AIR POWER

Journal of Air Power and Space Studies

Vol. 3, No. 3, Monsoon 2008 (July-September)

AIR POWER
CENTRE FOR AIR POWER STUDIES
New Delhi

AIR POWER is published quarterly by the Centre for Air Power Studies, New Delhi, established under an independent trust titled Forum for National Security Studies registered in 2002 in New Delhi.

AIR POWER Journal welcomes research articles on defence, military affairs and strategy (especially air power and space issues) of contemporary and historical interest. Articles in the Journal reflect the views and conclusions of the authors and not necessarily the opinions or policy of the Centre or any other institution.

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ISBN: 81-87966-30-0

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

Typeset by Dharana, e-mail: studiodharana@gmail.com

Printed and Published by Air Cmde Jasjit Singh (Retd) on behalf of the Forum for National Security Studies (the Trust running the Centre for Air Power Studies, New Delhi) and Printed by Glorious Printers, 1597-98, Patuadi House, Daryaganj, New Delhi 110 002 and Published at P-284, Arjan Path, Subroto Park, New Delhi 110 010.
Editor: Air Commodore **Jasjit Singh** (Retd).

RNI REGN No. DELENG/2006/18450

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VOL. 3, NO. 3, MONSOON 2008 (JULY-SEPTEMBER)

pose to the suppliers as well as the recipients. It is against these challenges that he examines the options for Indian policy to enable it to energise its defence and aerospace industry in the future.

EDITOR'S NOTE

While it is more than a decade since India and Pakistan overtly declared their nuclear weapon capabilities, anybody who had anything to do with national defence knew that in fact the weapons capability had been acquired by both two decades ago. While India went about seeking a solution through universal and non-discriminatory nuclear disarmament, Pakistan, on the other hand, stepped up its covert war through terrorism, expanding it from just two districts of Punjab to the state of Jammu and Kashmir and later beyond that. With the combination of nuclear weapons and covert war through terrorism, India's strategic deterrence began to be eroded (some would say it began to fail). South Block somehow failed to take note of the two concurrent developments: that of the increasing role of air power for coercive punitive application of military force (perhaps the only viable option in a nuclearised environment) with dramatically enhanced capabilities for longer range precision strikes, and, secondly, the use of covert war by Pakistan as its strategy of indirect approach.

Nuclear deterrence has been one of the esoteric subjects that have received enormous attention over the decades. However, its deep linkages with conventional wars have not received adequate attention in comparative terms. Pakistan's publicly stated aim of acquiring nuclear weapons was to neutralise superior Indian military capabilities which its former foreign minister had described as the "Sword of Damocles" hanging on his country; except that its army saw this as an opportunity to pursue a successful covert war without provoking a military response across the borders. We, on the other hand, continued to fight that war defensively, killing terrorist and losing lives of civilians and security personnel. Less than adequate attention was paid to the combination of the above two factors with the combat force level of the Indian Air Force (IAF) being allowed to wind down by as much as 23 per cent in a mere five years.

Perhaps we had failed to understand the linkages between nuclear deterrence and conventional deterrence (especially of air power) in the new framework of Pakistan pursuing a sub-conventional war. It is time to rethink our strategy of deterrence in order to rectify this situation.

Over two decades ago, India sent its armed forces into Sri Lanka on the invitation of the democratic government of that country to help maintain the peace. But the peace-keeping mission rapidly deteriorated into a peace-enforcement task against the separatist violent movement, the Liberation Tigers of Tamil Eelam (LTTE), which proved to be an elusive and ruthless enemy which had mastered the art of guerrilla warfare in a forested terrain. While there is significant literature on how the ground war was fought, the role played by air power does not appear to have received adequate attention. It was a crucial factor in strengthening the army's ability to fight a terrorist organisation. And this makes the strategy followed to deal with the terrorism in Jammu and Kashmir all the more inexplicable. Undoubtedly, there was a lot of difference in dealing with a terrorist organisation in our own country and that in a foreign friendly country (which sought the elimination of that threat rather than promoting it).

The period when the covert war in India began under the nuclear umbrella and the separatist movement had grown in viciousness and scope, interestingly was also the period when Indian air power directly became an instrument of foreign policy. One incident was what came to be known as the "rice bombing" of Jaffna and the other was the rapid dispatch of a small force by air to curb the separatists and terrorists aiming to overthrow the legitimate government of Maldives. But looking at the literature since then, one wonders whether those who planned the two operations and/or executed them saw them as the conduct of foreign policy through the use of the air force. A military blockade of Jaffna by the Sri Lankan military was lifted after the IAF An-32s (escorted by Mirage 2000s) dropped rice and other humanitarian support material to the besieged population. This led to the lifting of the siege and the Colombo government entering into an agreement with New Delhi to find a political solution to the ethnic violence in the island. The Maldives operation ensured the stability of the government.

Over the same two decades, the country had agonised over what came to be known as the Bofors Syndrome which has stymied military modernisation since then. The turn of the century saw efforts being made to introduce structures and procedures for defence procurement, and that process is continuing. Unfortunately, one of core problems was that acquisition and procurement of military weapons and equipment is a complex issue and mere adding more complexities through procedural innovations is unlikely to meet our long-term interests. On the other hand, it is necessary that procurement procedures be better understood in the country if we are to finally put the Bofors Syndrome behind us.

With this issue, AIR POWER Journal enters the fifth year of publication. It is for this reason that we decided to repeat the picture on the cover of the first issue. We have a sense of satisfaction that the demand and readership of the journal had dramatically increased, allowing us to send a personal copy to every student officer undergoing higher command courses at our major military training institutions like the College of Air Warfare, Army War College, Naval War College, not to talk of the College of Defence Management and the Air Wing of DSSC. We are grateful to our sponsors who are willing to advertise in the journal; and to Knowledge World Publishers for maintaining the quality and timeliness of the journal. Above all, we are happy that an increasing number of serving officers are now writing for the journal. We look forward to greater readership and increasing number of authors from the armed forces in the future.

AERIAL WARFARE: THE INDIAN WAY

V.K. VERMA

HISTORICAL BACKGROUND

Formative Inheritance

Aerial warfare over India has had a relatively short history. We can synchronise the clock of aerial warfare with the birth of the first Indian Air Force (IAF) squadron, that is, on October 1, 1933. In its formative years, the IAF had a start point already defined by its providers. The IAF was handed down the training, doctrinal concepts and, most importantly, obsolete – slow moving – short range aeroplanes. The British, with their exclusionary policy, ensured that exposure to strategic capability, equipment and responsibility was not entrusted with the IAF. Essentially, they made sure that we remained a tactical air force. The entire inventory had only one flavour: limited tactical reach. Apart from restricting our capabilities at that time, they perhaps hoped that our leadership would also get boxed in and remain short-sighted. However, as the future was to reveal, our leaders were very much aware of the strategic dimension of air power.

In the same period, the world was waking up to strategic implications of air power. Riding on the wings of the strategic bomber force, the economic wars were being carried deep into the enemy territory. Even population centres were not being spared. In fact, the end of World War II was triggered by the

* Air Marshal **V.K. Verma** AVSM VM VSM is currently with Air Headquarters, IAF, as Director General (Inspection and Safety).

nuclear holocaust. We also witnessed the inter-theatre mobilisation of forces through our country. During the Burma campaign of World War II, American forces would leapfrog along the numerous airfields, starting from western India through central to northeast India. It was from examples like these that our leaders were visualising the "Strategic Predicament" of the IAF. Every passing interaction with air forces of other countries strengthened their resolve for keeping the strategic aspirations alive. The seeds that were sown in the minds of leadership are slowly showing results. With all the arrows in its quiver, the IAF will soon boast of long range offensive capability, strategic lift capability, all weather and night capable helicopter fleet, networked air defence (AD) environment, and a lead into the exploitation of space.

IAF's Operational Journey: A Summary

The journey from "then" to "now" has been on a road fraught with difficulties. The chronological milestones of this journey are:

(a) Kashmir Campaign, 1947-48.
(b) UN peacekeeping operations in Congo (with a Canberra Squadron, 1961-62).
(c) Indo-China War, 1962.
(d) Indo-Pak War 1965, the first war against aerial opposition.
(e) Indo-Pak War, 1971.
(f) Indian Peace-keeping Force (IPKF) Operations, Sri Lanka, 1987.
(g) Operation Cactus, 1988, the response to the mercenary crisis in Maldives.
(h) Operation Safed Sagar, the war over the icy heights.
(i) UN peace-keeping and peace enforcing operations in Africa.
(j) International exercises, the latest being the prestigious Ex "Red Flag" at the US Air Force (USAF) base, Nellis.

PILLARS OF AERIAL WARFARE STRATEGY

The evolution of aerial warfare in India rests basically on four pillars. The first pillar is the possession of a strategic mindset in its leadership even though the equipment inherited was tactical. This ensured that the air force never lost its

vision. The next pillar is its allegiance to indigenous technology. Hindustan Aeronautical Limited (HAL) has developed into an aeronautics powerhouse due to constant support from the IAF. The third pillar consists of its instinctive reach for jointness amongst the Services as the IAF clearly understands that operational efficiency can come about only with one joint war plan. The fourth and the most important pillar has been its innovative approach. The IAF has always been brilliantly innovative in using its equipment and has exploited each situation for maximum gains.

With its instinctive reach for jointness amongst the Services, the IAF clearly understands that operational efficiency can come about only with one joint war plan.

Tactical Equipment: Strategic Mindset

A quote from the legendary Jumbo Majumdar underlines this thought, "If we do not fight this war for the British, we shall be nothing better than a flying club when the war ends. After the war is won, India will be a Dominion and we shall run our own air force. Free India without an air force with reach would be a helpless country."

Spurred by the prophetic words of Jumbo Majumdar and the aspirations of our leaders, IAF pilots and technicians were put to the acid test at the stroke of Independence. The obsolete inventory we received at the time Partition was immediately called upon to save Kashmir. Over the ensuing year and a half, and interspersed over two phases, the "tactical air force" of independent India went on to extend its reach from Kashmir Valley to the entire Ladakh region.

Our leaders, both political and military, had sized up the geo-political importance of our country. The vast size, substantial land and maritime borders – overlooking several important land and maritime economic routes – all contributed to the strategic importance of our country. Accordingly, they put the plan for acquisition of strategic assets into motion. The IAF was first to induct jets in Asia through the Vampires. Later, Canberras and Hunters added the strategic reach into our inventory. Karachi harbour and Sui gas plant would hold the testimony to that fact. Both of these were attacked in 1971.

We were forced to remain a tactical air force in the initial years as all the Russian aircraft that we got at that time had very limited operational range.

In the late 1950s, the IAF was keen to acquire the F-104 (Starfighter) but the US treaty alignment with Pakistan resulted in a denial, and we were forced to go the Russian way. The Russian inventory reflected a defensive mindset, with their aircraft optimised for air defence. We bought the MiG-21 – variants of which we continue to fly even today. Our exploitation of this specially designed interceptor with high altitude, Mach 2 capability, equipped with air-to-air missiles in the ground attack role is now a part of aviation folklore. However, we were forced to remain a tactical air force in the initial years as all the Russian aircraft that we got at that time had very limited operational range.

The strategic reach has now been firmly entrenched in our air strategy. It is not only the kinetic application of force but the dominance by being able to reach for the "out of area contingency" which has become part of our operational doctrine. Air-to-air refuellers, the soon to be inducted airborne warning and control system (AWACS) and aerostat radars have well been integrated in our concept of operations. Eight rounds of aid to the recent earthquake in Sichuan province in China and aid to the typhoon-affected areas of the US have showcased our ability to reach out. The Indian fleet of civil aircraft is also well endowed and it constitutes a significant part of our total strategic lift capability. The times of large occupation of land are over. Effect-based wars are the norm, and the criticality of dominance is in place. Space is the ultimate high ground. Warfare has evolved from the days of Alexander the Great, when he swept through continents, taking months and years to cover a few hundred kilometres. Then came the naval flotilla which moved at 15-20 knots, reducing the time-frames from years to months. This faster time-frame was one of the factors that helped the European powers to rule the world. However, naval power was available only with countries that could access the seas. All this has changed in the last century. Aerospace has injected speed and flexibility, cut time-frames (15-20 times faster) from months to hours. It has now become a major lever for

foreign policy. The emergence of aerospace power is now universally recognised as the "most visible deterrent."

Leadership

The IAF, in its formative years, was led by dynamic and competent leaders at all levels. Jumbo Majumdar, Subroto Mukherji, P.C. Lal, Baba Mehar Singh, Arjan Singh, Harjinder Singh, the legendary Hawai Sepoy, are just a few of them. The pioneers always led from the front. This aspect has been amply demonstrated through every conflict. Baba Mehar Singh's feat of personally flying the first Dakota into Leh and Poonch is one of the most outstanding examples of professional skill. Higher echelon directions from the then Chief of Air Staff Air Chief Marshal P.C. Lal reorganised the Air and Command Headquarters (HQs) for efficient and quick response. He also paved the way to induct contemporary technology from outside the Soviet bearhug. Mobile observations posts (MOPs) to detect and report intruding aircraft were integrated with the railways communication set-up in 1971. Advanced HQ and Tactical Air Centres were established astride Army Command HQs and Corps HQs. At the field level, the skill of numerous Gnat pilots slaying the air-to-air missile equipped Sabres is an unparalleled example of exceptional professional skill and competence. Spurred from then on, our pilots, logisticians and technicians have been giving a rousing account of themselves in every international exercise.

High Altitude: Our Privilege

No other country in the world has the topography demanding round-the-year operations, at altitudes ranging from 14,000 to above 21,000 feet. As a result, from very early on, we realised that expertise and skill in providing all kinds of air support is going to be the exclusive privilege of the IAF. In the initial phase, post-Kashmir conflict of 1948, the IAF had concentrated more on air maintenance. It has garnered leading experience in carrying out air assault operations, including para-drop over some of the highest dropping zones (DZs) in the world. Stakna and South Pullu DZ in Leh sector are two such examples. The IAF has been carrying out transport aircraft operations at some of the world's highest airstrips such as

Daulat Beg Oldi (DBO) at 16,400 feet altitude since the 1960s. Similarly, Cheetah helicopter operations in the Siachen Glacier have been a record breaking feat. Sustained heli-ops, including landing and take-off in the altitude band of 21,000 feet have been the sole bastion of the IAF. In the second phase, especially post-Kargil, fighter operations were also given a new impetus in the high altitude operations. The MiG-29 operations at Leh is one such example. Our expertise in air transport and offensive high altitude operations has drawn significant interest from almost all the Western air forces. Helicopter pilots from various air forces have come and got exposure of flying in Ladakh. Some air forces have taken part in high altitude paradrop exercises in Leh region.

Allegiance to Indigenous Technology: A Strategic Concern

Faced with "technology apartheid," the IAF has been pushing for developing the indigenous capability. Eventually, in the technology intensive arena of aerospace power, only the capability to generate original and indigenous technical solutions will hold us afloat in the long-term. Our leaders spelt out a two-pronged approach. Firstly, they wholeheartedly supported HAL. Secondly, they established base repair depots, BRD for short, which were fleet specific fourth line technical activity depots where overhaul of aircraft and associated equipment was accomplished. From its inception in 1940, HAL has now evolved into a large aeronautics complex. It has developed 11 types of aircraft from in-house R&D and 14 types built under licensed production. It has produced over 3,500 aircraft and 3,800 aero engines and overhauled thousands of aircraft and engines. It initially produced the Marut (HF-24) aircraft with foreign design support. It then upgraded the Folland Gnat to its ground attack version, Ajeet. It licensed produced the Avro (HS-748) and Dornier. It produced a large number of Chetak/Cheetah and graduated to the indigenously designed advanced light helicopters (ALH). It produced fighter aircraft of the class of the MiG-21, MiG-27, Jaguar and Su-30 MKI, and is developing modern aircraft like the light combat aircraft (LCA) and the intermediate jet trainers (IJT), in spite of technology denials. There are only four main fighter aircraft producers in the world: the US, Russia, China and the European conglomerates. We have resorted

to a large number of aircraft upgrades, as replacement costs are prohibitive. The requirements of offsets in future contracts will usher in greater defence equipment manufacture with big business houses like Tatas, Mahindras, Kirloskars actively investing. HAL and the IAF have worked in tandem to establish this indigenous capability. The level of self-reliance, though still being shaped, has provided us with distinct strategic depth.

Jointness for Synergy: Another Strategic Concern

Contrary to the commonly held view, the IAF instinctively knows the worth of jointness for generating synergised, effect-based war effort. Right from its inception as a tactical air force, the IAF has flown extensively in support of the other Services. As the Kashmir crisis started to develop in front of the "just born" nation and its armed forces – carrying forward the excellent traditions of jointness from the pre-Independence days – the IAF fought shoulder-to-shoulder with the Indian Army (IA) in Kashmir. Then Col Sam Manekshaw was onboard the first Dakota landing at Srinagar and Gen Thimaiyya accompanied Baba Mehar Singh on his first landing at Leh. The defence of Poonch garrison, right under the enemy's nose, and artillery barrage was planned and executed jointly. When the Dakotas were reinforcing the Indian Army through this 600-yard-long strip, the IAF Spitfires and Tempests were keeping the enemy's head down by accurate strafing. In 1962, our political masters, apprehending massive aerial retaliation on our cities, chose not to field the IAF in the war except for transport and helicopter support to the army. In the 1965 Indo-Pak War, the IAF played a great role, though its lack of knowledge of the army's plan resulted in the Pakistan Air Force (PAF) taking the initiative for the preemptive strike. Lessons from the 1965 War brought the army and air force to get down to better synergy. The 1971 Indo-Pak War saw the resurgence of jointness as the tenet of the Indian way of air warfare. Right from convincing the political leadership for the right campaigning season to the coordinated offensive actions at Karachi and Akhnoor, there were example galore. The Indian Navy and IAF attacked the Karachi harbour in tandem as well. In 1988, during Operation Cactus, excellent synergy among the three Services saw the first ever strategic projection of India's military power. Riding on the wings of

One must understand that true jointmanship in war-fighting will only come if the basic planning for war is done jointly.

the IL-76 from Agra, 50 Para Brigade saved the Maldives from the mercenaries – the Mirage 2000 provided protection as Indian Navy warships rounded up the mercenaries. In Kargil, most of the battle planning was done with the air officer commanding Jammu and Kashmir (AOC J&K) sitting side by side, with the general officer commanding (GOC) 16 Corps Srinagar.

