the largest US DoD prime contract awards accounted for nearly 30 per cent of total contract awards in 1998 as compared 20 per cent in 1990, and the single company receiving the largest award accounted for 10 per cent in 1998 as compared to 6.2 per cent in 1990. The most dominant prime contractors in the US defence industry have been in the aerospace sector.[15]

However, in the period between 1999 and 2003, the data of Infobase, a commercial producer of statistics on worldwide M&A activities in the defence and aerospace industry, indicate a strong declining trend in the total value of M&A deals from $65.9 billion in 1999 to $27.2 billion in 2002. Also, 129 acquisitions of defence related firms had taken place in the first half of 2003, a 30 per cent increase in comparison to the corresponding time in 2002, as per Infobase data. The trend was, in fact, in the number of M&A, not in their values, which could include a large number of small acquisitions. Reports and data released by the US DoD indicate that the number of M&A had increased. There

14. Congress and Executive Agencies spent considerable time attempting to improve the acquisition process. Changes were incorporated into Federal Acquisition Regulations to support the consolidation process. Federal Acquisition Regulation (FAR), http://www.acqnet.gov/FAR/.
15. Deba R. Mohanty, "Trends in Defence Industry" in Jasjit Singh, ed., *Aerospace Power and India's Defence* (New Delhi: Kowledge World, 2007), pp.99-119.

is also a trend towards lower values for each of these and a shift in transactions from the prime contractor level toward the sub-contractor level.[16]

Most of the companies have shown an increasing trend in defence sales in recent times mainly because of acquisitions of defence units from other companies. However, toward the end of 2003, commercial and industrial interest in M&A seemed to be declining. It was anticipated that high value defence M&A would slow down as a result of cooling defence stocks, rising potential for deals in commercial aerospace and a resurgence of commercial information technology (IT) firms, which would draw investors away from the defence industrial sector. In fact, M&A and company strategies are basically increasingly driven by the desire to obtain capabilities in growing sectors like aerospace, electronics, communications, IT and services. The process is based on long-term trends in the development of military technology and the transformations of military forces that emerged in the 1990s and this happened mainly because of the increase in US procurement spending since 2001-02. In fact, trends indicate that companies are inclined towards those areas where procurement budgets are increasing. The US DoD is playing a significant role in facilitating and promoting industrial transformation in this direction. The stated US policy includes purchase from, and cooperation with, non-US companies in order to get new technical knowhow.[17]

Looking at the trends in recent years, M&A in the defence industry remained the fashion in 2005, albeit at a less rapid pace than during the 1990s. One major difference from that period is that the largest arms producing companies have order backlogs and are currently "awash in cash."[18] Companies may have been using, and will continue to use, some of this free cash flow for spending on acquisitions. According to one estimate , "free cash flow" – the amount of cash that a company has left after paying all its expenses, including investments – at the world's largest defence companies, grew from $8.9 billion to $ 17.5 billion in 2004.[19]

16. Mohanty, Ibid.
17. For an account of trade offsets witnessed in the US defence industry in recent times , see Jasjit Singh, "Arms Trade Offsets: The Key to Energise our Defence Industry," *Air Power*, vol.2, no.1, Spring 2005, pp.149-177.
18. L. Wayne, "Cash puts US Military Contractors in Bind," *The New York Times*, May 13, 2005, at http://www.iht.com/articles/2005/06/12/business.contract.php.
19. The analysis was conducted by J.P. Morgan and reported in Ratnam, "Industry's Full Pockets: Surplus Cash, Tight US Budgets May Mean Wave of Acquisitions," *Defence News*, May 16, 2005, p.16.

Mainly two factors continue to drive further consolidation in the arms industry.

- The first is the rush into those sectors of the arms industry that company managers and investors consider to be expanding. These are primarily the military service sector, which supplies services and logistical support to the armed forces, and the information technology sector, which provides products and services in support of network-centric programmes. In order to succeed in these sectors, companies continue to seek to acquire smaller companies that have particular skills that they lack.[20]
- The second factor is the desire of non US-based companies to access the lucrative US market by acquiring (either directly or through a local subsidiary) a US arms producing company.[21]

Five very large acquisitions that were concluded in 2005, each with a deal value close to, or greater than, $2 billion, make it a particularly significant year for arms industry consolidation. In 2004, there was only one acquisition of comparable size. By far, the largest and most strategically noteworthy acquisition of 2005 was that of United Defense (USA) by BAE Systems (UK) for $4,192 million. This was the largest ever acquisition of a US defence company by a non - US company. An extraordinary result is that a British company is now the sixth largest contractor for the US DoD.[22] Three of the large acquisitions in 2005 were in the IT sector: L-3 Communications (USA) acquired Titan Corporation (USA) in a deal valued at $2,650 million; General Dynamics (USA)) announced an agreement to acquire Anteon International (USA) for approximately $2,200 million; and DRS Technologies (USA) spent $1,970 million to acquire Engineered Support Systems (USA).[23]

The BAE Systems acquisition of United Defense highlights an important development in their industry: BAE Systems is not alone in its strategy of gaining access to US markets by acquiring a US company. For example, another British company, QineteQ, acquired two US aerospace and defence companies in 2004 and another in 2005. VT Groups (UK) also acquired a US company, the Cube

20. *SIPRI Yearbook 2006*.
21. A. Chuter, and P. Tran, "UK Firms Flex Muscles in US Market," *Defense News*, August 22, 2005, p.16.
22. A. Rothman, and E. Lococo, "BAE Buys United Defense to tap US Military Sales," Bloomberg.com, March 7, 2005.
23. *SIPRI Yearbook 2005*, p. 392.

Corporation, and announced its intention to double the size of its business in the USA by 2008. Thales and Finmeccania have also expressed their desire to increase their sales, possibly by acquiring US companies.[24] Efforts by the non-US companies to access a greater part of the large US procurement budget in this way have been characterised as an "uphill battle," however, because of the ongoing political debates in the USA about the procurement of foreign military equipment.