For a long time, we in the IAF have felt that perhaps we have been unable to make the army understand the role of air power in the entire surface war. The army always treats only battlefield air strike (BAS) as the air contribution to the surface war. But the entire counter-air campaign is aimed at keeping the enemy air force away from our army. Battlefield air interdiction (BAI) brings out much greater results in support of the surface war. Slowly but surely, the army leadership has begun to accept our viewpoint. We cannot carry on fighting turf wars for equipment. The core competencies of each Service have to be accepted by the other Services and domain space clearly spelt out. Only then will operational efficiency surface. One must understand that true jointmanship in war-fighting will only come if the basic planning for war is done jointly. The tendency to create a Service-specific war plan and then superimpose the other Service can never give true synergy and operational efficiency. There is no escaping the fact that only one joint plan must exist. May be we need to seek an institutional remedy for this.

Extending the Reach: Innovative Approach

All through our journey, the limitations of technology and equipment inspired us to devise innovative ways of employment. The innovative flair has become the most important pillar of the "Indian way of aerial war-fighting." It could be summarised as the "will and the thought process" to extend our reach – the will to take the war to the enemy's hinterland and hit him where it hurts the most. When the Packet aircraft had to operate in the high mountains in hot weather and better aircraft were denied to us, we installed the Orpheus engine

of a Gnat aircraft on this transport aircraft for improving its high altitude handling. This was a measure that showcased our efforts to exploit the equipment beyond the limits specified by its manufacturer. Israel, with innovative means and initiative, could use excellent American equipment in a punishing manner against the Russian equipped Syria and Egypt. This gave rise to the myth of supremacy of American equipment over Russian equipment. The IAF, on the other hand, also equipped largely with Russian aircraft and AD equipment, consistently fared better against a determined Pakistan with its American equipment. The Sabre slayer Gnat busted the myth of the air-to-air missile equipped Starfighter and Sabre. The innovative spirit has acquired the status of a doctrinal percept that the "IAF shall use the equipment at its disposal with audacious innovation and will maximise the spinoff from it." It has been a lesson which has been taught to us by our pioneers, the likes of AVM Harjinder Singh, the legendary Hawai Sepoy of yore. From fitting truck tyres to the aeroplanes to employing the aerostat radar as a mini AWACS-like aloft AD radar, the IAF's instinct of innovating has been accepted as one of its strongest elements.

The IAF kept its forces ready for an escalatory response by Pakistan and by its strong posturing convinced the PAF that any escalation would be futile.

Operation Safed Sagar: Test of Innovative Spirit

The air war over the icy heights of the Himalayas has been the ultimate test of our innovative spirit. It was a case of use of air power in a limited localised war and in a restrictive manner. Our political masters tied our hands behind our backs. We could not cross the Line of Control (LoC). The IAF then used air power in an innovative way. What emerged was a lesson in escalation control dynamics. It kept its forces ready for an escalatory response by Pakistan and by its strong posturing convinced the PAF that any escalation would be futile. The pilots had never practised to deliver weapons at those altitudes and the transport aircraft and helicopters had not flown in that area for providing support. Even then, the IAF rose to the challenge. Our pilots went on to provide the best possible results under

conditions when even weapons ballistics data was not available for these heights. We resorted to using the global positioning system (GPS) for bombing without possessing GPS equipped bombs. A simple innovation of securing a handycam to the gun sight of the MiG-21 aircraft worked very well as a reconnaissance and battle damage assessment tool. Innovative use of the Aruna equipment of the Canberra which was essentially a jammer with partial electronic intelligence (ELINT) capability for gathering ELINT was a great help. The famous Indian *jugaad* was applied to Mirage weapon computers by our engineers to allow it a weapon delivery at these heights. The laser-guided bomb (LGB) attack on Tiger Hill and the logistics base at Muntho Dhalo provided the crucial breakthrough, and the tide reversed.

Air Strategy: The Indian Way

To understand the Indian way of air strategy, let us first see how air strategy evolved in the West. Initially, in the 1920s, aircraft were used as observation posts in the air, followed by search and attack, both army support operations. By the time of World War II, aircraft speeds and weapons improved, destruction of air forces in being, active support to surface forces (including the navy), economic targeting (breaking the military industrial back), population centres (destruction of the will of the people) became the major air power operations. Technology enhanced aviation tremendously. Radar, night sights, better weapons and more accurate navigation systems increased reach, flexibility and lethality. The Korea and Vietnam Wars saw the air-to-air and surface-to-air missiles come in. This changed the envelope. The 1967 Arab-Israeli War began with the preemptive destruction of the Egyptian Air Force on the ground – a case of command of the air. The 1973 War saw successful action of surface-to-air missiles followed by development of more active electronic warfare (EW) systems and the need for suppression of enemy air defence/destruction of enemy air defence

The 1967 Arab-Israeli War began with the preemptive destruction of the Egyptian Air Force on the ground – a case of command of the air.

(SEAD/DEAD) which was practised successfully in the 1982 Bekaa Valley Operation. Now let us see what we Indians showcased in 1971. This war was jointly evolved with the army in terms of campaign launch time. Right in the very beginning, the PAF in the East was targeted and destroyed, both in the air and on the ground. We then enjoyed total air dominance in this sector. The air operations like the Tangail drop and heli-bridge over the Meghna river were totally free of any enemy air opposition. Thus, ground forces could operate with a free hand with our aerial fire support. The result was the surrender of East Pakistan within a fortnight. Somehow, the world instead remembers the much longer period taken by the Americans in Iraq in the first Gulf War two decades later. Similarly, the innovative and timely attack on the Governor's House in Dhaka, with a crucial meeting in progress, broke the will of the enemy. However, the Western world credits Col John Warden as the first to conceptualise the five concentric circles, with leadership as the most sensitive centre of gravity. His paper was written decades after the 1971 War. The fact that the attack was done in an LGB like precise manner using an air-to-air missile fired from a high altitude Mach 2 interceptor proves our responsiveness and adaptability to the situation. It literally broke the political will of the enemy and resulted in immediate surrender. The IAF fought the war on two fronts. Economic targets like the Sui Gas plant and Karachi harbour were hit, simultaneously, signalling parallel warfare. Longewala and Chhamb Jaurian were classic cases of air power turning the tide of the ground war. The innovative use of creating a runway-like flare path at an air-to-ground range close to an airfield was an excellent example of deception which diverted the Pakistani air raids away from the Jamnagar airfield. Use of railway communication networks in Punjab to report aircraft movements which led to MOPs demonstrated our innovative spirit. Perhaps, unlike the Americans, we are not good at documenting our deeds, and then, blowing our trumpets. Like

The innovative and timely attack on the Governor's House in Dhaka, with a crucial meeting in progress, broke the will of the enemy leadership.

The Indian aerial warfare mantra has been to carry the war deep into enemy territory and make sure that the enemy air, at least at the pre-decided place and time, is not able to interfere with our surface forces.

the saga of Basmati rice, some of the concepts that originated here were documented later as Western. The innovative use of two AN-32, escorted by Mirage 2000s, dropping rice bags in Jaffna in Sri Lanka was a strategic move and a clear foreign policy statement, demonstrating our will to step in, in support of the Tamils. It forced the Sri Lankan government to seek our support to resolve the issue. Our air support at New Orleans after Hurricane Katrina and the earthquakes in China/Mynamar have once again confirmed the global dimension and reach of the IAF. India is the country which has taken the lead in employing the tethered aerostat radar in the AD role as against the coastal watch role in which the world has been using it. The marrying of Russian aeroplanes with Western avionics upgrade is another effort for making the low end aeroplanes capable for more complicated roles and tasks. The IAF has always consciously chartered its own applications, strategy and tactics. The jolt which the Western pilots have been receiving while exercising against us is a tribute to the establishments like TACDE and the adaptive skill of our pilots and technicians.

The Reach for the Sky and Beyond

The Indian aerial warfare mantra has been to carry the war deep into enemy territory and make sure that the enemy air, at least at the pre-decided place and time, is not able to interfere with our surface forces. In this effort, which has lasted for nearly two and a half decades, the following milestones can be identified:

(a) Induction of Jaguars – the so-called deep penetration aircraft, Mirage 2000 multi-role aircraft, IL-76 strategic lift transport aircraft, MiG-25 strategic reconnaissance aircraft and Su-30 aircraft.

(b) Push for acquiring the strategic reach enablers like the AWACS, in-flight

refuelling aircraft and EW equipment.

(c) Net-centricity as an overall synergiser was identified by the IAF in the early 1990s and efforts were started to acquire the technology and capability.

(d) In the same time span, the push for the ultimate high ground – space – was also initiated. Today, the IAF, along with Integrated Defence Staff (IDS) is pushing the space programme.

(e) As the efforts of the past several decades have come to fructify, all genres of technology applicable to every sphere of aerospace operations are in some or the other stage of induction.

(f) We now have a very credible air presence in the UN peace-keeping arena. Today, we fly to the farthest nook and corner of the world and the advanced air forces are keen to train with us.

CONCLUSION

The history of the IAF reflects the Indian way of aerial war-fighting. It is seen that our air force inherited warplanes that restricted it to being a tactical air force. But the leadership refused to be tied down and has kept the quest for strategic reach alive, and now, it has shown results. In the 1971 War, the best of the strategic thoughts were showcased by the IAF well before these terms became famous – from air dominance, parallel warfare to attacking the centres of gravity – without copyrighting or patenting these terms. The strategic pursuits of the IAF included indigenous capability and jointness. The air warriors behind these machines have innovated brilliantly to maximise their output. Now the time has come when our machines are also reflecting our aspirations. The future is indeed bright.

THE USE OF AIR POWER IN SRI LANKA: OPERATION PAWAN AND BEYOND

ARJUN SUBRAMANIAM

The ethnic conflict between the Liberation of Tamil Tigers for Eelam (LTTE) and the Sri Lankan government is one of the longest ethnic conflicts of modern times. The conflict owes its origin to both a perceived and actual neglect of the aspirations of the Tamil minority residing in Northern and Northeastern Sri Lanka comprising the Jaffna Peninsula, Killinochi (NW of Mullaittivu) , Mannar, Vavuniya and Trincomalee (refer Map below).[1]

MAP 1: MAP OF SRI LANKA

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* Air Commodore **Arjun Subramaniam** is an experienced fighter pilot who is presently commanding Air Force Station Hindon.

1. Taken from Encarta 2006.

Sri Lanka's stability has always been vital to India's strategic depth around its oceanic southern flank.

The initial secular thrust of the Sri Lankan government in the 1950s and 1960s gave way to a more sectarian approach to nation-building in the 1970s, with an emphasis on the dominance of the Sinhala community, Sinhalese language and Buddhism as a religion. The conflict, which started off in the late 1970s as a civilised and legitimate protest by an ethnic minority (Tamils) against an established state, flared up into a military conflict in 1983 when the LTTE officially declared their goal for the Eelam (independence). The two main protagonists in the conflict were the LTTE and the Sri Lankan state. Increasing violence and belligerence of the Prabhakaran led LTTE resulted in the declaration of an emergency in Sri Lanka in 1985 and scope for misunderstanding between New Delhi and Colombo. Inevitably, India gradually got drawn into the conflict due to two main reasons. Firstly, the proximity of Northern Sri Lanka comprising the Jaffna peninsula and Mannar to the South Indian state of Tamil Nadu precipitated a continuous influx of both refugees and militants into Tamil Nadu, creating a security problem for India. Secondly, Sri Lanka's stability has always been vital to India's strategic depth around its oceanic southern flank. Any instability in Sri Lanka without a suitable response from India could have invited attention from other global players like Pakistan, China and the USA—something that India wanted to avoid at all costs. A friendly or even neutral Sri Lanka was what India was looking for. Therefore, India had to lay down a threshold for itself, after which it was bound to step in to assist in conflict mitigation and, if the need arose, in conflict termination too. The mid-1980s saw an extremely aggressive LTTE take on the Sri Lankan defence forces with some success leading to extreme instability in the region, and the possibility of Sri Lanka asking Pakistan, China or the US for help in stemming the expanding insurgency. This was when India stepped in and offered to broker a sustained peace agreement and pave the way for a peaceful solution to the ethnic crises. The Indo-Sri Lanka Accord of July 29, 1987, was the result of this strategic gamble by India. Based on the initial mandate, the thrust of the agreement focused on the following aspects from an Indian point of view:

- Prevention of any forces detrimental to India's strategic interests from acquiring bases and gaining a foothold in Sri Lanka.
- Neutralising the centrifugal forces that were activated in Tamil Nadu in the wake of the ethnic conflict.
- Separating the belligerents viz the Sri Lankan armed forces and the LTTE to pre-1987 positions.
- Implementing and enforcing a ceasefire within 24 hours of signing the accord. This warranted a surrender of weapons by the LTTE within 72 hours.

The initial euphoria with which the Indian Peace-keeping Force (IPKF) was received in Sri Lanka wore out very soon because of the reluctance of the LTTE to lay down arms and the hesitant approach of the Sri Lankan forces to comply with the terms of the agreement in both letter and spirit. This resulted in the alteration of the military objectives of the IPKF from peace-keeping to peace-enforcement, which inevitably saw an escalation of hostilities between the LTTE and IPKF, something that the IPKF was not really prepared for. With the 'proxy war'[2] in Jammu and Kashmir (J&K) not yet having gained momentum, the experience of the Indian armed forces in dealing with irregular or unconventional warfare was restricted to the ongoing counter-insurgency operations in the northeast against relatively small and disorganised militant groups and operations against militant groups in Punjab that culminated in Operation Blue Star in 1984. 1987 was actually the first time that the Indian Army (IA) and Indian Air Force (IAF) came up against a well armed, well trained and tactically proficient guerrilla force, the LTTE.

The alteration of the military objectives of the IPKF from peace-keeping to peace-enforcement, inevitably saw an escalation of hostilities between the LTTE and IPKF, something that the IPKF was not really prepared for.

2. This is a term used by India to describe the Pakistani assisted insurgency in J&K and acts of terrorism perpetrated in various parts of India by *jehadi* groups with roots in Pakistan.

Air power in the hands of non-state actors does not really serve the purpose of limiting the scope of an "unconventional war."

AIR POWER IN ACTION

The baptism by fire of the IAF in a full-fledged counter-insurgency makes it important to analyse how it coped with this "unconventional scenario." It is also important to analyse how the use of air power in Sri Lanka has increased over the last 20 years and assess its relevance and effect on an unconventional conflict. In furtherance of this aim, the article would deal with three distinct phases of the utilisation of air power in Sri Lanka.

- The first phase would be the employment of air power in Operation Pawan by the IAF from July 1987 to March 1990.
- A brief mention would be made of the period between March 1990 and beginning of 2006 which saw the emergence of the LTTE's air wing and the growing capability of the Sri Lanka Air Force (SLAF).
- The current phase of bitter fighting would form the chronological culmination of the study of the air war between the LTTE and SLAF. This portion would also be the most contemporary in terms of similarities with a number of ongoing conflicts.

Certain doctrinal issues would emerge that highlight the growing effectiveness of air power in breaking the will and resistance of non-state actors who challenge the authority and legitimacy of the state. The most controversial issue that restricts the use of air power in low intensity conflict operations (LICO) and counter-insurgency operations (COIN) viz., its potential for escalation would also be discussed briefly and a question will be asked using the Sri Lankan template – can escalation caused by the utilisation of offensive air power in an unconventional scenario ultimately lead to deescalation and conflict termination? Air power in the hands of non-state actors does not really serve the purpose of limiting the scope of an "unconventional war." It only strengthens the hands of the state and allows it to unleash its entire range of offensive military capability that includes air power. That is exactly what has happened in Sri Lanka. It is opined that the increasing use of air power will result in decisive conflict termination, with the SLAF continuing to target the LTTE leader Prabhakaran,

keeping him on the run and preventing him from exercising the kind of unfettered command and control that has been possible over the last 25 years.

EARLY YEARS

Before dissecting the use of air power during Operation Pawan, it is important to throw some light on the state of the SLAF during the early Eighties. The SLAF was poorly equipped to fight a counter-insurgency and needed some Israeli help in a modernisation campaign that saw the induction of some light fixed wing aircraft like the Italian SF.260 and Bell 212 helicopters.[3] These aircraft were used in fire-support missions, foremost amongst which was an attack on an LTTE ammunition dump in Jaffna in 1986. This was followed by attacks against LTTE bases in China Bay and an integrated assault on Jaffna town with commandos supported by helicopters. It can be said that by 1986, a restructured and reorganised SLAF, with its modest firepower, contributed in no small measure to an imminent Sri Lankan victory against the LTTE. This was when India decided to step in, correctly assessing that it was only a matter of time before another external player would intervene to assist the Sri Lankan armed forces in defeating the LTTE and undermining its influence in the region.

For almost three years, the IAF played a significant role in continuous support of the country's largest expeditionary operation in its history.

OP PAWAN-IPKF OPERATIONS

For almost three years from June 4, 1987, when Operation Poomalai (humanitarian air drop over Jaffna)[4] was executed, to March 24, 1990, when the IPKF withdrew from Sri Lanka, the IAF played a significant role in continuous support of the country's largest expeditionary operation in its history. It was also the first integrated experience in fighting a guerrilla force that was trained to fight along both conventional and unconventional lines from within an unconventional environment viz., jungle terrain and the built up urban environment of Jaffna. Following an accord between the Indian and Sri Lankan

3. Tom Cooper, with Sam Wickramsinghe, "India Subcontinent Data Base, Sri Lanka Since 1971," October 29, 2003 from www.ACIG.org, accessed on December 12, 2007.
4. Operation Poomalai-The Jaffna Food Drop, www.Bharat Rakshak.com, accessed December 27, 2000.