The early years of M&A in the defence industry in 1988-89 and those in 2005 are distinct in two ways. In the earlier years of acquisitions in the defence industry, there were 18 transactions noted in 1988-89 and 54 transactions in 2005. There has been attempt by European companies to move into the US market and apart from that there have been seven trans-Atlantic acquisitions of US companies in 2005.[25]

US ARMS TRADE

Trends in world military spending can be divided into two major periods in the post-Cold War period: a marked decline from the Cold War peak in 1987, then a bottoming around 1998 and an increase in 1998-2005. Indeed, world military spending in 2005 exceeded in (real terms) the peak of spending during the Cold War. The US has been the main contributor to the upward trend in world military expenditure, with the combined expenditure of the next five largest spenders – the UK, France, Japan, China and Germany–less than half that of the USA. The 26 members of just one military alliance, NATO, account for 70 per cent of world military expenditure in 2005.

After the end of the Cold War, there was an immediate fall in the demand of arms that questioned the ability of the major powers, including the USA, to maintain a domestic defence industrial base. As a result there was not just a quantitative change in the number of weapons required, but a qualitative change in the types needed. There has been marked qualitative change in the nature of technology as civil technology became increasingly important for weapon systems. Since World War II to the 1980s, military technology had tended to be

24. *SIPRI Yearbook 2005*, p.393.

25. D.G. Jones, "The Rise of Europe's Defence Industry," *US-Europe Analysis Series* (Washington, DC: Brookings Institution, May 2005), at http://www.brookings.edu/fp/cuse/analysis/>

ahead of civil technology but now the focus is more on "spinning-in" civil technology to the military sector.

As a result of M&A, there has been a structural change in the defence industry. At the end of the Cold War, the international arms industry was not concentrated, with the top five companies accounting for 22 per cent of the total arms sales of the SIPRI top 100. By 1995, it reached 28 per cent, by 2000, it reached 41 per cent, and by 2003, total arms share of the top five (in which four were US companies) reached 44 per cent. In fact, the most intensive period of concentration was between 1993 and 1998 and further a smaller increase between 1998-2003.[26]

By 2003, total arms share of the top five (in which four were US companies) reached 44 per cent.

Looking at international arms transfers by nations, the trends show that one of the most noticeable facets of major arms transfer is the stable composition of the group of major suppliers, with the Soviet Union/Russia, and the United States comprising a category of their own. The total volume of arms sales reached its peak in 1982, when the Soviet Union, the United States, France, the United Kingdom and Italy accounted for about 82 per cent of the world total. In 2005 also, the five largest suppliers – the USA, Russia, France, Germany and Netherlands – still accounted for about 82 per cent of total deliveries, although the total global volume was only 51 per cent of that of 1982, thus, showing the post-Cold War decrease in transfer of major weapons.[27]

Coming to the United States, it remains by far the largest exporter of weapons in the world, with a sales volume that exceeds the next 14 countries combined. Military sales equal about 18 per cent of the federal budget, far and away the greatest proportion of any nation (estimated budget authority as presented in the president's budget). Due to the consequent fall in the gross domestic product (GDP) the US government has been relying on arms sales.[28]

US arms are sold either as foreign miltary sales (FMS), in which the Pentagon is an intermediate negotiator, or as direct commercial sales (DCS), where a

26. *SIPRI Yearbook 2005*, pp.397-412.
27. *SIPRI Yearbook 2006*, p.449.
28. See John Ralston Saul, *The Collapse of Globalism* (Atlantic Books, 2005).

company directly negotiates with the buyer. Most sales require a licence from the State Department. The Defence Department manages the excess defence articles (EDA), weapons from the US military given away or sold at bargain prices, emergency drawdowns, assistance provided at the discretion of the president, and International Military Education (IMET).

From 1989 to 1996, the global value of direct commercial arms sales was US $ 257 billion, of which 45 per cent was exported from the US. According to the 2005 annual US Congress reports, 58 per cent of all US arms trade contracts are made with developing countries.

In 2003, the US transferred weaponry to 18 of the 25 countries involved in active conflicts. From Angola, Chad and Ethiopia, to Colombia, Pakistan and the Philippines, transfers through the two largest US arms sales programmes (FMS and DCS) to these nations totalled nearly $1 billion in 2003, with the vast bulk of the dollar volume going to Israel ($845.6 million).

In 2003, more than half of the top 25 recipients of US arms transfers in the developing world (13 of 25) were defined as undemocratic by the US State Department's Human Rights Report: in the sense that "citizens do not have the right to change their own government" or that right was seriously abridged. These 13 nations received over $2.7 billion in US arms transfers under the FMS and DCS programme in 2003, with the top recipients including Saudi Arabia ($1.1 billion), Egypt ($1.0 billion), Kuwait ($153 million), the United Arab Emirates ($110 million) and Uzbekistan ($33 million).

In fact, in the period 2001-05, the USA accounted for 30 per cent of global deliveries of arms. The four largest recipients – Greece, Israel, the UK and Egypt – accounted for 36 per cent of US deliveries in 2001-05.[29] The year 2005 was important for US bilateral arms relations with three countries in particular – India, Israel and Japan. Increasing US arms relations with India and Japan can be seen in the context of counter-balancing Chinese influence in the Asian region and India as a viable market for its arms industry. US arms trade with these countries will see a more positive trend.

29. F. Berrigan, W. D. Hartung, and L. Heffel, *US Weapons at War 2005: Promoting Freedom or Fuelling Conflict?* (New York: World Policy Institute, June 2005) at http://www.worldpolicy.org/projects/ arms/reports/ wawjune2005.html.

SCENARIO AHEAD

There have been marked changes in the structure of the international arms industry since 1990. The future prospects for the US defence industry would hinge upon its ability and preparedness to meet a number of factors and challenges, which include the following:

Globalisation

Increasing globalisation has forced the US industry to secure markets outside their home market to sustain their revenues, profits and share prices. Foreign customers had been demanding local production, offset or workshare as a prerequisite for purchasing American defence equipment. Since the end of the Cold War, US defence companies have been trying to cope with the Pentagon's cut down in its defence equipment purchasing, and research funding, and international cooperation is increasingly being seen as a way for US defence companies to gain access to technology and products that they have neither the time nor the resources to develop themselves. The Pentagon too is not averse to supporting international partnerships by American defence companies, where they coincide with US security policy goals or allow US production lines to remain open.

Foreign customers had been demanding local production, offset or workshare as a pre-requisite for purchasing American defence equipment.

Technological Challenge

As long as the US had to face mechanised warfare, the major defence industrial challenge was basically a question of evolving new technologies and manufacturing the weapons. In the post-World War II period, the shortfall in the US force structure was compensated by its strategic and nuclear forces. But the technological challenge for defence today is fundamentally different. While the need for restructuring was only the first of many questions facing industry leaders and US policy-makers, the

technological challenge that exists and would remain in the future is how well the US defence industry adapts itself to the IT revolution; maintains a technology base that will ensure its military superiority in years to come; and responds to the competitive demands of an increasingly global and interdependent economy.

The Changing Nature of Warfare

It appears unlikely that the US and Europe (that is, NATO) will face an enemy that can provide a symmetric response; asymmetric conflict is most likely. This can change the nature of warfare and lead to more informal, guerrilla-type conflicts with implications for the weapon systems required.

The Pace of Obsolescence of Some Major Weapon Systems Such as Fighter Aircraft

Recent defence analysts have suggested that many fighter aircraft are coming to the end of their lives and will need to be replaced.[30] Also, the challenge is coming from the increasing use of unmanned aerial vehicles (UAVs) and the establishment of network-centric warfare.

The New Security Environment and its Demand for New Types of Military Missions

There is likely to be an increasing role for NATO and EU troops in crisis management and peace-keeping roles around the world. This changes both the nature and structure of the required armed forces and the types of weapons systems they need.

The New Technologies Introduced as a Result of the War on Terrorism

The global war on terrorism that confronts an uncertain enemy and US homeland security has stimulated the demand for communication and surveillance technologies. Where companies do not have these technologies, they are acquiring them.

30. According to one report, by 2011, the "global fighter aircraft market will reach a new post-Cold War peak, with deliveries reaching $16 billion." See M. Fabey, "US JSF Casts Long Shadow on Fighter Market," *Defense News*, June 6, 2005.

The Degree of Outsourcing of Services from the Military Sector (Armed Forces and Defence Ministries)

Defence ministries (particularly the US DoD) are increasingly using private companies to undertake tasks that would have been done by the military in the past.

Ageing Work Force

The problem of an ageing work force will need to be addressed. The average age of the civilian workforce is 46.7 years and the number of workforce members with 30-plus years of experience continues to increase. The US defence sector is losing a significant amount of corporate knowledge, experience, and capability. There is an impending talent gap created by the workforce problem.

The US defence sector is losing a significant amount of corporate knowledge, experience, and capability. There is an impending talent gap created by the workforce problem.

CONCLUSION

After the end of Cold War, the US defence industry has shown a tremendous amount of pliability and shock- absorbing capability to face the challenges. The inherent strengths of the US defence industry such as the industry being the most proficiently ordered, which allows interaction between the industry and the government, its sheer size, its high stakes involved in the international arms market, enabling it to foresee the forthcoming difficulties, the investment strength of private firms helping in the consolidation process, and the desire to maintain preeminence in defence related technology and its interests appear to have helped the US defence industry overcome the scenario that raised questions on its survivability.

In the post-Cold War era, restructuring and concentration have been the prominent trend in the US defence industry. But at the global level, this still has some way to go in Europe. In the coming years, the growing trans-Atlantic nature of the defence industry will be major driver of the restructuring of the US

defence industry in terms of both the European companies' aspirations to become major players in the US market and the USA's acceptance that interoperability requirements, the benefits of cooperative defence programmes, and an increasingly global industrial infrastructure require that the US DoD be prepared to accept the benefits offered by access to the most innovative, efficient, and competitive suppliers worldwide. The USA will continue to dominate the industry and the US defence market will see more and more non-US companies attempting to access it.

And given the global role that the United States has to play in the near future, the defence industry cannot be taken as just another business industry. It is backbone of US national security and its share in providing business and employment is large. The US defence industry will need to keep the US forces at the forefront the technology. Hence, active engagement of the US defence industry in the global economy, updating itself it with the latest technology, developing greater partnerships with the defence industries of its allies as well as partnerships with the private sector industry and commercial industry in the US to share both R&D and production expenses, can ensure the maintenance America's technological military preeminence and supremacy in the global defence industry.

THE IMPACT OF NEW TECHNOLOGIES IN THE MILITARY ARENA: INFORMATION WARFARE

PAULO FERNANDO VIEGAS NUNES

INTRODUCTION

> *We live in an information-dominated era. Technological discoveries... are changing the nature of war and the way we prepare for it.*
>
> – US Secretary of Defence William Perry

The current status of decision support systems is marked by the multiplicity and transitoriness of the information vehicles that feed them. The realm of its application is broad and decisive on the modern battlefield, which is characterised by the extensive use of technologically advanced equipment.

That fact, though not exclusive, characterises the action of the armed forces in emphasising its importance due to the critical nature of the information that flows in the command and control systems. Technology plays a key role within this context not only as a guarantor of the existing information systems' effectiveness but also as the best way to render those systems inoperable, repackaging an old but ever present concept that is now called "information warfare."

The significant technological advances witnessed in the telecommunications

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and information systems areas have compelled us to define and restructure new and old concepts linked to the transport and use of information, making terms such as digitalisation of the battlefield, communication integration and globalisation, war games, command, control, communications and intelligence (C3I) and communications, information and intelligence (CI2), military Internet, *hackers*, etc., the order of the day.

Due to its growing importance, this issue is currently the subject of a long debate in both military and civilian realms at a moment in history when one witnesses the progressive internationalisation of conflicts and of the world economy, where globalisation is the operative term.

CONCEPTUAL FRAMEWORK OF INFORMATION WARFARE

The new era, in which science and industry play a determinant role in the destructive power of the military, is characterised by the existence of three major types of weapons that succeeded one another in importance within the age-old offensive versus defensive conflict: obstruction weapons (ditches, ramps, bastions, armour, and fortifications of all types), weapons of destruction (spears, arches, firearms, artillery pieces, missiles, etc.), and, finally, communication weapons (signal, information and transport vectors, optical telegraphy, radiotelephony, radars and satellites, among others). Each of these types of weapons dominated a particular kind of confrontation: siege warfare for the first, manoeuvre warfare for the second and *blitzkrieg* for the last one.