Because the IPKF mission was originally a peace-keeping mission, the initial task for the air force was only strategic and tactical airlift.

governments, IPKF operations were undertaken against the LTTE in Sri Lanka from 1987 to 1990. The accord was originally designed for peace-keeping, with the expectation that the LTTE would lay down arms and the Sri Lankan forces would observe the ceasefire. However, the operations quickly took on the shape of peace-enforcement and then war due to political infighting and instability over various issues. In the ensuing conflict, the original objectives were redefined—the IPKF aimed for forcible disarmament of the militants and the LTTE aimed for an all out war against the IPKF in which the IPKF was faced with guerrilla tactics and suicide attacks in an unfriendly environment, with inhospitable terrain, belligerent locals and apathetic Sri Lankan defence forces. In the course of the war, limited success against the LTTE was obtained at considerable loss to the Indian Army, which later led to the withdrawal of the IPKF in 1990.

Because the IPKF mission was originally a peace-keeping mission, the initial task for the air force was only strategic and tactical airlift.[5] These were achieved in the initial phase without any opposition due to the nature of the accord. However, once fighting broke out, airborne operations and casualty evacuation (casevae) became the prime roles. The first air action took place on June 4, 1987, when five An-32 transport aircraft, escorted by four Mirage 2000 fighters, air-dropped some 24 tonnes of relief supplies over selected zones in the Jaffna peninsula that was cut off in the bitter fighting between advancing Sri Lankan security forces and the LTTE. The operation was conducted as a humanitarian gesture in response to an SOS from the common citizens of Jaffna and growing international concern. Thereafter, within hours of the signing of the accord on July 29, 1997, some 24 An 12 and An-32 tactical medium lift transport aircraft flew into Palaly airfield near Jaffna town in the north of the island. These, with the bulk of two Indian Army battalions, constituted the initial "peace-keeping force."

Operation Pawan was launched in first week of October 1987 to disarm the

5. S.S. Deshpande, "Employment of Offensive Air Power Against Insurgencies," *Trishul,* Autumn 2004, pp.19-27.

LTTE forcefully. However, the rules of engagement for the IPKF were extremely stringent with severe restrictions placed on the use of artillery, heavy weaponry and offensive air support. This was done to ensure minimum civilian casualties and damage to property. Seeing the belligerence of the LTTE, the rules of engagement were relaxed and helicopter gunships were pressed into action with Cheetah helicopters as scouts. When peace-keeping changed to full-fledged combat, the initial offensive by a single Indian brigade followed five different axes leading into Jaffna town. A bold attempt was made to capture the LTTE leadership by inducting para-commandos into the Jaffna University area by Mi-8 helicopters on the night of October 11/12, 1987, but this costly operation was aborted, with heavy casualties and damage to helicopters.[6] The prime operational base for the overstretched IPKF was Palaly airfield, where dozens of Mi-8 and Chetak helicopters, and An 32 and HS 748 transport aircraft were based, all of which had to be protected against LTTE raiders. Additional troops and equipment from various cantonments in India as well as from Trincomalee and Batticaloa in Sri Lanka were flown in using IL-76, An-12, An-32, HS 748, and civil Boeing 737 aircraft. Additional Mi-8 helicopter units arrived from air bases in India, supplemented by Cheetah helicopters for reconnaissance and casevac. The most formidable additions were the Mi-25 helicopter gunships. It is estimated that during the 20 days from October 11 to 31, 1987 some 2,200 tactical transport and 800 assault helicopter sorties were flown to fly in troops, weapons, vehicles, stores and various other equipment, and fly out the mounting casualties to military hospitals. During the second half of October 1987, the IAF flew more transport and helicopter sorties in support of the ground forces than at any similar period of time in the history of the country's armed forces. Mi-25 gunships were employed to interdict the movement of militants from the Jaffna peninsula to the neighbouring islands and mainland of Sri

The rules of engagement for the IPKF were extremely stringent, with severe restrictions placed on the use of artillery, heavy weaponry and offensive air support.

6. "Descent Into Danger-The Jaffna University Helidrop," www.bharatrakshak. com/IAF/History/1987IPKF/Chapter3.html

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Lanka, as the LTTE attempted to bring in reinforcements of personnel and logistics and, later on, to exfiltrate its cadres from Jaffna. Additionally, Mi-25s were used in the lagoon areas to destroy militant boats and vehicles.[7]

The first use of Mi-25s for close air support was on October 29, 1987, when Mi-25s attacked LTTE entrenchments 32 km east of Jaffna with rocket and cannon fire. This action enabled army battalions to overwhelm the last resistance and affect a link-up. In another action, Mi-8 helicopters flew para commandos in to areas on the western part of the peninsula and on to islands to engage LTTE strongholds. Mi-25s patrolling the key roads destroyed a number of LTTE vehicles. It is evident that in the entire IPKF campaign, the army was suitably supported by the air force in all possible roles by the transport aircraft and helicopters. Though the air environment was conducive for all air transport operations involving para drops, air landed operations, special heliborne operations (SHBO) and casevac, they were nonetheless fraught with danger from enemy fire below 2,000 feet altitude. In the later part of conflict, suitable reconnaissance sorties were flown with available intelligence inputs to gather more information on the enemy hideouts before carrying out any of these operations. The Cheetah helicopters were used in the scout role to direct the gunships accurately onto the known hideouts. Interdiction of supply and communication lines was effectively carried out in this manner. The roles of SHBO and casevac were supported by gunships to minimise the ground threat. Search and strike operations on opportunity targets were carried out frequently in different sectors of the conflict. The army cordons were tightened with patrolling sorties by the gunships, thus, forcing the enemy to operate only by night. During the 32 months of operations some 70,000 sorties[8] were flown out with no loss to enemy action or accident, a matter of great professional satisfaction for the IAF. Also taking an active part in the operation were the

7. Ibid.
8. Pushpindar Singh, "Indian Peacekeepers in Sri Lanka," *World Air Power Journal*, www.bharatrakshak.com/IAF?History/1987IPKF/Pushpindar01.html

Indian Army's Chetak and Cheetah light utility helicopters and the Indian Navy's Chetak helicopters and Alize turbo-prop fighters.

KEY LESSONS FROM OPERATION PAWAN

The advantages of air power were exploited during the IPKF operations in conditions of total air superiority. However, the concept of operations was different from classical conventional operations. There was no requirement of counter-air operations and the role of fighters was minimal throughout. At the same time, transport and helicopter operations were operating under severe limitations common to small wars, with fleeting enemy in hostile surroundings.

The policy was of nil collateral damage and no damage to civil property.

Challenges involved difficult terrain, unfriendly locals and urban areas, with restrictive rules of engagement that prohibited attacks that might hurt civilians or damage buildings. The mobile and fleeting nature of targets meant ineffective fire unless area targets like enemy camps or headquarters (HQ) were discovered. Meanwhile, there were significant limitations in the ability to gather intelligence, conduct night reconnaissance and conduct night attack, in terms of tactics and equipment. Political constraints early in the conflict greatly restricted effective use of air power. The rules of engagement also prevented any forcible disarmament in the initial stages of the accord. The policy was of nil collateral damage and no damage to civil property. The irony was that the enemy was deeply entrenched in the local population and their dwellings. Thick jungles and equally thick urban centres were the prime locations of the enemy. This complicated navigation, reconnaissance, target identification and acquisition. Lack of force landing fields was major concern for the helicopter operations. Helicopters were compelled to fly low for target acquisition, thus, inviting small arms fire. Consequently, reconnaissance mission altitudes had to be increased, which in turn led to decreased mission effectiveness.

Accurate intelligence has always been the key to successful airborne assault, special heliborne operations and targeting against fleeting targets. The IPKF operations were marred by lack of intelligence on the enemy disposition, due to the

IPKF operations were marred by lack of intelligence on the enemy disposition. This led to many SHBO and gunship missions falling short of achieving their aim.

huge local support enjoyed by the LTTE. The mistrust between the IPKF and the Sri Lankan forces added to that effect. Even though the LTTE did not have equipment capable of intercepting air-to-air and air-to-ground communication, they always managed to intercept the army's communications, thus, always being informed in advance. This led to many SHBO and gunship missions falling short of achieving their aim. All reconnaissance sorties were visual and no photo recce by day or night recce with IRLS equipment was carried out despite having the capability. Moving on to aircraft and equipment, helicopters were ill-equipped in navigation and targeting aids. There was no armour protection for the Mi-8 and Cheetah helicopters, nor were they equipped for night operations. Target acquisition was by visual means, undermining the rate of success. There was no provision or thought given to fitment of searchlights on helicopters, which completely prohibited any night search and patrolling. Finally, there were no precision weapons or any standoff capability with the helicopters. A study of the environment and the limitations of air power under which the operations were conducted in Sri Lanka bring out several lessons.

Joint planning at all levels of war is imperative. The use of fighter aircraft for photo reconnaissance missions at regular intervals could have resulted in a major show of force in addition to increased intelligence inputs. Inadequate intelligence led to the under-estimation of opposition at Jaffna University and turned out to be the main reason for the failure of the operation despite the heroics of the para commandos, 30 Sikh LI and pilots of the 4 Mi-8 helicopters from 125 HU. However, in today's environment, the advent of unmanned aerial vehicles (UAVs), satellite reconnaissance, precision weapons and guidance systems, advanced munitions such as fuel air explosives (FAEs), night attack capabilities and so on would definitely add lethal punch to such small wars in the future. A major requirement is that of continuous surveillance over the area of operations. In such conflicts, a dedicated UAV could cover the required area in repeated cycles giving an updated

picture. Night reconnaissance and targeting capability would have restricted the LTTE's freedom of movement around the clock, thus, completely paralysing them. Known hideouts in thick jungles could have been effectively destroyed with FAEs. Inaccessible targets could have been attacked with precision weapons on confirmed intelligence. Notwithstanding the advantages that modern technology could have provided during IPKF operations, the ever present limitations of political will would have remained a major factor in air power employment. Further, the kind of terrain, targets and the environment prevalent during the IPKF operations illustrate the challenges of small wars. No amount of modernity would suffice to target an enemy that is deeply entrenched within a sympathetic civilian population. The rules of engagement will always seek to limit damage to civilians and property, which are the inherent by-products of use of air power in such an environment.

THE NINETIES AND BEYOND

The departure of the IPKF from Sri Lanka saw an emboldened LTTE spreading its influence southwards into Vavuniya and Trincomalee regions. In January 1991, the LTTE launched a simultaneous attack against all SLA bases in Northern Sri Lanka and captured Elephant Pass, cutting off Palay from the rest of Sri Lanka. The SLAF with its outdated inventory of MiG-17s, MiG-15s, FT-7s from China and SF-260s Bell-212/206 and Kamov-26 helicopters could hardly influence the course of the land battle against the LTTE.[9] Operation Thunderbolt launched by the SLAF in January 1991 failed to cause any significant impact on the LTTE. In 1993, the depleted SLAF acquired four Pucara counter-insurgency aircraft from Argentina along with Mi-17s from Ukraine. This marked the beginning of an attempt by Sir Lanka to strengthen its air force and play a more active role in the war against the LTTE. The spring of 1995 saw the introduction of SA-7 MANPADS (man portable air defence systems) into

Use of fighter aircraft for photo reconnaissance missions at regular intervals could have resulted in a major show of force in addition to increased intelligence inputs.

9. Tom Cooper, "Sri Lanka Since 1971, Rearming the SLAF," p.6, www.acig.org, October 29, 2003.

the conflict with the LTTE downing two Avro HS-748 aircraft on the same day at Palay airfield. It is believed that these missiles were supplied to the LTTE by a Pakistani terrorist organisation run by the Inter-Services Intelligence (ISI) called Harkat-ul-Ansar. This escalation forced the Sri Lankan government to take emergency measures and acquire Mi-24 attack helicopters from Ukraine. They also acquired their first lot of IAI Kfir-C2 fighters from Israel. Fierce fighting during 1995 saw the Sri Lankan armed forces making little headway despite large brigade size attacks in the Killinochi, Vavuniya and Mullaittavu sectors, supported by artillery and attack helicopters. Pucaras and SI-260s launched hundreds of rockets in close air support (CAS) missions to save SLA troops from being overrun by the LTTE. After fierce fighting through the autumn, the SLA launched Op Riviresa to capture Jaffna and established a safe corridor south of Jaffna. By December 1995, Mi-24s were introduced into the fight and the LTTE struck back by downing a Y-8 transport aircraft and an AN-32 with 63 troops on board. Despite having lost two Avros earlier in the year, the SLAF were not able to sanitise their airfields or equip their aircraft with appropriate counter-measures like infrared (IR) flares. As a result, 4 transport aircraft with crew and 132 soldiers were lost with no comparable attrition caused to the LTTE.

The rest of the Nineties saw the SLAF being blooded into an operationally effective force with induction of more Mi-24s and Kfir jets. Typical missions flown during the period 1996-2000 included strikes against LTTE bases and supply nodes. Close air support training improved significantly with pilots and technicians being sent overseas for training. Local production of bombs and rockets also commenced. The induction of Super Scout reconnaissance drones in 1998 provided a significant improvement in recce capabilities that could be used for targeting. From 1997-2000, fierce fighting for control of Jaffna saw the SLAF support the army's drive up north with Mi-24s and Kfir jets. These were supplemented by newly acquired MiG-27s from Ukraine and other aircraft, and by the summer of 2001 the SLAF order of battle (ORBAT) comprised the following squadrons(Table 1).[10] Most of the air bases are indicated on Map below.

10. Cooper, Ibid., p.11.

Table 1

Unit	Location	Aircraft
1 Flying Training Wing	Anuradhapura AB	PT-6/CJ-6 Cessna, SF.206
2 Heavy Transport Squadron	Ratmalana AB	An-32, C-130, HS-748, Cessna 421
4 VIP Helicopter Squadron	Katunayake AB	Bell 206 &214
5 Jet Squadron	Katunayake AB	F-7 BS, FT-7, Mig-27/23
6 Helicopter Squadron	Vavuniya	Mi-17/Mi-17 I
7 Helicopter Squadron	Minneriya AB	Bell 206/212
8 Light Transport Squadron	Ratmalana AB	Beech 200, Y-12
9 Attack Helicopter Squadron	Minneriya/Hingarukoda	Mi-24/35
10 Fighter Squadron	Katunayake AB	Kfir-TC.2, Kfir C.7
11 UAV Flight	Vavuniya AB	Scout UAVs
14 Squadron	Katunayake AB	K-8

MAP 2: SRI LANKA AIR BASES[11]

11. Tom Cooper, www.acig.org/artman/publish/article_336.shtml

ESCALATION OF THE AIR WAR

After a hastily brokered peace agreement/ceasefire in 2000 broke down, the SLA and SLAF were in action again, this time with better equipment and tactics. Night vision devices were said to have been used effectively by both attack helicopters and fighter aircraft to attack LTTE buses carrying leadership at night. This marked a critical point in the air war, with targeting of LTTE leadership based on actionable intelligence. Though the offensive against Jaffna ended in failure, MiG-27s continued to strafe LTTE positions with some success. In response to a punitive strike by MiG-27s and Kfir jets against a reported LTTE build up in Wanni and concerned about the growing effectiveness of the SLAF and their depleting air defence capability, the LTTE showed tremendous tactical brilliance by deciding to try and neutralise the SLAF on the ground. In pursuance of this strategy, on July 24, 2001,[12] they launched a daring commando raid on Katunayake airfield near Colombo. Despite having over 90 sentry points and 500 men guarding it, LTTE commandos managed to breach all layers of defence and inflict significant damage to aircraft of various types. Though all the members of the LTTE squad were killed, they managed to destroy three Kfir C-2 fighters, two K-8 jet trainers, one MiG-27M, one Mi-24V, two Mi-17s and one Bell-412. Additionally, they also destroyed two Sri Lanka Airline commercial jets and damaged several other Airbus aircraft belonging to the national carrier. The sheer magnitude of the strike surprised Colombo and forced them to negotiate a ceasefire in November 2002 that was brokered by the Norwegians. Notwithstanding the ceasefire, the fragile peace started showed signs of cracking in December 2005, with both sides having built up significant military capability during the three years of the ceasefire. Increasing international pressure on the LTTE after it was declared a terrorist organisation,

Increasing international pressure on the LTTE after it was declared a terrorist organisation, made it difficult for the LTTE to upgrade its inventory of weapons as it was able to do during the Eighties and Nineties.

12. Cooper, Ibid., p.14.

made it difficult for the LTTE to upgrade its inventory of weapons as it was able to do during the Eighties and Nineties. The only value addition that manifested itself was the unleashing of the Tamil Eelam Air Force (TAF) with a few slow moving Zlin-143 light aircraft of Czech origin and the creation of a few airstrips for operations. On the other hand, the Sri Lankan armed forces embarked on a modernisation spree that saw them better prepared to take on the LTTE this time around. The acquisition of Searcher class of UAVs to complement the existing Scout UAVs meant that the Sri Lankan armed forces could hope for better real - time intelligence that could aid targeting from the air. Eelam War-4, as the present undeclared war is called by the LTTE, is proving to be extremely critical as it could see the LTTE pushed to the brink of defeat by the resurgent Sri Lankan armed forces, backed by effective utilisation of air power that is targeting the LTTE's centres of gravity.

AIR WAR—EELAM-4

The Eelam-4 war assumes significance for a number of reasons. Firstly, Karuna's breakaway LTTE group[13] in the east revealed the first signs of fissure in the LTTE and provided the Sri Lankan security forces with a distant window of opportunity to exploit, especially from an intelligence point of view. It also exposed chinks in the LTTE leadership and, for the first time, Prabhakaran appeared vulnerable, particularly after the death of Anton Balasingham, the suave political face of the LTTE. Secondly, the Sri Lankan security forces have changed their targeting model with respect to the LTTE. They have realised that Prabhakaran and the top LTTE leadership present the most valuable targets. This is where air power has been used extremely effectively over the last two years by the SLAF with tangible pay-offs. As a corollary to the previous point, the SLAF has also been targeting critical military capabilities of the LTTE that relate to its ability to wage a prolonged war. Interdiction of Sea Tiger camps and the LTTE's naval capability points to a concerted attempt to choke the LTTE by interdicting supply routes. SLAF aircraft have even engaged LTTE boats within an hour of

13. Karuna was one of Prabhakaran's key military aides and controlled LTTE cadres in the Eastern province. He is supposed to have fallen out with Prabhakaran on the manner in which the struggle for Eelam was being orchestrated.