This historical evidence is also described in *The Third Wave* and *War and Anti-War*, in which the argument is made that the wars waged throughout several historical eras are characterised by revolutionary technological discoveries that cause "waves" of socio-economic changes. According to the authors of those works, Alvin and Heidi Toffler, the first wave (agrarian) was characterised by the cultivation of the land and the domestication of animals; the second wave (industrial) was characterised by mechanisation, large-scale production, and work division; the current wave (informational) is characterised by digitalisation, computers, and information technologies.

The arguments made by those authors include a definition of the objectives of

the wars imposed by the predominant socio-economic structures in the different epochs. Pre-industrial wars were generally materialised by the conquest and/or control of territorial resources. Industrial era wars had as their objective the reduction and limitation of the opponent's production resources. Supposing that this analogy is valid, future wars will be fought to ensure control over data, information, and knowledge.

In fact, everything henceforth hedges on information or disinformation – truthfulness or untruthfulness. That once again brings the conflict between sword and armour to the surface.

In this context, some propose that the hierarchical command structures and the heavy military industry structures created to meet the needs of the industrial era now give way to the more decentralised and horizontal structures of the information era, as is the case in business-oriented civilian organisations. The success of those organisations that have adjusted to the modern world of computer networks, communication and data processing – and the failure of those that did not – is a compelling argument for the introduction of new command and control processes and procedures in the military.

INFORMATION WARFARE: RELATED ISSUES

> *Communication without "intelligence" is noise, intelligence" without communication is irrelevant.*
>
> – Gen Alfred M. Gray, USMC

> *Winning 100 victories in 100 battles is not the exponent of excellence. Subjugating the opposing army without a fight is the true exponent of excellence.*
>
> – Sun Tzu, *The Art of War*

Information warfare is one of the pleasant sounding terms to which we have grown accustomed over the past decade. It is normally associated with both military and civilian arenas.

Despite the fact that this topic has been the object of several studies done by both strategy analysts and defence organisations, no one has been able to precisely define "information warfare." However, everyone agrees on one thing:

in the digital era, information and its dissemination have reached the status of a vital strategic resource. In the light of this situation, a large number of military and civilian organisations have already established their work processes and methods so as to include and integrate this "new" concept in their fields.

The term "information warfare" means to perform the same tasks we used to perform but at a much faster rate by occasionally using equipment derived from our society's technological evolution. In fact, there is nothing really new at the root of the term. One can even ascertain that the basic ideas of the information warfare concept have been around for centuries.

The real problem concerning the information warfare concept lies in the fact that we have a set of old concepts dressed in new clothing. Depending on whom we talk to, information warfare encompasses attack on command and control systems, operational security, cyberwar, and electronic warfare; hacking, information-based warfare, and even psychological warfare.

The term "information warfare" means to perform the same tasks we used to perform but at a much faster rate by occasionally using equipment derived from our society's technological evolution.

Attack on Command and Control Systems

Attack on command and control systems takes place through actions that make it more difficult for the enemy to control his forces and communicate with them. This embodies one of the oldest principles of war, and, even if our forefathers did not call it information warfare, it is probably its most important aspect. The key to the problem is the ability to make decisions faster than the opponent and then act according to those decisions.

The decision cycle contains no mysteries – it is a fact of life. Everything we do is based on decision cycles. In the military arena, the decision cycle can be encapsulated in the acronym OODA (Observe, Orient our attention toward what has just happened, Decide how to proceed, and Act). Information warfare can, for example, deny our observation. The lack of information prevents us from adequately orienting our attention, making a decision, and, most importantly, acting in an effective way.

As an example, let us suppose that a computer genius was able to enter one of the networks that serve the North Atlantic Treaty Organisation's (NATO's) information systems. The enemy hacker deleted some information and changed data so as to create a false picture of what was happening on the Kosovo battlefield. After the operation, NATO commands would see a false version of reality and would inescapably end up making disastrous decisions, such as bombing areas where Serbian munitions warehouses or armoured vehicles were supposed to be, but where in fact Albanian refugee camps are located.

Operational Security

Operational security is designed to ensure the preservation of our secrets and the places where they are kept. It is accomplished by safeguarding secret documents in safe places, thus, assuring that electronic messages be coded and not easily accessed by the enemy, and by training our troops to keep important information only to themselves. Known as OPSEC in the civilian business world, this concept gave rise to some famous World War II slogans, such as "loose lips sink ships" and "the enemy is listening."

Electronic Warfare

Electronic warfare uses electronic means to neutralise enemy command and control systems, working on their communication and electronic systems while ensuring the integrity of their own systems. This type of action has existed since the military began using the telegraph in 1850. Equipment specific to electronic warfare began to appear in an efficient and coordinated way in World War II. Today, it is a standard component of any army's inventory.

Cyberwar

The cyberwar concept, though at times referred to as being different from the electronic warfare concept, can be considered as one of its integral parts. Thus, cyberwar encompasses the use of all electronic and information systems "tools" available to bring down enemy electronic and communication systems while keeping our own systems operational. Many of the actions to be developed in

this area are still not clearly defined due basically to the fact that new equipment is emerging continuously and that only recently did the military start considering this technological area as a new way of war. Some elements typical of cyberwar appear here and there in an irregular and not very systematic way as opportunities for their use emerge. "Cybersoldiers" are normally confined to combat information centres (CIC) equipped with monitors, computers, and other high-technology equipment maintained by expert technicians. Their mission consists of ensuring that commanders receive current data about the situation on the battlefield.

The US Navy introduced the use of CIC for the first time about 50 years ago. Since then, their use has expanded. They have also been adopted by the other branches of the US military as well as by the armed forces of other countries.

Hacking

Hacking or "electronic guerrilla warfare" can be used by any person at any place in the world. All one needs are a computer, a modem, and some determination. This phenomenon is something recent due to the fact that it only has been a few years since we began to witness the introduction of international computer networks that virtually anyone can access. The Internet is the best example of this.

A large number computer programmers, technicians, and surfers with free time in their hands and malicious intentions, surf computer networks in search of security holes or breaches in information systems belonging to the armed forces or major corporations. This has been taking place on a consistent basis for more than a decade due to a certain lack of organisation in the network structures operated by the government and some corporations. Over the past decade, there have been a few attempts to turn the hacker problem into a "military weapon." This process has neither been agreed to nor easily put into practice, but in the light of the major advantage one can gain by penetrating the enemy information system in times of war, it is worthy of serious consideration. This has happened only in fiction, but many countries are already working toward using this scenario in the next conflict in which they are involved.

Today, hacking is an extremely attractive strategic activity for international terrorism. A testimony to that fact is the news disseminated by the August 21, 1991, *Correio da Manhã*, whereby Ramos Horta threatened Jakarta with computer terrorism activities to be carried out by 100 hackers (from Europe. Canada, and the United States) against the Indonesian banking systems.

Today, hacking is an extremely attractive strategic activity for international terrorism.

Information Jamming

Information jamming is a variation of the concept underlying the old practice of physically blocking an enemy's territory, thus, preventing him from receiving resources and goods. Due to the extreme importance of today's information, it is possible to effect a real "information jamming" if we shoot down the satellites and destroy the cable links and microwave antennas that channel information into enemy territory. After some time, this situation will be extremely difficult to overcome, especially in the more technical areas.

Information-Based Warfare

This is an area that is more associated with the concept we are attempting to define. In the 1960s, it was discovered that the mass media could make a decisive impact on the political decision-making process. Even before then, several governments in all parts of the world realised the importance of controlling the media (especially the print medium) and directing them to meet their own interests. As an increasing number of people began to see the way the media operates – collecting and disseminating information – more people began to participate in the handling of the news, thus, influencing what is disseminated by the mass media.

In the 1960s, it was discovered that the mass media could make a decisive impact on the political decision-making process.

A good example of information-based warfare could be observed during the 1991 Gulf War, when CNN, through Peter Arnett, showed the war live via

satellite to the whole world. We watched the US use television as a way of bringing pressure to bear on national and international public opinion.

Iraq also tried, with some success, to sway public opinion in its favour. The Iraqi cause remained popular among the general population of many Arab and Third World countries due to the way the Iraqi leadership exploited the visibility CNN and other international media gave the conflict. The "media offensive" did affect public opinion somewhat in the nations involved in the conflict.

More recent examples of the use of the mass media as elements to pressure public opinion and the international community are the recent conflict in Kosovo and the ongoing process for the independence of East Timor.

Psychological Warfare

Widely used, psychological warfare is nothing more than disseminating misleading information designed to demoralise the enemy. This type of action continues to be frequently used with marked success. However, there is another aspect of information warfare that has to be considered. Information warfare is defined largely by the way information is used as a weapon against enemy forces. Within a context of psychological warfare, we can work on the information that travels through the enemy's systems to prevent him from using it, or we can defend ourselves against this type of action by attempting to delete the information the enemy covertly handles and sends to us via computer, telephone, or even through any other means.

The Gulf War, often described as the first information war, is once again a good example of that type of action. The Coalition carried out an extremely effective psychological warfare campaign against Iraqi forces, at least if we consider the number of Iraqi soldiers and how quickly they would surrender whenever Allied ground troops would approach them. In fact, this operation went as planned since the pamphlets that were dropped over Iraqi troops told them exactly how they should surrender and showed the advantages of surrendering (becoming guests of honour of the Saudis). Both sides also used the media to reinforce the operation in an attempt to influence the enemy forces' will to fight.

THE INFORMATION WARFARE CONCEPT

Current definitions of information warfare are military in nature, despite the fact that many people are now beginning to understand that information warfare is not limited to the military realm. The information warfare concept can be described as the use of information and the equipment that it uses as tools (weapons) against opponents.

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Non-military uses of information warfare can take the shape of industrial or economic espionage that is used through government or private agents to gain a competitive advantage over an opponent by revealing his secrets while protecting those belonging to their sponsor. Of course, that situation will have a direct military effect if those "infospies" select military technology as the focus of their activity.

There is no need for weapons of physical destruction to conduct information warfare, but, as we will have the opportunity to see next, that may happen at times. In fact, most tools used in information warfare are of the non-violent type, since information assumes visible form as data even if it sometimes is linked to military information systems. Even the primitive peoples, armed only with bows and arrows, had a very real understanding of the value of information: on the current enemy position, his organisation, his combat tactics, and on the battlefield in general. Accordingly, the primitive man could afford not to have a lot of technology, but needed a lot of information, and used it. From the primitive man to the man of our time, we can see that there has been an evolution in the amount of available information and the degree of dependence we have in relation to the information that we do not control.

The military in industrialised nations has become increasingly dependent on its communication systems and electronic equipment. The superiority of modern weapon systems is basically due to the fact that they transfer their data quickly across the battlefield. If we interrupt that flow of information, we will disable those high-technology systems.

Information warfare encompasses everything that can be done to protect our information systems from being exploited, corrupted or destroyed while simultaneously exploiting, corrupting or destroying the enemy's information systems.

So, in seeking to define this concept, we can say that information warfare encompasses everything that can be done to protect our information systems from being exploited, corrupted or destroyed while simultaneously exploiting, corrupting or destroying the enemy's information systems. That will enable us to gain a necessary information advantage if we become involved in an armed conflict.

Even if the use of force becomes imperative in the event combat breaks out, that is not the natural order in information warfare, as we have already seen. Information warfare is often nothing more than obtaining information faster that the enemy and assessing it in a more careful and effective way.

TYPES OF INFORMATION WARFARE WEAPONS

Much has been written recently on the various shapes information warfare can take. Within this realm, scenarios have been developed involving hacker wars, electronic warfare, information jamming, etc. However, this type of approach is a product of a vertical analysis that has only a few specific capabilities. There is no systematic approach to a taxonomy adapted to the weapons of information warfare. If instead of adopting a definition based on a weapon's physical configuration, we distinguished them according to their effects, we will arrive at an analysis matrix that will enable us to have greater relational objectivity. So, there are currently three major types of weapons capable of being used to carry out information warfare. They can produce physical, "syntax", and "semantics" effects.