The interesting feature of Eelam War-4 is the psychological impact of the use of air power by a non-state actor.

being alerted. The third interesting feature of Eelam War-4 is the psychological impact of the use of air power by a non-state actor. The daring Tamil Eelam Air Force (TAF) strikes by the LTTE's air arm against Katunayake air base on the outskirts of Colombo on March 26, 2007, and the combined strike by commandos and aircraft of the TAF against Anuradhapura air base indicate the growing importance given by both sides to the use of air power in an unconventional conflict.[14] The other interested doctrinal issue that has emerged from Eelam War-4 is the issue of the contribution of air power in conflict escalation and its immediate potential for rapid deescalation and conflict resolution, if used judiciously.

AIR POWER WITH NON-STATE ACTORS

Till very recently, air power assets with non-state actors mainly comprised a variety of ground-based air defence weapons like anti-aircraft guns and MANPADS of the Stinger and SAM-7 class. In recent years, the LTTE has made remarkable progress in its attempts to put together an air wing of its own. Apart from training aircrew in Europe, it acquired a few light aircraft with limited armament carrying capability, supposedly of Czech origin, and built a few airstrips in Northern Sri Lanka in the area northwest of Mullaittivu. More than any long-term impact, the TAF was meant to be used as a psychological weapon against Colombo. In what was supposed to have been a coordinated commando/air strike on Katunayake air base on the night of March 26, 2007, two unidentified TAF aircraft bombed a brightly lit hangar facility of the SLAF, inflicting significant but unconfirmed damage to equipment and aircraft. Surprise was the key to the attack and why the LTTE commando raid did not materialise is not known. It is also believed that locally manufactured and fused 250 kg bombs were fitted on crude bomb racks and dropped with the help of the global positioning system (GPS) for reasonable accuracy. In a second coordinated strike on October 22, 2007, a suicide commando group of the Black

14. B. Raman, "LTTE's Anuradhapura Raid," *Indian Defence Review*, October-December 2007, p.107.

Tigers, in conjunction with two aircraft of the TAF carried out a precision attack on the Anuradhapura air base, destroying a large number of aircraft that are said to have included three helicopters (Mi-24/17), two fixed wing aircraft, three drones/UAVs and an expensive Beechcraft surveillance plane. The raid was executed with daring, unbelievable courage[15] and precision, sending shocks through the world community at the appearance of such tactics of desperation amongst non-state actors. The attack was planned well with the commandoes neutralising a radar and an anti-aircraft position before calling in the air strike. The series of air attacks by the TAF galvanised the SLAF into action and what followed was a series of strikes by Mi-24s, Kfir fighter jets and MiG-27s against the Sea Tigers, LTTE camps, the LTTE airstrip complex at Irramadu, and most importantly, the LTTE leadership, more of which would be discussed in the following section.

TARGETING LTTE LEADERSHIP

The persistent efforts at targeting the Al-Qaeda leadership by the coalition forces led by the US over the last six years led the SLAF to explore possibilities of doing the same with the LTTE leadership. While the Al-Qaeda leadership is highly mobile and has safe havens in multiple countries, the LTTE leadership is now confined to the Jaffna peninsula and Northern Sri Lanka. Additionally, Prabhakaran is known to prefer bunker-based refuges and is said to move around with a fairly large entourage, making him relatively vulnerable to air strikes, something that the SLAF has taken advantage of. The air strike by SLAF jets at Thiruvairu, a suburb of Killinochi on November 2, 2007, saw the elimination of the LTTE political commissar, S.P. Thamilselvan.[16] Considering that Killinochi is considered the capital of the LTTE's controlled Northern province of Wanni, the SLAF has exploited the coercive and deterrent capability of air power without any ground action. This scenario was recreated on November 26 and 28, 2007, when the SLAF hit two "high value" targets in Jeyanthi Nagar in Killonchi. The targets comprised bunkers in which the LTTE

15. Raman, Ibid., p.109.
16. Ed Johnson, "Sri Lanka Plans More Air Strikes, November 5, 2007, Bloomberg.com

Accurate and actionable human intelligence (HUMINT) is indispensable and critical for targeting elusive terrorists.

supreme Velupillai Prabhakaran was said to have been injured by falling debris. The intensity of bombing even caused the LTTE to cordon off the area and close the approach road to Jeyanthi Nagar. The extent of injury to Prabhakaran is not as important as the fact that Prabhakaran is now extremely vulnerable in his limited area of operation.[17] More recently, on January 23, 2008, SLAF fighter jets bombed an important LTTE base called X-ray base that was supposedly located in a thick forested area in the vicinity of the make-shift LTTE runway at Iranamadu, also in Killinochi district.[18] This area is also said to be frequented by Prabhakaran. The mission was reported to have been launched after the area had been kept under constant surveillance by multiple sensors and validated by real-time intelligence prior to the launch of the mission. Three important factors need to be highlighted in this air campaign by the SLAF. These are:

- Accurate and actionable human intelligence (HUMINT) is indispensable and critical for targeting elusive terrorists. The in-fighting within the LTTE, leadership, growing disillusionment amongst the local Tamil populace with Prabhakaran and his ruthless recruitment drive, and successful infiltration of Tamil strongholds by Sri Lanka's intelligence agencies are factors that have improved intelligence for targeting.
- Weapon effectiveness and delivery techniques by Kfirs and MiG-27s have improved significantly. There is even a possibility that the SLAF has acquired limited precision capability in the form of strap-on laser guidance kits coupled with appropriate airborne/ground-based laser designation capability by special forces who are trained to infiltrate into the vicinity of the target area, exfiltrate to pass on target information, and infiltrate into the target area to aid in real-time targeting. Indigenously developed/modified bunker buster bombs are likely to have been used by the SLAF in recent attacks.

17. D.B.S Jeyaraj, "Examining a Post-Prabhakaran Scenario," *The Hindu*, December 25, 2007.
18. B. Murlidhar Reddy, "LTTE 'hub' in Kilinochi Bombs, *The Hindu,* January 24, 2008.

- There is also a distinct synergy in operations among the three Services. A typical example is the fighter strike on a key Sea Tiger facility at Mullaittivu on September 29, 2007.[19] This attack was preceded by a naval operation in which three LTTE boats were sunk off the Trincomalee coast while attempting to evacuate LTTE cadres who were trapped and encircled by the Sri Lankan Army. Relentless pressure is something that is being applied by all forms of combat power on a weakened enemy. Terrorising the terrorists seems to be one of the methodologies being adopted by the Sri Lankan armed forces to good effect. On January 6, 2008, the head of the LTTE's military intelligence "Col Charles" or Shanmuganathan Ravishankar was killed in a claymore attack on his van by the Sri Lankan Army's deep penetration unit in Pallamadu in Mannar. Thus, in a span of two months, two key aides of Prabhakaran have been killed and Prabhakaran himself has been injured in surgical attacks by Sri Lankan security forces
- Political will to use air power extensively has resulted in significant gains for the Sri Lankan government. The bottom line is that the LTTE is now on the back foot despite its daring air raids; air power has played a critical role in this reversal.

Political will to use air power extensively has resulted in significant gains for the Sri Lankan government.

KEY TAKE AWAYS

As the ethnic conflict in Sri Lanka reaches new levels of sophistication, the official abrogation of the four-year ceasefire by the Sri Lankan government in early January 2008, means that the stage is set for a final thrust by the Sri Lankan armed forces to try and defeat the LTTE. History tells us that most of the times when air power has been used intelligently in an "unconventional war" between a state and an "unconventional enemy," the conflict has escalated, only to deescalate equally quickly. Linebacker II in Vietnam after the Tet Offensive allowed the US to carry out a calibrated withdrawal from Vietnam. Air power

19. "Sri Lanka Air Force Bombs Sea Tiger Training Facility in North-East," September 29, 2007, Colombo Page Newsdesk, Sri Lanka.

History tells us that most of the times when air power has been used intelligently in an "unconventional war" between a state and an "unconventional enemy," the conflict has escalated, only to deescalate equally quickly.

broke Milosevic's will in Kosovo, as did the use of air power hasten the defeat of well entrenched intruders in Kargil. However, the success achieved by the SLAF in targeting the LTTE leadership has been astounding to say the least. Integration of coordinated intelligence, extremely short sensor to shooter time cycles and accurate weapon delivery have seen the use of offensive air power in urban and jungle terrain reap rich dividends notwithstanding the collateral damage. Despite the severe depletion of critical SLAF assets after the twin LTTE strikes on Katunayake and Anuradhapura airfields, the author opines that the LTTE is now fighting for survival and a few aircraft and sporadic attacks are not going to achieve Prabhakaran's goal for Eelam. The writing is on the wall because the LTTE leadership is boxed into small areas of Wanni, Mullaittivu and Jaffna, making them fairly easy targets for air strikes, especially with increased availability of accurate HUMINT and assistance from the Sri Lankan Army's deep penetration commando units. Some lessons to be drawn from the last six months of fighting in Sri Lanka are:

- Notwithstanding the daring attacks by the TAF on Katunayake and Anuradhapura, the overall impact of the offensive use of air power by a non-state actor has been detrimental to its overall objective.
- It has, instead, acted as a catalyst for galvanising the Sri Lankan government and security forces into offering a befitting riposte.
- Considering the failure of the US to eliminate Osama bin Laden and Zawahiri, the success of the SLAF in targeting the LTTE leadership is likely to have a telling impact on the final outcome of the conflict. The importance of leadership as a critical centre ofgravity of a non-state actor has been amply validated in Sri Lanka and needs to be taken cognisance of by India, especially in its fight to contain the spread of terror networks and Naxalism.

The importance of leadership as a critical centre of gravity of a non-state actor has been amply validated in Sri Lanka

Whether the Indian government can ever take a call on using air power offensively against insurgent leadership within its own geographical boundaries is purely a function of domestic political compulsions and national will when it comes to combating terrorism and other forms of "unconventional and irregular warfare." It is also extremely critical for the Sri Lankan government not to get carried away by the effectiveness of air power, and use it only as an effective tool for conflict termination. The key to this maturity would lie in a realisation that the ethnic conflict can only be resolved through negotiations and not through indiscriminate use of military force. The current policy of "terrorising the terrorist" has to be accompanied by a concerted attempt at winning the hearts and minds of the Tamil minority.

ARMY AVIATION IN INDIA

RAJIV GHOSE

Aviation is proof that given the will, we have the capacity to achieve the impossible.
—Eddie Rickenbacker

The history of military aviation dates back to the middle of the 18th century when armies faced each other on the field of battle, standing and advancing in the open, towards an equally exposed enemy. Although air observation as a branch of military science is generally associated with recent advancements in the field of modern warfare, the earliest suggestions for employing balloons with armies in the field seems to have been made in France after the first successful ascensive power of heated air was demonstrated by Joseph Montgolfier at Annonay, near Lyons, on June 5, 1783. The first man to advocate and point out the military possibilities of the new invention was Andre Giraud de Vilette.[1] The technology needed to make a flying machine was not available and balloons were used—tethered observation balloons to look into the other side or the enemy's side, observe, communicate and direct fire. This paper traces certain events and facts which reveal, with an emphasis, that observation from the air and requirement to direct fire was primarily the requirement of the surface forces from which evolved the need of exploiting the dimensions of air and then space. It does not draw any parallel between air force and army aviation as we

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1. Fredrick Stansbury Hayden, *Aeronautics in the Union and Confederate Armies* (Manchester: Ayer Company Publishers, 1980), pp.1-2.

Progressive thinking identified the domineering power of the air power and, therefore, the need of a specialised Service.

know it, but as a probable interpretation of facts, it is seen that aviation has been primarily military in nature and the distinctive term "air power" itself came into use soon after the first powered flight by the Wright Brothers.[2] The quest for advancement in this field has been with the ultimate goal of securing and preserving the sovereignty of a country. Sport and other functional means of this dimension have been ancillary developments, which have gained prominence in the event of more functional and constructive thinking. The mindset of the air force as a subsidiary force had always given a more tactical hue and, therefore, indulgence into practical development remained restrictive till the years of World War I. Progressive thinking identified the domineering power of this dimension and, therefore, the need of a specialised Service. World War I itself lent the tactical-strategic dimension which later paved the way for the air force to be considered as a strategic power. The need for this specialised Service, however, could not distance the requirement of close support for the land and naval forces and, therefore, in the line of this thinking, a requirement of an air wing for the land and sea forces brought about the existence of army and naval aviation. Air is intrinsically entwined with land and sea operations, whether strategic or tactical, and, therefore, study of any component—in this case, army aviation—requires attention on the aspects of its role based on historical evolution of the entity, past and present performance, and a contemporary look into future requirements.

BACKGROUND

A short interject of the history and development of "flying machines" will be essential to understand the evolution of flying in the army. Although fixed-wing aircraft received attention by most historians, initially, rotary flight was, envisioned by man. The ancient Chinese, as early as the 4th century AD, played with a hand-spun toy that rose upward when revolved rapidly—this could be

2. Air Commodore Jasjit Singh, *Air Power in Modern Warfare* (New Delhi: Lancer International, 1985), p.xvi.

taken as the first concept of rotary wing aviation. About 320 AD, Ko Huang speaks of a flying machine on the principle of the helicopter: "Some have made flying cars *(fei-che)* with wood from the inner part of the jujube tree, using ox leather straps fastened to returning blades so as to set the machine in motion."[3] This is the first recorded pattern of what we might understand as a rotary wing or a type of propeller. The technology needed to create a helicopter rotor or propeller had not been produced yet but the concept of rotary wing aviation had unquestionably been found. During the period 1487-90, the great Italian inventor Leonardo Da Vinci, used his fertile mind to make drawings of the aerial screw or air gyroscope which was a futuristic design, and actually looks like an ancestor of the helicopter.[4] Thus, we see that the origins of flight, as conceived in the early days, commenced from a concept based on rotary motion flight, which is virtually synonymous with army aviation, as we know it today. Among the technical developments of the industrial revolution was a much improved artillery field gun and more powerful ammunition. This allowed the commander to fire an artillery barrage on the enemy and its reserves and neutralise them before they could be committed. However, for this barrage to be effective, it was necessary to see where it was falling and to direct it onto the target. Sending artillery observers out to a convenient viewing point to direct the gunfire was slow and not very effective. Man-carrying balloons had been around since the latter half of the 18th century and developed over many years to become relatively effective observation platforms. The French were the first to use balloons for aerial reconnaissance in the Battle of Maubeuge on June 2, 1794, and then on June 26, 1794,[5] during their conflict with Austria, with the tethered observation balloon, *L'Entrepenant*. Thereafter, during the siege of Venice by the Austrian Army in 1849,[6] balloons were used in an attempt to drop bombs into the besieged city as two miles of water prevented the "balls and bombs" from reaching their destination, though the attempt stood failed as the wind direction changed after the launch.

3. Luigi Pareti, *The Ancient World* (London: G. Allen and Unwin, 1965), p.747.
4. Enrica Crispino, *Leonardo* (Italy: Giunti, 2002), p.112.
5. Don Berliner, *Aviation: Reaching the Sky* (Minneapolis: Oliver Press, 1997), pp.24-25.
6. William Coxe, *History of the House of Austria* (London: Henry G Bohn, 1853), p.Ixxxviii.

However, their use on the battlefield came to be considered as too cumbersome and the earlier ideas of usage of this mode became restrictive in thinking and their only use thought of was as signals in war.[7] Further development of ideas and innovative use by the confederate armies of America led to some enthusiastic use for observation and aerial reconnaissance, "...that the aerial reconnaissance had been so satisfactory in results that the general-in-chief (Gen Meigs) had ordered four more balloons added to his army."[8] It was also historic when Thaddeus S. Lowe, on September 24, 1862, directed federal artillery fire from a balloon by the use of the telegraph. In the Franco-Prussian War, balloons were used to great tactical advantage when Paris was surrounded and sealed off by the Germans – as many as 66 balloons were utilised to keep contact outside the siege which carried dispatches with almost 1.5 trillion letters.[9] Hereafter, from the year 1878, efforts began to introduce such measures into the British Army.

EARLY HERITAGE OF INDIA'S ARMY AVIATION

Since 1794, as stated above, we have gone through two eras and have now entered a third, in aerospace power. Two centuries ago, there was a problem of integrating the intelligence, surveillance and reconnaissance system into the military. A century ago, we had similar problems involving the aircraft and, today, we move to integrate the entire space into our operations. In effect, as the balloon did to cavalry and surface forces, the airplane, with manned and unmanned space vehicles as of today, did to the balloon and surface forces which bear a direct relationship to military operations. In 1892, the French War Ministry had contracted Clement Ader to build a combat airplane capable of dropping explosives. This air power prophet had remarked, "Whoever will be the master of the sky, will be the master of the world."[10] Focussing on the heritage of India's army aviation, the most technical arm of the British Army at that time was the Corps of Royal Engineers. They were entrusted with the responsibility of

7. Henry Philip Stanhope, *Notes on Conversations with the Duke of Wellington, 1831-1851* (Boston: Adamant Media Corporation,2001), p.86.
8. Hayden, n.1, p.229.
9. James J. Clarke, *The US Air Service in the Great War, 1917-19* (Westport: Greenwood Publishing,1996), p.5.
10. Henry Villard, *Contact! The Story of the Early Aviators* (New York: Dover Publications, 2002), p.140.

operating the balloons and the first tethered observation balloons were purchased; balloon schools and balloon sections were established in 1890.[11] There seemed to be a technological pause between the end of the Franco-Prussian War and 1890, which could be attributable to the lack of funding for such development. During the next ten years, the balloon sections developed their techniques, and at the close of the century, a number of sections operated with great, even decisive, effect in South Africa during the Boer War,[12] but the branch was always kept on a tight budget by the War Office which showed scant enthusiasm in spite of the military intentions of France and Germany in aeronautical soldiering. In the interim, Samuel Franklin Cody, a showman and American expatriate who was fascinated by the way the Chinese flew a variety of kites, fired up his passion to develop the Cody War Kite. By the year 1904, his success attracted the army and he was employed by the War Office between 1905 and 1909. He built Britain's first military dirigible, the *Nulli Secundus*, (which flew from Farnborough to London) and then the first aeroplane to fly in Britain. The machine, based on the Wright Brother's latest model, made the first sustained flight in Britain on October 16, 1908.[13] After the accidental death of Cody, the War Office in Britain had almost decided to discontinue work on aeroplanes when Press and public attention in Britain was seized in the same year when Louis Bleriot crossed the English Channel in an aeroplane on July 25, 1909—he took off from Calais for a 27 minutes flight and landed at Dover on the other side of English Channel.[14] By 1910, a small number of aeroplanes were owned and operated by army officers and some of these persuaded the War Office of their importance as aerial platforms for observation and reconnaissance. In 1911, the Royal Engineers Air Battalion was formed; its 150 men, in two companies, were to be instructed in the use of balloons, man-carrying kites and aeroplanes.[15] The Press and public pressure obliged the

11. Charles Fredrick Snowden Gamble, *The Air Weapon: Being Some Account of the Growth of British Military* (London: H. Milford, 1931), p.25.
12. Laurence Yard Smith, *The Romance of Aircraft* (New York: Fredrick A. Stokes Company, 1919) p.26.
13. Villard, n.10, p.81 and Peter Hore, *Patrick Blackett: Sailor, Scientist and Socialist* (London: Frank Cass, 2003), p.13.
14. Neville Duke, Edward Lanchbery, *The Saga of Flight* (New York: John Day Company, 1961), pp.46-47.
15. Walter Alexander Raleigh, Henry Albert Jones, *The War in the Air: Being the Story of the Part Played in the Great War* (London: Clarendon Press, 1922), p.142.

government to look into the development of military aviation and, ultimately, led to the formation of the Royal Flying Corps on April 13, 1912, to comprise the military and naval wings and a joint Service Central Flying School. Aeroplanes had now joined the balloon and kite sections and companies of the Royal Engineers. Almost immediately, and despite the goodwill of the officers actually engaged in flying, the two wings drifted apart. The War Office and Admiralty were unable to agree on a common policy for the development of aviation, which could meet the requirements of the two forces and by July 1914, the *de facto* split was acknowledged by the independent formation of the Royal Naval Air Service on July 1, 1914.[16] The Royal Flying Corps became the army's air branch and was no longer part of the joint Service organisation for which it was originally intended. Therefore, what was widely accepted is that although military flying was very much in practice, and the acknowledgement that a superior form of combat can be waged from the air, the nature of warfare is such that it requires dedicated efforts in every aspect, whether of strategic or tactical nature. The air corps of the army existed as a support measure; there did not seem to be much significant thought on its employment in terms of strategically linked operations, hence, a sort of amalgamation of utility and basic requirements existed as far as air power was concerned.

WORLD WAR I

World War I witnessed the use of air to gain advantage over the forces engaged on the surface of the earth. Aircraft were used either to bomb enemy locations, which included civilian settlements, or to engage in aerial observations. There were personalities like Gen Ferdinand Foch of France (a country considered a forerunner in the development of aviation technology) who, in 1910, prior to the outbreak of World War I, had remarked, "That's good sport, but for the army, the plane is of no use." Similar views were also aired by the British General Sir Douglas Haig who lectured at the British Army's Staff College, "I hope none of you gentlemen is so foolish as to think that aeroplanes will be usefully employed

16. David French, Brian Holden Reid, *The British General Staff: Reform and Innovation* (London: Frank Cass,2002), p.207.

for reconnaissance from the air. There is only one way for a commander to get information by reconnaissance and that is by the use of cavalry."[17] This gives an insight into the military thinking at a certain point of time which suggests that there was a lack of military understanding about the effect air power could have to further military objectives. Even those with limited military knowledge and perspective of air power, would in some fundamental way accept the idea of aerial observation and reconnaissance in the aid of surface forces. This aspect was highlighted during the war when aerial observers were called to locate troops, railheads, aerodromes, camps and supply dumps. Aerial reconnaissance and artillery fire direction flourished in an atmosphere of cooperation between army flyers with the aid of the signal corps. However, controversial alterations in existing doctrine were demanded when the broader combat implications of military aviation were considered. Both dirigibles and airplanes were potential weapons for attack upon troop concentrations. These concepts required revolutionary changes in army thought patterns and it was viewed that aerial combat was a necessary means to achieve the aerial superiority to maintain dominance in the air space over the battlefield.[18]

The new concepts required revolutionary changes in army thought patterns and it was viewed that aerial combat was a necessary means to achieve aerial superiority to maintain dominance in the air space over the battlefield.

This was the beginning of the concept of a dedicated air force to create and maintain total dominance of the air while the surface forces were to battle it out with the aid and support of this force. Eventually, the rise of a dedicated air wing for the land forces would be conceptualised and later be termed as the army air corps or army aviation. In the first part of World War I, military aviation still had only one officially recognised function: to serve as the 'eyes' of the army. Be it a

17. Michael Dewar, *An Anthology of Military Quotations* (London: Robert Hale, 1990), p.25, and Sebastian Cox & Peter Gray, *Air Power History* (London: Frank Cass, 2002), p.94.
18. Herbert Alan Johnson, *Wingless Eagle: US Army Aviation Through World War I* (North Carolina UNC Press, 2001), pp.68-69.

tank, an airplane, or a longbow, the appearance of a new weapon has traditionally posed a fundamental question to the minds of military thinkers: shall it be used as an auxiliary to an older mode of fighting or shall the new instrument be used as a main striking force in its own right? In the typical case, the first answer has been that the new weapon should constitute an auxiliary to the older tools of war. Then, as the technology of the new system improves, there gradually emerges a body of thought which advocates its use in organisations which have independent offensive missions of their own, and so it was with airplanes. The first impulse in the days of World War I was to consider it as a new and better horse, or at the very most, a better kind of long-range artillery. Even before the war had started, the armies of the world had conceived of reconnaissance and artillery spotting roles and, therefore, had developed rudimentary organisations for accomplishment of those missions. The development of artillery spotting was handicapped by the difficulty of communications between the observer and the gun battery commander but the reconnaissance missions produced immediate and important results as in the first Battle of Marne. Any sociological study of the first generation of airmen will reveal that a disproportionate share of them came from the artillery branches of their respective branches.

Giulio Douhet, a military career soldier, who rose to the rank of general and military strategist, advocated the idea that air power is a decisive instrument of war in its own right and has a role completely independent of the army and navy. This idea is really the crux of all the inter-War struggles between the air warriors and their brethren on the ground; once the proposition is accepted, everything else would necessarily follow.[19] During the first weeks of the war, however, when hundreds of thousands of troops swarmed all over, aviators often attacked marching columns at their own initiative with whatever weapons they happened to have. Headquarters of the Royal Flying Corps (RFC) noted: "Several instances have occurred lately in which targets suitable for attack have been passed over without any action being taken. In future all aeroplanes

19. John H. Bradley, *The Second World War: Europe and the Mediterranean* (London: Square One Publishers, 2002), pp.55-56.

carrying out reconnaissances *[sic]* will carry bombs ...whenever suitable targets present themselves, they should be attacked by dropping bombs." Thus, we see that the growing need of a specialised Service to look into the needs of such strategic action was already emerging. Artillery spotting maintained its importance because of the central role of artillery during the conflict. The early command relationship between air and ground forces sprang largely from the need for air reconnaissance and artillery spotting. The Royal Flying Corps (RFC) assigned a squadron to each army corps: in the French and German Services, the various army corps were allotted *Escadrilles* and *Flilegerabteilungen* (flight units) respectively.[20] This was signalling the requirement of not only a specialised Service but also of a future need of identical nature of support to the land forces, thereby, setting the grounds for a dedicated support Service for the army to perform similar tasks. One British document on artillery spotting observed laconically, "One of the principal factors necessary to enable successful work with the artillery is a slight knowledge of gunnery on the part of the observer."[21] As longer range artillery guns were brought into service, "spotting" for artillery became important. To emphasise the traditional role of observation and reconnaissance in those days from the air, the British Royal Air Force had taken 14,678 photos and helped range artillery on 9,539 targets.[22]

The organisational structure of the British during that period, comprised a system with a director of military aeronautics in the national capital and a commanding general in the war zone, which the Americans also adopted. The Italians followed a unified command for artillery spotting during the period April 1916 to April 1917 but otherwise, till 1918, there was only an aviation commander assigned to each individual army (initially, as the unit commander of the aviation group allocated to each army).[23] A number of Indians had served in the Royal Flying Corps, and distinguished among them was Lt Indra Lal Roy (his nephew Air Marshal Subroto Mukherjee would become the first Indian to

20. Benjamin Franklin Cooling, *Case Studies in the Development of Close Air Support* (Darby: Daine Publishing Co. 1990), p.16.
21. Sebastian Cox & Peter Gray, *Air Power in the First World War* (London: Frank Cass, 2002), p.5.
22. Arnold D. Harvey, *Collision of Empires: Britain in Three World Wars, 1793-45* (London: Continuum International Publishing Group, 1992), p.404.
23. Harvey, Ibid., p.420.

command the Indian Air Force) who was awarded the Distinguished Flying Cross (DFC) for his exemplary performance in war with the Royal Flying Corps, a rare honour for an Indian.[24] In the midst of the war, the British Army chose to restructure the armed forces and, thus, came into existence the independent Royal Air Force on April 1, 1918.[25] The Royal Air Force was the first independent air force and owed its creation in World War I to the hue and cry over the bombing of London by the Germans.[26]

Every transformation has its equal share of pros and cons. On the one hand, it led to the consolidation of a specialised Service and, on the other, it created a situation thereafter wherein the army felt that it was unable to make much progress in putting soldiers in the sky. Interest in vertical flight was practically non-existent during World War I; during the 1920s, there was a variety of experiments, followed by a wave of popular interest in the 1930s led by Juan De La Cierva. In 1923, the autogyro was the first type of rotating-wing aircraft to fly successfully and this demonstrated a useful and practical role in aviation, pre-dating the first successful flight of a helicopter by about fifteen years. Over thirty different designs were produced during the period 1923-38 and the capability of low speed flight and capability to land in confined areas gave a new dimension to military applications.[27]

WORLD WAR II

As a result of the prevalent thinking in the Royal Air Force, during the inter-War period, whereas the German and French Armies both had different types of aircraft for ground attack, general purpose close support and artillery observation roles, the Royal Air Force had only a single type, the Westland Lysander, which was able to carry out all different functions involved in aerial support of a ground army. The Germans used the Fieseler Fi 156 Storch as an artillery observation plane with remarkable success, having one-third the power and half the weight and speed, compared to the British aircraft. The Westland Lysander which was a two-seater army cooperation and short range tactical reconnaissance aircraft, of course,

24. Air Commodore Jasjit Singh, *Defence from the Skies* (New Delhi: Knowledge World, 2007), p.5.
25. Simon Hall, *The Hutchison Illustrated Encyclopedia of British History* (London: Taylor & Francis, 1999), p.294.
26. Williamson Murray, *Strategy for Defeat: The Luftwaffe 1933-1945* (Philadelphia: Diane Publishing, 1983), p.321
27. J. Gordon Leishman, *Principles of Helicopter Aerodynamics* (London: Cambridge, 2006), p.692.

earned fame for a different reason by way of landing and picking up secret agents, made possible because of its remarkable short landing and take-off run (the plane weighed 2,685 kg in normal loading). By October 1939, the British Army had called for a new type of light aeroplane to improve the application of artillery fire.[28] It was felt that the British Westland Lysander was falling short of the requirements which the ground support role demanded. The whole gamut of true army cooperation duties and in particular artillery observation and coordination duties, was undertaken by the genuine light liaison aircraft, the Austers (weighing 499 kg), which were inducted into No. 654 Squadron in August 1942.[29] The British were not too much in favour of the close air support concept during the inter-War period, resulting in the Royal Air Force finding itself in a situation of comparative inadequacy in 1939. The entire air support of the Royal Air Force was equipped and trained to provide what was officially termed "army cooperation," and emphasised reconnaissance. There was one joint RAF/Army School of Cooperation at Old Sarum where junior army officers were trained for liaison duties with the squadrons, with the aim of providing tactical reconnaissance, artillery spotting and photographic reconnaissance to the British expeditionary force.[30] In the meantime, a key factor in the return of the air observation post to the British Gunners was the formation of the Royal Artillery Flying Club in 1934. Capt H.C. Bazeley (later colonel) was seconded to the Royal Air Force as an army cooperation pilot who formulated the detailed concept of the air observation post which essentially coupled the requirement of "gunners" for air observation tasks, thereby, leaving other combat roles to the pilots of the Royal Air Force.[31] They would fly simple, unarmed light aircraft, depending for survival on being agile

The Entire air support of the Royal Air Force was equipped and trained to provide what was officially termed "army cooperation," and emphasised reconnaissance.

28. Harvey, n.22, p.645.
29. Chris Bishop, *The Encyclopedia of Weapons of World War II* (London: Sterling Publishing Company, 2002), pp.424-425.
30. Dr Ian Gooderson, *Air Power at the Battlefront: Allied Close Air Support in Europe, 1943-45* (London: Routledge, 1998), p.22.
31. Peter Mead, *The Eye in the Air* (London: H.M.S.O, 1983), pp.153-154.

and inconspicuous and by flying, as far as possible, over areas held by friendly forces, but using height and freedom of movement to look into areas not visible to ground observers. Bazeley's ideas were seconded by two other like-minded soldiers, Lt Col (later major general) J.H. Parham and Brig H.R.S. Massey. In 1939, Brig Massey was Brigadier Royal Artillery Southern Command, and was able to add weight to the army's case for the "Flying OP (Observation Post)" as it was called.

The proposal was finally accepted amidst some debates and after tentative trials in 1938-39, a flight was established for the purpose in 1940 (D Flight RAF). Capt Bazeley, was given command of this unit.[32] The first squadron to come into action was No. 651 Air OP Squadron (RAF), commanded initially by Lt Col Bazeley and then Maj R.W.V. Neathercoat. The squadron fought throughout the North African campaign during 1942-43 where it amply proved the success of the Air OP concept, often flying in the face of enemy air superiority. Though, it has also been argued that by 1943, while the Royal Air Force moved towards becoming a close support workhorse, especially in Northwest Europe, operations saw artillery being relegated to a secondary role and, therefore, less emphasis on artillery spotting. This happened mainly because of the speed of operations where the armoured thrusts would succeed in penetrating the German defensive positions and be beyond the range of supporting artillery, thereby, becoming limited to those pieces which could be transported to the dropping zones.[33] Although the D Flight raising could not convince most of the sceptics, authority was given in 1941 for the formation of Air Observation Post Squadrons. To overcome inter-Service organisational limitations and 'ownership' of the squadrons, a compromise was agreed upon. These squadrons were to be RAF units, each commanded by a gunner major (pilot) with an RAF adjutant. The RAF would provide the aircraft (Austers) and the airmen to maintain them; the army would supply vehicles, ground radios and soldiers to man them; all the pilots would be artillery officers, trained to fly by the RAF. The RAF would be responsible for technical flying matters but

32. Royal Aero Club of UK, *Flight International* (London: IPC Transport Press, 1962), p.154.
33. Gooderson, n.30, pp.59-84.

the army would command the unit in the field.

Later experience proved the need for observers in the rear seats of the aircraft to watch out for enemy fighters. As no official provision had been made for this eventuality, volunteers from the squadrons, army and RAF ground crews carried out this duty when needed. No. 651 Squadron was followed by the formation of 15 more squadrons during the period 1942-45, numbering 652 to 666. Of these, No. 663 was mainly Polish manned, and Nos. 664 to 666 were Canadian. The squadrons flew in every theatre of war and made a significant contribution towards greater efficacy of the use of artillery. Their outstanding attribute was their ability to put a skilled artillery observer into the air at short notice, fully aware of the tactical situation and the needs of the troops on the ground, and able to direct the fire of all guns within range. By the end of the World War II, Air OP pilots had been awarded more than 90 Distinguished Flying Crosses. During the 1940s, the Cierva Company had developed a light, two seater, piston-engine helicopter as an aerial observation platform. However, the Cierva Company merged with Saunders-Roe Ltd and the aircraft became known as the Saunders-Roe Skeeter. The army's attention was attracted to the possibility of the helicopter for AOP duties and on September 1, 1947, Capt P.R.D. Wilson RA made history by conducting the first AOP shoot from an army helicopter. It was a further ten years before the helicopter would enter army service in the observation role. No. 656 Air OP Squadron (RAF) was the first Air OP unit of the British Army to set its feet on the Indian subcontinent in December 1942. The unit was sent to India as part of *specialist units* to assist the operations in the Burma campaign where it provided valuable ground reconnaissance and directed artillery fire in greater numbers; artillery shoots were conducted with much greater effectiveness, which caused heavy casualties to the Japanese.[34] It was here that the squadron adopted the "Chinthe Badge" which shows two crossed

Capt Furdoon S.B. Mehta (who later rose to the rank of brigadier) was the first Indian artillery officer to wear the Air OP Wing.

34. E.W. Maslen Jones, *Fire By Order: Recollection of Service with 656 Air Observation Squadron in Burma* (London, Lee Cooper, 1997), p.86.
35. Mark C.A. Hennniker, *Red Shadow over Malaya* (Blackwood, 1955), p.184.

guns in the background and the side face of the mythical lion, "Chinthe." After successful participation in the Burma campaign, the squadron returned first to Madras and was subsequently assigned for the liberation of Malaya.[35] The initial training for the squadron was done with the "Tigermoth," and later it was equipped with the "Auster."