Physical Effects

The use of a physical weapon will result in the permanent destruction of the information structure's physical components. A direct consequence of this is the corresponding denial of services. The complexity associated with these types of weapons is low, and their use is linear. To attain this objective, we have a wide gamut

of means that encompass traditional weapon systems such as missiles, explosives, sabotage, etc. There are also the so-called directed-energy weapons that are under development. These weapons, also known as radio frequency (RF) weapons, are devices that destroy through the emission of electromagnetic radiation in an RF with a wavelength greater than 1mm(a frequency less than 3000 GHz). This specific pulse type could cause more damage in the World Trade Centre's information systems than that caused by the bomb that exploded there recently.* These weapons are seen as a very important development because they allow the use of non-lethal force.

"Syntax" Effects

A "syntax" weapon is designed to attack an information system's operational logic by introducing delays or unpredictable behaviours in its operation. New computer viruses, as well as their counter-measures (anti-virus software), are being created at an alarming rate. Currently, there are programming environments in the market that "incubate" viruses according to the attacker's wishes. The objective of this class of weapon is to control or deactivate the logic of the networks and information systems targeted. Using the operational system's software or other systems tools, a virus can make the system work differently than expected or simply experience major delays in its execution. Here lies the central axiom of information warfare – control the enemy information systems and you will control his decision-making process and his ability to see and understand events. In that case, there is no need to destroy the enemy information or systems if we can control it. The use of viruses as an information warfare weapon has as its designated target the structural component of the information infrastructure – that is, the system's operational logic. As such, the use of this type of weapon becomes somewhat complex and follows a statistical model in the targeting process.

"Semantics" Effects

The objective of a "semantics" weapon is to destroy the trust the user places in the information systems and its supporting network, as well as to influence the interpretation of the information that flows in them. The focus of this type of

* This refers to the World Trade Centre bombing in 1993 – *Editor*

weapon is to manipulate, change, and destroy the decision models, the perception and representation of reality built through the use of an information system belonging either to a military command and control system or to a civilian organisation. The complexity associated with this type of weapon is high, since it does not seek to affect the information systems proper but rather the behaviour of its users, thus, influencing their decisions. In a not so distant future, information systems in multimedia environments will be the main information management tool. As a direct consequence of this situation, the user will have to place an even greater trust in automated processes to seek, access, collect and present information during the critical phase of intensive processing of information that as a rule occurs in a crisis situation. The existing danger (or opportunity) lies in the fact that what we believe to be objective information always resides in a specific point of view and, as such, is open to manipulation. As we can logically infer, this situation will greatly affect the correct decision-cycle performance.

Framework for the Use of Information Warfare Weapons

The technology associated with information warfare weapons is not a limiting factor nowadays. Its use is limited only by the lack of organisational, doctrinal, and legal knowledge on this issue.

Determining how these information warfare weapons are to be used, in terms of offence or defence, sparked a heated debate on the legitimacy of activities classified as information warfare actions. The US resolved this dilemma by dividing information warfare into two different components: offensive information warfare (OIW) and defensive information warfare (DIW).

The US military is working especially hard on the development of a defensive capability. This option is seen as acceptable, and it is classified by many as a legitimate information warfare activity. However, conducting information warfare activities does not eliminate the need to develop research processes, offensive in nature. These capabilities are activated due to the need know the weaknesses within the system itself. The fact is that we are led to conclude that the development of this type of action requires an offensive information warfare

capability. So, if we talk about defensive information warfare without alluding to offensive information warfare, we will be studying only one side of the coin, disregarding the synergy required from those who wish to maintain strategic superiority in information warfare.

The capability to assess weaknesses is one of the ways to ensure that information is effectively and safely configured. Classifying networks according to their size, locating all their structural elements, determining all access points, and installing sensors to monitor and exploit the processes are some of the important activities that have to be carried out to make a correct analysis of the vulnerabilities. To conduct war games, defensive information warfare needs an offensive information warfare capability to reach a relatively safe risk management level.

THE INTERNET AND INFORMATION WARFARE

The Internet: Birth and Evolution

In the late 1970s, personal computers (PCs) equipped with modems became progressively more common not too long after the emergence of computer networks. Many of those computers belonged basically to private corporations, where some programmers had designed information database software that allowed users to share files and messages with other users. This system involved nothing more than a single modem-equipped computer running a BBS (Bulletin Board System). Anyone who knew the phone number of the line to which the modem was connected could make a call and be connected to the system. Some private companies also began to adopt this system, though with some additional security procedures to prevent access from unauthorised persons.

However, the system that would drastically change this situation was the Internet. Designed in the early 1960s under the aegis of the US Department of Defence (DoD), it was first called ARPANET (Advance Research Project Agency Network). This network started to be more widely used only in the 1970s. Thus, military and university computers were connected through telephone lines. Researchers from the scientific community and military personnel could now

communicate more easily over technical projects in which written communication was much more effective than verbal. The experimental nature of this network allowed quick progress in solving a large number of technical problems. The system was built in such a way as to enable any network user to access any other computer within the same network. Although this situation could expose all network computers to sabotage, it seldom happened, at least in the beginning. Everything went smoothly until the network grew so large that the small number of hackers, who had always existed, increased considerably.

In early 1990, the Internet was already an international platform with more than 10 million users. Many of those mischievous hackers decided that it was much more fun to destroy the system than to promote its expansion or sustainability. Although people who use their personal computers connected to the Internet are generally aware of their vulnerabilities, not all of them improve their own systems to inhibit computer vandals. Besides, there is still some doubt as to whether or not the use of the Internet will become completely secure. The Internet was developed as a poorly organised project. The US government, which funded its initial design, has encouraged its growth as a very "loose" network. That means that if major parts of the network were destroyed in a nuclear war, for instance, the surviving parts could still work. People who build the network, many of them volunteers, also see the advantage of a decentralised network free from the tutelary control of a central authority.

Benefits and Vulnerabilities Associated with Internet Use

The Internet consists of millions of personal computers interconnected by telephone lines using software and common formats to send and receive information. A user can access the Internet through his or her personal computer or through a mainframe shared by thousands of users. Each computer has its own address within the Internet domain, such as *brown.edu* (a university), *army.mil* (US Army), *mobil.com* (multinational corporation), or *aol.com* (large commercial chain). Although all these computers use a common software to communicate with one another, they can individually use a great variety of operating systems. By the early 1990s, the system became so large and complex that no one could exactly say

who controlled it. Even today, we still don't know all the nasty things that can be done to the different types of computers connected to the Internet. Some of these computers are more vulnerable than others. All it takes is to access a computer connected to the Internet to get passwords and other information that will enable access to many more computers that are also connected to the Internet. As a response to this situation, many corporations began to develop firewall software for their own use or for sale. This software allows isolating the computer. However, since almost all computers (from the personal computer to the mainframe) can be connected to the Internet and not all firewall systems are identical, it is impossible to reach the same level of effectiveness.

The Internet as an Element in Information Warfare (IW)

The local area network (LAN) saw increased use in the 1970s. A LAN, as its name indicates, consists of computers usually located in the same building and connected by electric cables. When a LAN computer is connected to the Internet, all other computers within that LAN can, in most cases, be accessed by any other computer connected to the Internet. The Internet has become too valuable not to be used, but also too risky for an intrusion in a PC or LAN from vandals. This situation is now much more dangerous than it was 50 years ago, when the only existing networks were the telephone networks.

The Internet brought something slightly different from the original telephone networks. These new networks now carry multimedia information (voice, database, text, and video) using satellites and microwave systems in addition to the traditional cable systems. There is an increasing number of automated systems in which machines communicate with machines with minimal human intervention. These "machines" control electric power systems, communications and a large number of tasks in factories or wherever easy and repetitive tasks are involved. Although these tasks are easy and repetitive, they are often vital. If one of these machines makes an error or if it is sabotaged, a whole city can be without power, a telephone network can become inoperable in a large area, or a bank can be without power, a telephone network can become inoperable in a large area, or a bank can be robbed.

This situation has contributed to the increasing importance of information warfare. If a person has the chance to access one of these "robots", he or she can often neutralise its decision-making process. That, of course, will not directly cause anyone's death, but the fact of the matter is that military systems use several of these automated systems. For example, it is estimated that 90 per cent of military communications use commercial data connections. The individual user, the banking system and DoD all use the same telephone lines. Although most of the data is sent from a machine to another with no human intervention, it is possible to interfere in the process if we are able to access the system. We can use secret codes to send data, but these codes can be broken. Any computer network user is vulnerable.

Since it is true that we cannot afford not to use computer networks nowadays, we find that information warfare consists basically of exploiting that vulnerability. Many weapon systems, radars and headquarters (HQs) depend on the speed and functionality offered by computer networks to ensure their operability. The country that tries to manage its armed forces without these networks will find itself at an enormous disadvantage before an opponent who is completely interconnected by communication networks. We must not forget that the first objective targeted during the Gulf War comprised the Iraqi communication networks. Once those networks were cut, the Iraqis never regained their full operational capability. That is the embodiment of an information war accompanied by smart bombs, themselves a product of the modern technological evolution. However, it is also possible to perform information warfare actions using a personal computer and a telephone line. Never before was there a situation in which a war was open to anonymous individuals sitting at their desks from distant locations and armed with personal computers and other electronic devices.

The first objective targeted during the Gulf War was the Iraqi communication networks. Once those networks were cut, the Iraqis never regained their full operational capability.

So far as we know, it has not been organised hackers who have usually created all existing

computer viruses or attempted to penetrate networks. In fact, most of these acts are perpetrated by individual hackers and freelancers. Some of these independent hackers have made arrangements with spy agencies for ideological, monetary or even other specific or unknown reasons. Some of them have already been detected and arrested, but the uncertainty over how many are yet to be found dictates the dire need to ensure an effective control capability over information warfare. What at times goes unnoticed in all this fear associated with information warfare is that most of the damage inflicted on information systems is (and has always been) caused by human error. These problems are usually caused by users, programmers, hardware designers, and system integrators. It is often impossible to determine if a system malfunction is a result of poor programming, a physical defect, or an information warfare attack. This led to a development of standard diagnostic procedures to check usual system defects to enable the detection of information warfare attacks. What makes this perspective interesting is that a smart information warfare attack would attempt to create defects in the enemy's networks so as to appear to be hardware defects or software problems. But the most immediate and popular idea, insofar as information warfare is concerned, is to hit the enemy fast and hard using all means at our disposal to bring down his information systems. However, several nations look at information warfare as a means to decisively defeat the enemy. With a few exceptions, the industrialised nations have the majority of computers and hackers.

The former Communist nations educated more people than they could actually employ. This led to an abundance of computer experts with time on their hands and a certain resentment against society. Since the 1980s, Bulgaria, strange as it may seem, was identified as a source of most of the current computer viruses. Non-Communist nations, such as Pakistan, which has a large number of highly skilled unemployed people, have also produced many hackers over the past few years. On the other hand, India, which was certain to employ the computer programmers it had trained, has a small number of hackers and a high potential for information warfare. Although it is also possible to hire mercenary hackers, one learns that, as with any weapon, the nation that better

On the other hand, India, which was certain to employ the computer programmers it had trained, has a small number of hackers and a high potential for information warfare.

organises and leads them will gain the advantage. Although a handful of super hackers working for a small nation can inflict heavy damage on a superpower's information systems (the US, for example), the odds of that happening are somewhat remote. The industrialised nations take the information-warfare-related threat very seriously, making that scenario even less likely.

Today, military information systems are consistently threatened by foreign governments and criminal organisations. The impact of hacker activities and attempts to penetrate information systems have grown largely due to the fact that there is a greater military dependence on the Internet.

Thus, the Internet has played a major role in breaking down boundaries, and, as we have already seen, it is currently one of the best platforms for the development of information warfare actions.