Capt Furdoon S.B. Mehta (who later rose to the rank of brigadier) was the first Indian artillery officer to wear the Air OP Wing. He trained as a pilot at No. 2 Elementary Flying and Training School (EFTS) at Jodhpur which was established by Lt Gen and Air Vice Marshal Umaid Singh, Maharaja of Jodhpur, who had established an aircraft landing ground in 1924, at Jodhpur Flying Club in 1931 and EFTS in 1941. Brig Mehta (then captain), along with seven others, traced out the squadron in Arakans, because the arrival of the squadron more or less coincided with the Japanese offensive, first in the Arakans and then later on the central front, the main feature of which was the Imphal plains,[36] from where they were told to fall back to Dimapur, the location of the Squadron Headquarters. The course at EFTS of ten weeks terminated on April 15, 1944, but they still had to complete their training in Air OP duties and had to wait till the squadron fell back to Ranchi for rest and refit forced by the monsoons. The Air OP wings were awarded in November 1944, with Brig F.S. Mehta (then captain) assigned 'A' Flight, to the successful five out of the seven who had joined the squadron. This sort of ad hoc arrangement of training in EFTS, Jodhpur, and then at the squadron was not found suitable and, therefore, 1587 Air OP Refresher Flight RAF was raised and attached to the army in Devlali on October 16, 1944, under 227 Group RAF in Lahore[37] which was responsible for all air training, and continued training pilots in Air OP till December 31, 1945. Officers in Britain were training in the No. 43 Operational Training Unit (OTU) at Larkhill, established on October 1, 1942, which kept shifting base close to each other, and had formed a helicopter training flight using Hoverfly 1 till January 1946. No. 656 Squadron had already returned to England by early 1945 after their Malaya tryst, to never again revive their Indian connection thereafter. Capt H.S. Butalia was the first Indian pilot to be trained at No. 43 OTU and graduated on January 15, 1946.[38]

36. Mead, n.31, p.189.
37. Ashley Jackson, *The British Empire and the Second World War* (London: Hambledon Continuum, 2006), p.367.
38. Lt Col S.V. Pandya, *Soldiers in the Sky* (New Delhi: Flight Safety Section, ADG Army Avn, 2006), pp.21-39.

POST-WAR DEVELOPMENT TILL 1971 INDO-PAK CONFLICT

The 61st Course of No. 43 OTU was the last basic course of Indian pilots and, notably, Capt A.B. Awan (later lieutenant general) was Pakistan's first army aviator. By July 1948, the training had shifted to No. 2 EFTS at Jodhpur and the gunnery leg of the Air OP conversion was to be completed at Devlali where the first batch of six Indian artillery officers completed their training in March 1949. While the saga of No. 656 Squadrons association ended, No. 659 Air OP Squadron, raised on April 30, 1942, which had accredited itself as part of 8th Corps in Operation Goodwood during the Normandy tryst,[39] arrived in Bombay (now Mumbai) in October 1945 and moved to Dhubulia, 80 km north of Calcutta (now Kolkata).[40] The flights of this squadron were displaced over the expanse of the country and had the arduous task of assisting the Punjab Boundary Force. Just prior to partition of the country, the disposition of No. 659 Air OP Squadron (RAF) was Squadron Headquarters and 'B' Flight at Lahore, 'A' Flight at Devlali, 'C' Flight at Razmak, 'D' Flight at Jullunder and Rear Maintenance Detachment at Peshawar. With the partition of the country also came division of assets of No. 659 Air OP Squadron (RAF) which virtually ceased to exist at midnight of August 14, 1947. Capt H.S. Butalia, with Capt Govind Singh, Capt R.N. Sen and Capt S. Mansingh, hurriedly flew out the assets of 'B' Flight from Lahore to Amritsar and then on to Jullunder. These assets were to comprise the raising of 1(I) Air OP which actually started functioning on October 6, 1947. Capt R.N. Sen was soon to be posted out for the raising of 2(I) Air OP Flight at Devlali with the assets of 'A' Flight of No. 659 Air OP Squadron (RAF). The Indian No. 659 Air OP Squadron was to be once again raised on June 1, 1958. No.1 (I) Air OP Flight was very much involved in the days of 1948 and historically on February 12, 1948, Maj H.S. Butalia flew Defence Minister Shri Baldev Singh for reconnaissance of the forward area in Jammu and Kashmir.[41] Capt S. Mansingh (later brigadier) and Maj S.W. Shahane (later brigadier) were awarded the Vir Chakra on account of outstanding gallantry for evacuating the body of Brig Mohammad Usman,

39. Perry Moore, *Kursk in Normandy* (Infinity Publishing, 2005), p.69.
40. Pushpinder Singh, *History of Aviation In India* (New Delhi: Society for Aerospace Studies, 2003), p.230.
41. Pandya, n.38, p.54.

In spite of being vulnerable to enemy aircraft and ground fire, the Air OP aircraft flew over enemy concentrations, directing fire of their own guns and more so in the Chhamb-Jaurian sector.

commanding 50 Parachute Brigade, killed by the splinters of an enemy shell,[42] and Air OP shoots after locating enemy guns at Bagsar and Batot. 2 (I) Air OP Flight participated in the "Hyderabad Action" (Operation Polo) after diplomatic parleys had failed with the Nizam of Hyderabad, on September 13, 1948. The flight was able to provide effective communication from an elevated platform to 1 Armoured Division when other means failed and also dropped leaflets on the headquarters of the commander-in-chief of the Hyderabad State Forces and crown prince of Bidar, as also the Nizam of Hyderabad's plenipotentiary.

The raising of additional Air OP units was put on hold till the government sanction for raising was issued in a letter dated October 11, 1956, wherein a Squadron Headquarters (that is, No. 659 Air OP Squadron) and two Flights (Nos. 3 and 4 Air OP Flight) were to be raised, with orders for No. 5 Air OP Flight to be issued at a later date. The squadron and No. 3 Air OP Flight were raised in Devlali while No. 4 Air OP Flight was raised in Adampur. No. 3 Air OP Flight was later moved to Adampur in January 1959 along with Squadron Headquarters placed at Jullunder. No. 4 Air OP Flight was raised in Adampur and later shifted base to Dimapur for operations in the Naga Hills in 1961. No. 3 Air OP Flight also saw action, Operation Vijay, in Goa, in support of 17 Infantry Division being commanded by Maj Gen K.P. Candeth, when it was tasked to engage enemy armour and artillery concentrations, reconnoitre enemy movement and water obstacles as well as casualty evacuation on requirement. The reason for the slow expansion was attributable to the government stance, financial constraints and perception variances, which were all ironed out with the ominous clouds of war. Even after the ceasefire in the Rann of Kutch, No.1 (Independent) Air OP Flight was put in support of 50

42. K.C. Praval, *Valour Triumphs: A History of the Kumaon Regiment* (Faridabad: Thompson Press, 1976), p.202.

(Independent) Parachute Brigade and was instrumental in directing artillery fire on a ammunition dump at Biar Bet, of 71 Medium Regiment on April 30, 1965, during Operation Riddle. Maj S.K. Mathur (later major general), who was commanding the flight, had earlier directed fire on a moving convoy in Kangarkot and was decorated with the Maha Vir Chakra.[43] No. 660 Air OP Squadron had been raised at Adampur on January 1, 1965, followed by No. 5 Air Op Flight on April 1, 1965 at Nasik Road, No. 6 Air Op Flight on July 1, 1965, at Bagdogra [Maj Atma Singh (later major general) was the first flight commander], No. 7 Air Op Flight on September 6, 1965, at Patiala and No. 8 Air Op Flight on September 11, 1965, at Jullunder. This was all in anticipation of the second conflict with Pakistan.

The flights were raised but there was a severe shortage of serviceable aircraft which was eventually tided over with the intervention of Brig Furdoon S.B. Mehta who, with the generosity of Air Marshal (Retd) Harjinder Singh, in his capacity as the aeronautical adviser to the Government of Punjab, was able to get the Pushpak aircraft of the Flying Clubs of Punjab, though further work had to be done to get this through and out of the doors of the ministry, Service Headquarters and Directorate General of Civil Aviation.

The war broke out on September 1, 1965, and each division in the plains could manage a flight affiliated to it. Army pilots on regimental duties were recalled to make up a perennial shortage. In spite of being vulnerable to enemy aircraft and ground fire, the Air OP aircraft flew over enemy concentrations, directing fire of their own guns and more so in the Chhamb-Jaurian sector. They not only directed artillery fire on Pakistani tanks but at times also gave early warning of approaching enemy planes.[44] For their valiant actions in the face of the enemy during the 1965 Indo-Pak conflict, Air OP pilots were awarded three Vir Chakras and four Sena Medals. After the end of the conflict and return of Pushpak aircraft to the Flying Clubs, Hindustan Aeronautics Limited (HAL), designed and developed the HAOP 27 Krishak, which was inducted after user trials. No. 5 Air OP Flight received the first of these aircraft in November 1965, followed by No.

43. Pandya, p.63.
44. Sitaram Johri, *The Indo-Pak Conflict of 1965* (Nagpur: Himalaya Publications, 1967), pp.203-204.

6 Air Op Flight. The period 1966-68 was one of debate and deliberations for expansion of the Air OPs and induction helicopters. Ten years would see the induction of 15 flights, with five between 1969-71, as also the decision to equip Alouette II (Chetaks in India) for the plains and SA 315B Lama (Cheetahs in India) for the mountains. No. 661 Air Op Squadron was raised at Nasik Road on January 26, 1967, followed by Nos. 10 and 11 Air Op Flight in March 1969 at Bagdogra. Nos. 12 and 14 Air Op Flights were raised in Nasik Road and Patiala in August 11 and December 31, 1970 respectively, followed by No. 15 Air Op Flight in June 1971. The training of additional pilots for these five flights was conducted at No. 660 Air Op Squadron at Patiala with the aid of Air OP instructors and civil flying instructors and aircraft of various Flying Clubs in Punjab, notably the Patiala Flying Club. Gen P.P. Kumaramangalam, DSO and Chief of Army Staff at that time, pinned the Air OP wings on 27 successful pilots on April 10, 1967.

Nos. 10 and 11 Air Op Flights were the first to be allotted Chetaks, and by the time the 1971 War was declared, only three flights had helicopters, namely, Nos. 10, 11 and 15 Air Op Flights while the rest had Krishaks and supplemented once again by Pushpaks of the Flying Clubs. The tenure of pilots for flying duties at this time was made six years, keeping in mind the time and flying effort required to operationalise helicopter pilots in Air OP duties. The allocation of flights in the Western Sector and a brief description of achievements by the flights action performed by the aviators are given in Table 1.

Table 1				
Ser. No.	**Unit**	**Location**	**Formation**	**Action**
(a)	HQ 660 Air OP Squadron	Madhopura	1 Corps	Air cover for offensive action in Shakargarh Bulge along with Nos. 1 & 9 Air Op Flights.
(b)	1 Air OP Flight	Madhopura	39 & 54 Infantry Divisions	(i) Enemy tanks damaged on December 6, 1971, in Thakurdwar. (ii) Enemy tank concentration engaged on December 9, 1971, at Lagwal and Lohara.
(c)	2 Air OP Flight	Udhampur	26 Infantry Division	(i)Three direct hits on enemy tanks along Munnawar Tawi. (ii) On December 9, Marala Headworks struck thrice with Air OP control of guns. (iii) Extensive damage to amour concentration with Air OP directed artillery fire.
(d)	3 Air OP Flight*	Rajasansi	15 Infantry Division	Custody of Squadron Leader Amjad Hussain Pakistan Air Force (PAF) after he ejected from his fighter plane.
(e)	5 Air OP Flight	Barmer	11 Infantry Division	Effective Air OP shoots on December 8, during the advance on Naya Chor due to limited observation of ground observers.
(f)	7 Air OP Flight	Faridkot	1 Armoured Division	Enemy tank and reinforcement movement.
(g)	8 Air OP Flight* (2 Sections)		HQ Foxtrot Group	Three enemy gun positions neutralised on December 8, 1971.
(h)	8 Air OP Flight*	Faridkot	11 Corps	Air reconnaissance and enemy reserve movement.
(j)	9 Air OP Flight	Madhopura	36 Infantry Division	As part of Shakargarh offensive.
(k)	12 Air OP Flight	Jaisalmer	12 Infantry Division	(i) Directing of Hunter aircrafts to enemy tanks in contact and advance reinforcing attack on Longewala Post on Dec 5, 1971. (ii) Message dropping right over the post during the battle. (iii) Directing of Hunter aircraft, artillery fire on enemy tanks, troops and guns on December 7, 1971.

In the Eastern Theatre, No. 659 Air OP Squadron, located at Bagdogra, provided Air OP cover. The squadron consisted of Nos. 4 and 6 Air OP Flights equipped with Krishak aircraft, and Nos. 10, 11, and 15 Air OP Flights equipped with Chetak helicopters, and disposition was as given in Table 2.

Table 2

Ser No	Unit	Location	Formation	Action
(a)	4 Air OP Flight (Less 2 Sections)	Krishnanagar & Barrackpore	2 Corps	
(b)	Air OP Flight	Bagdogra	33 Corps	Casualty evacuation and enemy engagement during Battle of Bogra.
(c)	6 Air OP Flight	Karimganj	4 Corps, 8 & 57 Mountain Divisions	Preliminary operations, air shoots and aerial photography.
(d)	10 Air OP Flight	Barrackpore	2 Corps	Aerial Command Post, reconnaissance and air photo
(e)	11 Air OP Flight	Agartala	4 Corps, 23 & 57 Mountain Division	(i) Detection of enemy movement towards Belonia. (ii) Damage to enemy guns with artillery fire at Pirbakshat. (iii) Artillery shelling on enemy at Kodda. (iv)Engaging enemy convoy on December 7, 1971. (v) Guiding assault troops in Mi-4 helicopters to the landing spot for assault across Meghna river by 57 Mountain Division. (vi) Leaflet dropping for propaganda.
(f)	15 Air OP Flight	Bagdogra	33 Corps, 6 & 20 Mountain Divisions.	(i) Air shoots, enemy movement detection and aerial photography in the capture of Bhurangamari. (ii) Silencing of enemy guns in the capture of Amarkhana. (iii) Photography and continuous reporting in the daylight capture of Khansama as also directing own aircraft on advancing counter-attack column with tanks.

Very accurate predicted artillery fire by night and observed fire by Air OP by day demoralised the dwindling Pakistani garrison.[45] For their valiant efforts, the Air OP pilots earned their share of honour, being awarded one Maha Vir Chakra, nine Vir Chakras, five Sena Medals, four Vayu Medals and one Mention-in-Despatches for their valiant actions beyond the call of duty in the 1971 Indo-Pak conflict. The experiences learned from the above conflicts that can be pushed forward have been the need for availability of equipment to conserve efforts of both man and machine for the actual offensive effort of fighting; communication between fighting and support elements in the battle zone to be a thrust area wherein in one instance, Capt (later lieutenant general) Narayan Chatterjee had to take an Air OP shoot from 39 Field Regiment guns by physically landing at the gun area for radio frequency handing/taking over. He was to take the shoot with the guns of 176 Field Regiment when radio communication could not be established.

The dedicated attack helicopter purports to counter the armour imbalance and, therefore, India's compulsion is not similar to that of Pakistan when we view the qualitative and quantitative aspects.

PRESENT DAY ARMY AVIATION IN INDIA

The Army Aviation Corps as we see it today was formally established on November 1, 1986. The proposal indicating a requirement for an integral army aviation was mooted by Gen J.N. Chaudhry in February 1963 when the J.R.D. Tata Committee deliberated on the expansion and rationalisation of the air arm of India. The case was submitted to the government in April 1968, with the underlying concept of induction of helicopters, including attack helicopters, with large scale mechanisation, combining various arms, including armour, mechanised infantry, self-propelled artillery, all requiring integrated command for meshing elements into a cohesive fighting force. A memorandum of July 16, 1986,[46] directed that the 31 Air OP Flights be transferred to the army by October

45. Lachman Singh, *Victory in Bangladesh* (Dehradun: Natraj Publishers, 1991), p.106.
46. Government of India, Ministry of Defence Memorandum No 69(6)/86/D(AirI)1808/DIA(AirI) dated July 16, 1986.

31, 1986, though the attack, medium and heavy lift helicopters were to remain assets of the air force, along with certain instructions not being elaborated here. The dedicated attack helicopter purports to counter the armour imbalance and, therefore, India's compulsion is not similar to that of Pakistan when we view the qualitative and quantitative aspects.

An Army Aviation Cell was created at Army Headquarters under Brig (later major general) Atma Singh who later became the first additional director general of Army Aviation. This nucleus was initially placed under the Director General Mechanised Forces. The air force continued providing logistic and maintenance support till October 31, 1989, for the 45 Chetak and 95 Cheetah helicopters. Regular expansion had been undertaken since the 1971 Indo-Pak conflict; even with the imposition of financial constraints and aviation development propositions by the government, 23 flights and 11 Squadron Headquarters have been established post 1971. In the meantime, the Indian Army became committed in Operation Meghdoot in the highest battlefield in the world—the Siachen Glacier. The requirement of man and machine to operate in the rarified temperatures is phenomenal and this has been a continuous effort on the part of army aviation since April 1984. No other helicopter, till the date of induction and some several years after, except the Cheetah, has been able to make a landing at the highest of helipads at altitudes in the range of 24,000 feet. The air at Siachen's altitude is half as dense as at sea level, which means helicopters are able to lift only a quarter of their load or even less.[47] A helicopter can carry only one soldier or a few boxes of ammunition or supply, and more so if it has to land.