INFORMATION WARFARE: STRATEGIC DIMENSION

The term "information warfare" has been increasingly used to broadly designate a large set of concepts associated with warfare phenomena of the information age. These new emerging war concepts are directly linked to the idea that the fast cyberspace evolution – the global information infrastructure—can bring both opportunities and vulnerabilities. Most of the existing studies on this issue focus on one of those vulnerabilities: that this situation may jeopardise high-value national resources usually located off the battlefield and outside a country's power projection theatre in such a way as to affect its military strategy and national security strategy.

Today, the term "information" has just a general meaning in our common language and is known for being necessarily dynamic in nature. However, there is an emerging element in information warfare that appears to be common to all uses of this constantly evolving term. We define this emerging conflict area

where nations can use cyberspace to affect strategic military operations and damage national information infrastructure as "strategic information warfare." We believe that strategic information warfare deserves special attention and recognition as a legitimate new facet of warfare with profound implications to both military and national security strategies.

In recent years, the new cyberspace culture and infrastructure (Table 1) have evolved almost exclusively outside the military arena – although the contribution made by the DoD's ARPANET to the creation of the Internet is well-known – and now offer new opportunities for information warfare.

Table 1: Strategic Information Warfare

- Information Technologies
- Cyberspace Infrastructure/Culture
- Information Warfare
- Post-Cold War International Politics
- War
- Strategy
- Strategic Information Warfare

Parallel to that, we are witnessing the continuing evolution of international politics and, in this context, the inevitable evolution of war, as Clausewitz pointed out, as a political instrument. In this environment, new interests emerge naturally for the various nations, leading to new dilemmas and new strategic targets over which influence should be exercised, including the threat of the employment of new (and old) types of strategic forces. New threats and strategic vulnerabilities appear as well. Now it becomes increasingly clear, as we intend to show, that the strategic warfare evolution will include a cyberspace threat and vulnerability dimension that should be defined as "strategic information warfare."

Strategic Information Warfare

Today, most of the industrialised countries such as the US already have an impressive number of information-based resources, including complex systems

US allies and potential coalition partners are equally dependent on several informational infrastructures. Conceptually, when a potential foe tries to damage these systems through information warfare techniques, it inevitably takes on strategic overtones.

that control electric power, currency circulation, air traffic, oil, gas, and other information-dependent items. US allies and potential Coalition partners are equally dependent on several informational infrastructures. Conceptually, when a potential foe tries to damage these systems through information warfare techniques, it inevitably takes on strategic overtones.

The above scenario contains a fundamental aspect of strategic information warfare: there is no "front line". Strategic targets located in the US can be as vulnerable to this sort of attack as its C3I (command, control, communications and intelligence) systems positioned in the theatre of operations. When responding to information warfare attacks of this nature, military strategy cannot afford to focus solely on its area of interest when conducting and supporting operations. At the present time, we have to examine in detail all information warfare implications to the infrastructures that depend on free information management.

Strategic Information Warfare: Related Issues

Interconnected networks are subject to attacks and interruptions caused not only by states but also by private organisations, including different groups and even individuals. Thus, the number of potential threats to the interests of countries such the US can rise substantially.

Some believe that the degree of difficulty in accessing the systems, alluded to in the discussion of the different types of information warfare attacks, can increase if easy access to the networks and control systems is denied through the use of new software cryptography techniques. Others admit that this could reduce some of the threats, but point to the fact that this approach would not remove other kinds of threats to a network systems made by a corrupt operator,

a direct physical attack, or both. This, by its own nature, would also make it more difficult to develop intelligence (strategic, operational and tactical) actions against strategic information warfare opponents.

The great variety of potential enemies, weapons and strategies makes it increasingly difficult to distinguish internal from external information warfare actions and threats.

The great variety of potential enemies, weapons and strategies makes it increasingly difficult to distinguish internal from external information warfare actions and threats. This particular kind of warfare basically creates new problems in a cyberspace environment. One of the basic problems in distinguishing an attack from others caused by this type of information warfare is that we at times may not be able to detect when an attack is taking place, who is mounting it, or how it is being conducted. Another consequence of this uncertainty phenomenon is the lack of a clear definition of the different levels of actions against a state that can range from crime to war. In the light of this uncertainty, nation-states opposed to the strategic interests of a certain country could abstain from traditional military or terrorist operations and instead use individuals or transnational criminal organisations to conduct criminal operations.

There is also a growing possibility that information warfare agents will be able to manipulate key information to be disseminated to the public. For example, some political groups and other non-governmental organisations can use the Internet to galvanise political support. There is also a possibility of using multimedia techniques to manipulate the "facts" about a certain event and disseminate them. Since it is true that there may also exist a reduced ability to build and maintain domestic support for controversial political actions taken by government leaders, one of the ways to adequately cope with this problem is to use the Internet as part of any public information campaign.

CONCLUSIONS

The threat of a strategic information war completely erases the distinction between military and civilian systems. The connection between them

complicates the process of detecting an attack and developing an affective defence. So, the disturbing question still remains of figuring out how a government can protect its information infrastructure, which it neither owns nor controls.

Information technologies are being developed in strategic-level planning as an offensive weapon and, at the same time, as a "logistical attack" weapon. They are considered a means of disrupting the civilian infrastructure upon which the enemy's military systems depends.

We should always bear in mind that information warfare is a two-edged sword. The countries that are most capable of waging it are also the ones most vulnerable. The growing dependence on sophisticated information systems brings an increasing vulnerability to hostile actions, to include terrorist acts.

Information warfare is a two-edged sword. The countries that are most capable of waging it are also the ones most vulnerable.

Information-based technology attacks are extremely easy to execute. The means are relatively cheap, easy to smuggle, virtually undetectable, and hard to associate. All this, along with the vulnerability of civilian communication networks (which are extremely attractive to terrorists), affords information warfare actions a prominent place in the terrorist arsenal.

Current security solutions are far from ready to face the potential threat posed by information warfare actions. This situation will probably remain unchanged until the threat becomes a reality. Only then will we be compelled to seriously consider preventive measures.

Disclaimer

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