The Indian Peace-Keeping Force (IPKF) had been inducted into Sri Lanka at the request of the Sri Lankan government in terms of the Agreement of July 29, 1987.[48] By this time, the first All Arms Course, comprising officers of the armoured corps, infantry and mechanised infantry who joined the artillery officers to be trained at Air Force Academy at Dundigal in June 1987, had earned

47. Eric S. Margolis, *War at the Top of the World: The Struggle for Afghanistan, Kashmir and Tibet* (London: Routledge, 2002), p.189.
48. H.P. Chattopdhyay, *Ethnic Unrest in Modern Sri Lanka: An Account of Tamil-Sinhalese Race Relations* (New Delhi: 1994), p.135.

their wings in November 1988. Select officers, after having qualified in the mandatory tests, would be trained by the air force, including the conversion to the rotary wing, and the final leg in gunnery and other tasks related with flying would be completed at Nasik Road under the squadron located there. The Combat Army Aviation Training School became operational at Nasik Road in September 2003. Aviation support during Operation Pawan was invaluable. Helicopters were christened "Ranjit" after being fitted with two medium machine guns fitted on either side. Directing artillery fire, evacuation of casualties, battle reconnaissance and surveillance were routine. The army aviation units in support of the IPKF were as under:

(a) HQ 664 Air OP Sqn - Trincomalee
(b) 10 Air OP Flt - 54 Infantry Division, Jaffna Peninsula
(c) 26 Air OP Flt - 36 Infantry and 57 Mountain Divisions Trincomalee
(d) 31 Air OP Flt - 4 Infantry Division, Vavunia

The last elements of army aviation returned to India in March 1990 by which time, trouble was brewing in Jammu and Kashmir. The nomenclature air observation post (AOP) was changed to reconnaissance and observation (R&O) with the formation of this separate corps. Notable contributions have since been made by the army aviators since May 1990 (Operation Rakshak) in insurgency ridden Jammu and Kashmir, in reconnaissance, casualty evacuation and air observation shoots. Operation Vijay involved tremendous helicopter effort to provide support in terms of ammunition supply and casualty evacuation. Two Vir Chakras, one Yudh Seva Medal and seven Sena Medals were awarded to this corps to commend their contribution in the three-month conflict with Pakistan. Not only has the battlefield seen active participation and contribution of this corps but active involvement in United Nation missions and natural disaster management as well as in aid to the civil authorities. Notable among these are the rescue of civilians on a Manasarovar trek at Malpa village (in Uttarakhand) when tragedy struck in August 1998, by way of a landslide, the Orissa cyclone in October 1999 and the Gujarat earthquake in January 2001.

Army aviation in India has been emblematic of significant contributions in terms of professional achievements and this would support a justification to sustain a capability-based organisation.

The acquisition programme for helicopters for army aviation is now a matter of much debate and choice. India emerges as a need–based country and, therefore, needs a balance in managing inter-relations, with not only neighbouring countries, but also its own standing as a military-politico-economic force to be reckoned with. India had announced a preferred purchase of 197 helicopters at an approximate cost of US $ 550 million dollars,[49] to replace the Cheetah and Chetak fleet of the 1970s vintage. Unfortunately, the arrangements with Eurocopter of France could not see the light of day on account of procedural requirement shortcomings, and the end was sounded on December 6, 2007. The indigenous helicopter programme of developing the advanced light helicopters (ALH) named *Dhruv* (Pole Star) had met with considerable success with a demand for 120 helicopters.[50] The Combat Army Aviators Training School has been functioning in Nasik Road since September 1, 2003, to train army aviators. As a paradigm shift to the training module, *ab-inito* training of aviators and instructors commenced at No. 664 Aviation Squadron (reconnaissance and observation) as rechristened, and the Rotary Wing Association at Bangalore, which was later discontinued.

THE FLIGHT AHEAD

The time had already come a decade ago when the ageing fleet of Cheetah and Chetak helicopters of nearly 40 years needed to be retired; however, a worthy heir to the Cheetah helicopter is still in waiting. The detailed process, commencing with paper evaluation and followed by winter and summer trials at present, has spread over a two-year period. Keeping in mind the time lost and urgency required in view of delivery schedules, with inherent delay factors, it is

49. Gulshan Luthra, "India Prefers it to Bell 407," *India Strategic* (New Delhi), April 2007, accessed online at http://www.indiastrategic.in/topstories03.htm on November 10, 2007.
50. http://www.army-technology.com accessed on November 12, 2007.

certainly time to step up efforts, since all the aircraft are not be procured in "fly-away" condition, and a significant number is expected to be built indigenously under a transfer of technology agreement at HAL. Significantly, a requirement of 115 helicopters by the air force to the 197 aircrafts that the army requires, pushes the value of the deal to $ one billion and the number of aircraft to 312. It is interesting to note that there will be an addition of two squadrons of attack gunships and six heavy-lift helicopters to complement the expansion and modernisation efforts, thereby, nudging the combined worth to $ 1.4 billion.[51] Army aviation in India has been emblematic of significant contributions in terms of professional achievements and this would support a justification to sustain a capability-based organisation rather than an equipment and inventory-based structure, implying commensurate induction of man, machine and infrastructure requirement, though not mentioned here in order of priority. Optimum asset utilisation and air space governance will require significant application and forethought. Application of aviation resources to disaster management has attained significance in the context of the requirement for growing economic and support stability operations and this would certainly require a doctrinal overview for optimum resource utilisation as compared to insulated application for combat scenarios only.

While the impressive modernisation and replacement programme arouses enthusiasm, a more than soft look may be required at the indigenous development efforts. It has been remarked that the performance of the advanced light helicopter *(Dhruv)* has been satisfactory and a concerted effort has been made to improve the serviceability state.[52] Certainly, early in the stage of a successful launch, its high terrain capability was questioned by Chile, and it also got into troubled waters regarding its maritime role due to "payload and endurance limitations."[53] The question is not in the efforts and credibility but the time penalty in terms of immediate upgrades at the doorstep of induction.

We also see completion of the design for the light combat helicopter (LCH)

51. http://afp.google.com/article/ALeqM5hTRelb3AUXlsZZACuvo66AdUivcQ accessed on February 7, 2008.
52. http://live.defenseworld.net/go/detailinterview.jsp?id=17, accessed on Februaru 8, 2008.
53. http://in.news.yahoo.com/indianexpress/20080209/r_t_ie_nl_politics/tnl-navy-rejects-hal-s-light-helicopters-0058794.html, accessed on February 12, 2008.

In the permanent cadre, the manning level in the flight is still a matter of constant concern on account of an even-paced flying and administrative commitment.

and it will be ready for the first test flight by the end of the year, which translates into another prototype in the inventory.[54] The questions hover around the requirement for it, inventory control becoming varied over a period of time, and a scheduled successful induction programme at the desired scale.

Intake and retention of army aviators has been a potential subject for animated debate. The average period of employment of an artillery officer on aviation duties was six years in the formative years, which has since increased to approximately eleven years for those in the support cadre. While in the permanent cadre, with induction, retention and recall rate of the support cadre caters to the minimum sustainable requirements of the aircrew, the manning level in the flight is still a matter of constant concern on account of an even-paced flying and administrative commitment on the part of those who constitute this corps. This may certainly require a policy analysis, considering that the equipment strength and base is increasing with the announcement of the induction of the light utility tactical battle support helicopters (TBSH), armed and attack helicopters (AH) in a phased manner during the current Plan period and extending up to 12th and 13th Plans.[55]

Along with the induction of equipment, a recount of the infrastructural facility, existing and proposed, to obviate adhoc storage arrangements, will certainly need advance thinking in terms of planning, capital outlay and time-bound completion. In the process of transition, what lies ahead is employability, not only in the battlefront but a milieu of multifarious tasking in all domains for potential realisation and tangible unrestricted contribution so that the power and capability within is gainfully exploited.

54. http://economictimes.indiatimes.com/News_by_Industry/HAL_to_test_flight_Light_Combat_Helicopter_0902.cms accessed on February 12, 2008.
55. http://live.defenseworld.net:9080/go/detailinterview.jsp?id=17, accessed on February 4, 2008.

CONCLUSION

Assessing the impact of army aviation is more complex than it might first appear. The requirement of an observation platform offering a useful perspective of the battlefield treaded into the realm of the need to direct artillery fire. The Nazi tanks racing across the Polish frontiers maintained supremacy which brought in helicopter gunships as significant counter-weapons. The embryonic nature of aerial warfare paved the way for specialisation and a kind of self-replicating motion gravitated towards the manifestation of air power in future wars. Army aviation in India stands at the juncture of physical and technological expansion, leaving behind a past that has witnessed various debates connecting its requirement and efficacy in the present and expanded forms. Since its evolution, teamwork has been one of the greatest trials, which paves the way for individual sustenance through collective functioning. The requirement to traverse large distances in mountainous terrain in the shortest possible time, in order to either save a life or transfer troops, remains as essential even today. The organic requirement of an integrated air element has held ground, based on the experiences both own and those of other countries, but what we see in totality will be the requirement of judicious admixes of organisational strength, based on geographical, military-socio-economic factors, and time relevant advancement.

The embryonic nature of aerial warfare paved the way for specialisation and a kind of self-replicating motion gravitated towards the manifestation of air power in future wars.

DRAGON IN SPACE: IMPLICATIONS FOR INDIA

KAZA LALITENDRA

If one side reinforces a shield, the other will reinforce its spear. It is all too easy to start a competition.

—Xu Guangyu, Director of China Arms Control and Disarmament Association

The beginning of the 21st century has been extremely eventful for China as regards its successes in the realm of space. As part of its policy of peaceful rise, China has made resolute investments in space technologies over the past five decades and is reaping the benefits of the same. The successful culmination of the first phase of its manned and moon missions have enhanced its return to greatness. Though the successful anti-satellite (ASAT) test on January 11, 2007, invited much international criticism on China's claims of using outer space for peaceful purposes, it also demonstrated China's counter-space capability, evoking concerns about space security. In 2007, China conducted its 100th space launch with a Long March rocket, commenced operations of the Beidou satellite navigation and positioning system and launched its Chang'e lunar orbiter. Further, the launch of the Tain Lian-1 (a tracking and data relay satellite) on April 25, 2008, on board its new Long March 3-C carrier rocket has catapulted China into a select league of nations having this niche capability of establishing inter-satellite communication links. China is making a concerted effort in its force modernisation drive to ensure seamless integration of its space capabilities into the war-fighting doctrines of its

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China is making a concerted effort in its force modernisation drive to ensure seamless integration of its space capabilities into the war-fighting doctrines of its land, naval and air forces.

land, naval and air forces. The revolution in military affairs (RMA) brought about by the Gulf War and its aftermath has been imbibed by China and enabled it to transform the People's Liberation Army (PLA) from one fighting a "people's war" to one that is capable of fighting "local wars under conditions of informationalisation."

Many attribute China's near-term focus on preparing for contingencies in the Taiwan Strait, including the possibility of US intervention, as an important driver of its modernisation efforts. However, analysis of China's military acquisitions and strategic thinking suggests Beijing is also developing capabilities for use in other contingencies, such as conflict over critical energy resources or disputed territories. The US advances on ballistic missile defence (BMD) and the successful interception of the US-193 by a modified SM-3 missile fired from an Aegis destroyer on February 20, 2008, is viewed by China as erosion of its nuclear deterrent capability against the US. Hence, China considers its space programme as the capability which will allow it to counter the US designs in the ultimate high ground. Apart from the US, China has catered India in its overall security calculus at the regional level and the fact is evident from the recent commercial satellite imagery revealing extensive missile sites in central China, with nearly 60 launch pads for medium-range missiles capable of striking Russia or India. The detection of a nuclear submarine base in Sanya, Hainan Island, in China, also points to the growing regional role China sees for itself in the near future. In the light of this, the aim of this paper is to study the military space and counter-space capabilities of China and its evolving space doctrine and their implications for India.

HISTORICAL PERSPECTIVE

The Chinese tryst with space began in 1956 as an offshoot of China's missile technology development efforts and was soon considered a national priority

alongside the country's missile and nuclear programmes, together referred to under the rubric *liang dan, yi xing*"– two bombs (atom bomb, hydrogen bomb), one star" (i.e. satellite)[1]. An integral part of the programme was the development of aviation and rocket technology for the construction of the nuclear warhead delivery systems. As a result, China established the Fifth Academy of the Ministry of National Defence. The launch of Sputnik-1 on October 4, 1957, by the Soviet Union encouraged the Chinese to develop a satellite.

The US and USSR both helped China in furthering its rocket and space programme – the first by default and the second by design. Tsien Hsue Shen[2] who is credited with being the father of China's space and missile programme was deported to China post-Korean War as a result of the sweeping McCarthyism in the US. Tsien Hsue Shen was made the director of the First Rocket Research Institute. Meanwhile, the USSR supplied the resources (R-2 missile models, technical documents designs and technical expertise) which were deftly managed by Tsien Hsue Shen, enabling China to pursue its rocket and satellite programme in parallel. Thus, Project 1059 (October 1959) was initiated for rocket development and Project 581 (first project/first month of 1958) for development of an earth satellite. However, a resource crunch and the ensuing political upheavals forced China to shelve the satellite project a year later. The prevailing military considerations[3] forced China to press on with its rocket development programme, culminating in the successful launch of it's first rocket, a Chinese R-2, on November 5, 1960. It was named the Dong Feng-1 (East Wind).

The US and USSR both helped China in furthering its rocket and space programme – the first by default and the second by design.

1. Jeff Kueter "China's Space Ambitions and Ours," *Atlantis Journal*, Spring 2007, http://www.thenewatlantis.com/publications/chinas-space-ambitions-and-ours
2. Tsein Hsue-Shen was a Chinese born American educated scientist. He founded the Jet Propulsion Laboratory in California and was a member of the team of scientists that entered Germany just behind the American lines under Operation "Paper Clip" which brought truckloads of V-2 rockets and their chief designer Wernher Von Braun to the US. The anti-Communist backlash in the US during the McCarthy era led to the arrest of Tsein Hsue-Shen in 1950 and his subsequent deportation to China in 1955.
3. The revelation of the US intentions to use nuclear weapons against China during the Korean War and the subsequent Taiwan Strait crisis meant China was desperate to have a means of delivery system for a nuclear weapon(a bomb which it was trying to procure secretively from the USSR). The Soviets' refusal to part with the bomb resulted in the Sino-Soviet split in 1960.

The decade of the 1960s witnessed China pursuing its missile programme in right earnest, culminating in a series of long range missiles like the Dong Feng-1 (DF-1), DF-2 and DF-3, and the nuclear capable DF-4 and DF-5. The resulting iteration of the medium range DF-4 missile was adapted into China's first satellite launch vehicle (SLV) – the Chang Zheng-1 (CZ-1) or Long March-1. Similarly, the DF-5 intercontinental ballistic missile (ICBM) became the LM-2. By the late Sixties, efforts had been put in for a national space tracking and control system as well as a manned space programme. The satellite programme also picked up pace in the mid- Sixties and China's launched its first satellite, the Dong Fang Hong[4] (DFH), on April 24, 1970, becoming the fifth nation to do so.

The decade of the 1970s witnessed China producing the Feng Bao-1 SLV, a derivative of CZ-2 and it was used to orbit the Ji Shu Shiyan Weixing (JSSW) electronic intelligence (ELINT) satellite series under Project 701[5]. The CZ-2 was also used for launches of the Fanhui Shi Weixing (FSW) photo reconnaissance satellite, with a recoverable reentry capsule, beginning in 1974. From the mid-1980s, China's space programme became increasingly dual natured with China concentrating on both military and civil space programmes with renewed vigour with a sense of restoring "techno-nationalistic pride" to its space programme. China launched 27 foreign-made and 47 indigenous satellites[6] between1985-2000. Altogether, four satellite series were developed in China, namely:

- The Fanhui Shei Weixing (FSW), recoverable test satellites.
- The Dongfanghong (DFH) telecommunications satellites.
- Fengyun (FY) meteorological satellites.
- Shijian (SJ) scientific research and technological experiment satellites.

However, the new millennium witnessed China's foray into dedicated military communication, reconnaissance and navigation satellites, along with the manned and moon missions. China's current space capabilities are examined in detail to provide the linkage between China's capabilities and its doctrinal percepts of space.

4. hhtp://www.astronautix.com/articles/china.htm
5. Brian Harvey, *China's Space Program: From Conception to Manned Space Flight* (UK: Praxis Publishing), ch. 4, p. 70.
6. White Paper on China's Space Activities, released in 2000 at http://www.china.org.cn/e-white/8/index.htm

CURRENT SPACE CAPABILITIES OF CHINA

Launcher Capability

China's satellite launch vehicle capability is an offshoot of its ballistic missile programme and features the Long March or the Chang Zheng (CZ) series of rockets. Barring an occasional failure in 1996 to launch the US Intel Sat, the Long March series has undertaken 67 successful orbital insertions since then, making a total of 107 successful launches, with the launch success rate being 93.5 per cent, at par with international standards. According to relevant statistics[7], the success rate of America's Delta carrier rockets is 94 per cent, of the European Ariane carrier rockets 93 per cent and of the Russian Proton carrier rockets, it is 90 per cent. The success rate of India's PSLV, with 11 out of 13 successful launches, is 84.6 per cent. Though China leads Asia in the number of launches a year, it is still behind the US and Russia, while closing in on the gap with the European Union, as can be seen from the data available over the last decade. The launch rates, however, do not reflect the number of satellites launched by these countries.

China stands to gain more commercially by providing a sound launch and satellite market for the increasing number of aspiring space- faring nations.

Table 1: China Launch Progress

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008*
USA	37	34	27	28	21	17	27	17	16	22	16	06
Russia	26	24	26	20	25	25	24	15	15	23	25	12
EU	13	11	10	12	08	10	04	03	05	05	06	04
China	06	06	04	06	02	08	09	10	06	07	10	03
India	01	0	01	0	02	01	02	01	02	01	03	02

** Launch figures as of June 30, 2008.*

It is evident that China stands to gain more commercially by providing a sound launch and satellite market for the increasing number of aspiring space-

7. Wang Qian, "Long-March Rocket Technology Meets International Standards," May 3, 2003, at www.china.org.cn

faring nations that do not have launch facilities[8]. Developed indigenously by the China Academy of Launch Vehicle Technology (CALT), the "Long March" carrier rockets fall into four series, with 11 working models.

The available launchers with their payload and launch success rates are as tabulated below (Table 1).

Table2: Prevailing Chinese Launch Vehicle Capabilities

Launch Vehicle	Payload (kg)			Launch Site			Reliability in %	Remarks
	LEO	Polar	GTO	Jiquan	Xichang	Taiyun		
LM-1D	900	300		✔			100	
LM-2C	2,000	700		✔			100	
LM-2D	300		1,250	✔			100	Used for FSW spacecraft
LM-2E	8,800		3,375		✔		71	
LM-2F	800		3,375	✔			100	Used for ShenZhou
LM-3	5,500		1,400		✔		77	
LM-3A	7,200		2,500		✔		100	
LM-3B	13,500		4,000		✔		86	
LM-3C			3,700				100	Maiden launch on May 25, 2008
LM-4A		2,200				✔	100	Built by SAST used for FY Series
LM-4B		2,500					100	Built by SAST

8. China announced agreements in 2004 and 2005 to export its first satellites. A contract was signed in December 2004 between the Nigerian government and the China Great Wall Corporation for China to build and launch the satellite, provide operating services, and train Nigerian technicians in its operation. The Nigerian communication satellite is based on the Dongfanghong-4 communication satellite and was launched on May 14, 2007. China also signed a similar agreement with Venezuela for a telecommunication satellite to be launched in 2008.

Next Generation Launchers

China's next generation of launch vehicles to support its manned and lunar exploration programmes are expected to offer increased reliability and adaptability and will be powered by more pollution free engines that will provide more thrust than the current generation of launch vehicles. These launchers will be able to lift a 1.5 to 25 ton[9] payload into low earth orbit (LEO) and a 1.5 to 14 ton payload into geosynchronous earth orbit (GEO). The first launch of the new rocket, the LM-5, is expected to take place in 2014.

Launch on Demand Capability

China is also pursuing efforts towards launch on demand capability by development of a smaller solid fuel road mobile rocket series, called the Pioneer (*kaituozhe*/KT), The KT-1 is a four-stage booster based on the military DF-21(used to launch the ASAT) and is designed to launch satellites weighing less than 100 kg into 300 km polar orbit while the KT-2[10], is based on the DF-31 ICBM capable of lifting up to three 100 kg or one 400 kg payload. After an unsuccessful first test in September 2002, KT-1 was successfully launched in September 2003. In addition, efforts are on since 2000 to develop an air launched variant of the KT-1. To be carried by a modified H-6 bomber, the KT-1 would be released at an altitude of 3 km to place a 50 kg payload into LEO.

Launch Centres

China has three modern[11] (but land-locked, thus, azimuth-restricted) launch facilities: at Jiuquan for LEO missions, Taiyuan for sun-synchronous missions and polar orbits missions, and Xichang for geostationary missions. A fourth one is under construction at Wenchang in the southern island province of Hainan[12] and is likely to be operationalised by 2013. China is constructing all its new generation launch vehicles at a new base located at the Binhai New Area in the

9. "China: Launch Capabilities," accessed at http://cns.miis.edu/research/space/china/launch.htm
10. "China Missiles and Launch Vehicles," at http://www.sinodefence.com/strategic/launchvehicle/kt1.asp
11. Dr Jesco Von Puttkamer "Asian Space Activities. Space Flight 2003,",http://spaceoperations.nasa.gov/2003/yearinrev/03asia.html
12. "Hainan to Build a Space Harbor in 2010," *Hainan Economic Daily* (Hainan Jingji Bao), October 12, 2005.

While China has an enviable record for flawless launches over the years, it remains to be seen whether it can replicate its success with its mobile and air launched variant.

northern port city of Tianjin[13] which will enable it to move the rockets by sea to its launch centre using a sea barge, overcoming the constraints of land mobility in difficult mountainous terrain. Like the Indian launch site at Sriharikota, the southern launch site would provide an additional eastward 'push' to enhance the payload performance of a rocket launched into orbit. The island site would also provide a variety of launch paths that would not overfly populated areas.

While China has an enviable record for flawless launches over the years, it remains to be seen whether it can replicate its success with its mobile and air launched variant in the years to come as the changing spectrum of warfare will place on China the demands of a more disguised, rapid and flexible response to launch micro satellites to ensure a redundant surveillance and warning capability for its nuclear and conventional forces.

SATELLITES

Earth Observation

China's attempts at earth observation prior to the new millennium were very limited and primitive compared other space-faring nations but they focussed on both military reconnaissance and earth resources and disaster monitoring. The People's Republic of China (PRC) today operates a constellation of nine satellites with various designations like FSW, Jiang Bing/Ziyuan, CBERS/ZiYuan, Haiyang and Yaogan/ Jiang Bing to confuse even the best informed in the field. Of these, the FSW, ZiYuan and Yaogan are for military use and are discussed below.

FSW. The FSW programme began in 1966. The first successful FSW mission (JianBing-1-01) was carried out in November 1975, with the satellite recovered two days after the launch. So far, five models have been introduced, with a

13. "China Developing New Heavy-duty Carrier Rockets," October 31, 2007, http://news.xinhuanet.com/english/2007-10/31/content_6984931.htm

cumulative launch of 22 satellites[14] – from 1975 to 2005. Of these, the later versions like the FSW-3 and FSW-4 are "high-precision photographic mapping satellites," equipped with a film camera with a higher resolution (10~15m), and a charge coupled device (CCD) camera with a lower resolution (~50m).[15] The films are developed on the ground after retrieval from the landed reentry capsule. However, the CCD camera can transmit its images to the ground in a near-real-time manner. This combination enables the satellite to use the lower-resolution CCD camera for wide-range scanning, and then use the higher-resolution film camera to only capture areas of interest, thus, avoiding the waste of film as a result of bad weather.

JiangBing-3/ZY-2. The ZY-2 is China's first high-resolution CCD military reconnaissance satellite. Despite being reported by the Chinese official media as the ZiYuan-2 (Resource) remote sensing satellite designed for civilian roles such as territorial and resources surveying, the satellite is, in fact, operated by the PLA for military imagery reconnaissance purpose. Equipped with CCD cameras and an infrared multi-spectral scanner, the ZY-2/JB-3 satellite[16] is capable of generating high-quality (<2m resolution) satellite images and transferring them to the ground in near real-time. A total of three satellites was launched till 2004. The sun-synchronous ZY-2 is China's largest and heaviest indigenous satellite, and its 3-axis stabilisation technology is the most advanced in China.

YaoGan WeiXing/Jiang Bing-5 Synthetic Aperture Radar. The remote sensing satellite launched on April 27, 2006, is believed to be China's first launch of a satellite carrying a space-based synthetic aperture radar (SAR)[17]. For over a decade, China had been planning to put a high-resolution SAR satellite in orbit for all-weather targeting applications, particularly the location of naval forces in the Taiwan Strait. China has also taken interest in the potential civil applications of such a system in the aftermath of the flooding, landslides, and typhoon damage in 1994. While China has used optical and infrared imaging space-based civil remote-sensing systems, there is particular

14. Analysis of data compiled by Wikipedia on Chinese launch records.
15. "Recoverable Satellite Program," at http://www.sinodefence.com/strategic/spacecraft/fsw3.asp
16. "Jiang Bing Reconnaissance Program," at http://www.sinodefence.com
17. Joan Johnson- Freese, "China's Space Ambitions", *IFRI Security Studies Centre*, Summer 2007.

The PLA views SAR satellite imagery as vital in its ability to achieve information dominance in future warfare.

interest in active microwave imagery that can penetrate southern China's constant cloud cover. It is believed that China's space-based SAR system development has benefited from its cooperation with Russia and Europe in this field, while Canada helped it to upgrade its existing image processing facilities for SAR image processing in 1993[18]. China launched a second SAR satellite named JB-5-2/YGW-3 on November 12, 2007, while the missing number in the series, the YGW-2, was launched in May 2007 and is purported to be the electro-optical component of the JB-5 series.

The PLA views SAR satellite imagery as vital in its ability to achieve information dominance in future warfare. Unlike the conventional passive optical imagery satellites, the space-based SAR system can see through clouds, rain, fog and dust in order to detect targets on the ground or underground, and at or under water. In addition, SAR satellites are extremely useful in tracking moving targets, and can be useful in satisfying military mapping requirements. Chinese engineers have been examining SAR satellites as a means to track enemy submarines in shallow waters.

In addition, China also operates three dual purpose China Brazil Earth Resource Monitoring Satellites (CBERS), with two more planned to be developed in the near future. These provide 20 metre resolution with a CCD camera. China is planning eleven satellites in the Huanjing microsatellite programme[19], capable of visible, infrared, multi-spectral, and synthetic aperture radar imaging. In the next decade, Beijing will most likely field radar, ocean surveillance, and high-resolution photoreconnaissance satellites. In the interim, China will probably rely on commercial satellite imagery to supplement existing coverage. The in-orbit details of China's information, surveillance, reconnaissance (ISR) satellites are as given below.

18. n. 6.
19. As quoted by the Ministry of Science and Technology, *Newsletter No. 339*, August 10, 2003.

Table 3: China's Earth Observation Constellation

Satellite	Launch date	Launch centre	Launch vehicle	Orbit	Perigee in km	Apogee in km	Period in min	Remarks
Military Reconnaissance								
JB-3-01	Sep 01, 2000	Taiyuan	LM-4B	SSO	484.4	487.6	94.2	ZY-1
JB-3 -02	Oct 27, 2002	-do-	LM-4B	-do-	493.9	505.3	94.5	ZY-2, officially for disaster monitoring
JB-3-03	Nov 06, 2004	-do-	LM-4B	-do-	505.6	513.8	94.7	ZY-2A, for digital imaging
Dual Use								
CBERS-1	Oct 14, 1999	-do-	LM-4B	-do-	779.8	788.4	98.2	Not in use
CBERS-2A	Oct 21, 2003	-do-	LM-4B	-do-	779.5	782.7	100.3	Also known as ZY-2 to confuse with its military counterpart
CBERS-2b	Sep 19, 2007	-do-	LM-4B	-do-	779.7	781.8	100.3	-do-
Ocean Monitoring								
HaiYang-1A	May 15, 2002	-do-	LM-4B	-do-	793.2	806.8	100.7	Experimental
HaiYang-1B	Apr 11,	-do-	LM-2C	-do-	789.7	821.0	100.8	Experimental
	2007							HY-1C and 1D will be the operational satellites
Synthetic Aperture and Electro-optical								
YGW-1	Apr 27, 2006	Xichang	LM-4B	-do-				JB-5-01. Launch not notified to UN
YGW-2	May 25, 2007	Jiquan	LM-2D	LEO	636.2	664.1	97.6	JB-6-01. Officially a scientific research satellite
YGW-3	Nov-12, 2007	Taiyuan	LM-3B	SSO				Launch not notified to UN

One of the main focus areas in China's 11th Five-Year Plan has been the development and launch of communication satellites with increasing service life and enhanced bandwidth.

Signal Intelligence (SIGINT)

China's initial attempts for space-based ELINT gathering which commenced with operating a constellation of five Ji Shu Shyan Weixing[20] (JSSW) ELINT satellites was stopped after the death of Mao Zedong, who supported this technology. China, however, continued its SIGINT efforts by establishing a terrestrial infrastructure network which was considered one of the most extensive SIGINT networks in the Asia-Pacific region, consisting of a large number of ground stations, ships and submarines, and complemented by an airborne one consisting of modified AN-12s, PL-5s, HZ-5s, and Tu154 Ms. Hence, there has not been much emphasis on satellite-based SIGINT collection efforts. However, with increasing emphasis on information dominance, China has commenced according high priority to this aspect. All ShenZhou (SZ) missions since November 1999 were known to have performed military missions. The SZ-1 and SZ-2 carried an ELINT payload to monitor communication signals in the UHF band as well as radar transmissions[21]. Passive ELINT capabilities were reportedly to be integrated with the Hughes-built satellites for Asia-Pacific Mobile Telecom (APMT) but the sale of the satellites was scuttled by the Americans in the late 1990s. China still hopes to acquire the satellites in the future.

Military Communication Satellites

One of the main focus areas in China's 11th Five-Year Plan has been the development and launch of communication satellites with increasing service life and enhanced bandwidth, to cater to the increasing needs of its burgeoning civil and military customers. Presently, China operates a series of commercial satellites like China Star, Asia Sat, Apstar, Sino Sat and the military series like the China Sat or the Feng Huo.

20. n. 6, The JSSW satellite series is not discussed in Chinese literature on the subject and, hence, not much is known about the payload and capabilities of these satellites.
21. K.K. Nair, "China's Space Programme: An Overview," *Air Power*, vol.1, no.1, Monsoon 2004, p. 154.

Post-Gulf War, with emphasis on force modernisation, the PLA perceived that secure, redundant communications are critical if the PLA is to achieve its stated objective of winning local wars under "informationalised" conditions. Though commercial communications satellite programmes may enhance military communications, they will not provide access to military-specific technologies such as jamming resistance and spread-spectrum transmission. Hence, in spite of having an extensive fibre-optic communication network and limited bandwidth on its DFH satellites for military use, the PLA proposed a network of five defence communication satellites (China Sat 21-25). The first one, launched in January 2000, was given the military designation of Feng Huo-1 (FH-1) and consists of the Qu Dian C4I (command, control, communications, computers and intelligence) system. This network would enable PLA commanders to communicate with their in-theatre forces in near real-time,[22] and also enable data transfer with all units under joint command, in addition to providing the Chinese military with a high speed and real-time view of the battlefield, thereby, enabling effective command and control. The satellites would reportedly provide the military with both 'C' and UHF band communications. China launched a second satellite based on the advanced DFH-3 bus in November 2003, featuring a number of new technologies, including the first Chinese satellite to provide the Ku-band communication; the first to use the advanced multiple steerable spot beam antenna technology to enable ground users to communicate while on the move; the first to use secured uplink transmission for satellite antenna control; and the most powerful onboard data processing capability. A third in the series was launched in 2006.

Once fully deployed, the FH series constellation would establish space-based military tactical communication networks to support China's military operations and seamless tactical-to-strategic targeting capability.

22. John Pike, "The Military Uses of Outer Space," *SIPRI Yearbook 2002: Armaments, Disarmaments and International Security*. Also see Jhonson- Freese, n. 17.

Thus, once fully deployed, the FH series constellation would establish space-based military tactical communication networks to support China's military operations and provide its ballistic missiles, cruise missiles, aircraft and ships a seamless tactical-to-strategic targeting capability. Studies are under way to develop a Global Mobile Satellite Information System (GMSIS)[23], which would provide personal hand-held communications via 18 to 24 satellites in medium orbits. The details of China's military satellites are given in Table 4.

Table 4: China's Military Communication Satellites

Satellite	Launch Date	Launch Centre	Launch Vehicle	Position	Remarks
FH-1 (ChinaSat 22)	Jan 25, 2000	Xichang	LM-3A	GEO98°E	ZhongXing 22
FH-2 China Sat 20	Nov 14, 2003	Xichang	LM-3A	GEO 98°E	ZhongXing 20
ShenTong1 China Sat 22A	Sep 12, 2006	Xichang	LM-3A	GEO 103°E	ZhongXing 22A

China Tracking and Data Relay Satellite System (CTDRSS)

On April 25, 2008, China launched the Tainlian-1 tracking and data relay satellite to support China's human spaceflight programme[24]. The satellite's primary purpose is to ensure that the taikonauts of the upcoming Shenzhou-VII manned mission will remain in contact with ground control for more than 60 per cent of the time compared to the existing 12 per cent even when they are out of line of sight of the ground control. China plans to launch another satellite in the near future. The planned TDRS system comprising two satellites in GEO will be capable of relaying data from 5-10 satellites at a time, enabling the ground control to monitor over 85 per cent of the footprint of its LEO and MEO (medium earth orbit) satellites across the globe. This will enable near real-time transfer of ISR data, enabling quicker decision-making in the event of a conflict.

23. Mark A. Stokes, "China's Strategic Modernization: Implications for the United States," Strategic Studies Institute (SSI) Monograph, USA, September 1998 at http://www.fas.org/nuke/guide/china/doctrine/chinamod.pdf
24. "China Launches Data Relay Satellite," April 26, 2008, http://www.spacetoday.net/Summary/4174

Dual Use Weather Satellites

The FengYun 1 (FY-1) was China's first meteorological satellite. A total of four satellites in the first series was launched between 1988 and 2005. Since then, China has developed three series, namely, the FY-1, FY-2 and FY-3, with a fourth series, the FY-4, under development. Although designed for civil uses, the satellites support the defence needs by providing accurate weather inputs during operations, which is an important variable in planning an amphibious strike or even concerted air and missile attacks, apart from land operations. Four satellites are now in orbit, including two satellites launched specifically keeping the upcoming Beijing Olympics in view. On May 26, 2008, China launched the third generation[25] FY-3 which provides a spatial resolution of 250 metres compared to the existing 1.1 km on FY-2D which equals world standards. In addition to visible and infrared scanning radiometers, they carry microwave sensors and imaging devices capable of identifying highways from a height of 870 km[26]. Plans are afoot to launch another 22 meteorological satellites by 2020, including four more from the Fengyun-2 series, 12 from the Fengyun-3 series and six from Fengyun-4 series. It is evident that with every launch, capabilities and performance will witness greater improvement. The details of the operational weather satellites are as given below (Table 5).

Table 5: Chinese Weather Satellites in Orbit

Satellite	Launch Date	Launch Centre	Launch Vehicle	Orbit
FengYun 2C (#04)	Oct 19, 2004	Xichang	LM-3A	GEO 105°E
Feng Yun 1D	May 15, 2005	Taiyuan	LM-4B	GEO
FengYun 2D (#05)	Dec 08, 2006	Xichang	LM-3A	GEO 86.5°E
FengYun 3A	May 27, 2006	Taiyuan	LM-4C	Polar

25. China launched the FY-3 as part of its efforts to ensure accurate weather forecasts during the 2008 Olympics. The FY-3 is able to carry out a three-dimensional, all-weather, multi-spectrum quantitative detection to acquire data from the ground surface, the ocean and the space, according to sources with the China National Space Administration.
26. n. 19.

Navigational Satellites (NavSats)

China currently operates a regional navigational and positioning (PNT) system called the Beidou consisting of two first generation and one second generation satellite in GEO and MEO orbits, as depicted in Table 6.

Table 6: Chinese Navsats

Satellite	Launch Date	Launch Centre	Launch Vehicle	Orbit	Remarks
Beidou-1A	Oct 31, 2000	Xichang	LM-3A	GEO 140°E	Not in use
Beidou-1B	Nov 11, 2000	Xichang	LM-3A	GEO 80°E	Experimental
Beidou-1C	May 25, 2003	Xichang	LM-3A	GEO 110.5°E	Operational
Beidou-1D	Mar 02, 2007	Xichang	LM-3A	GEO 86°E	Operational
Beidou-2A	Apr 14, 2007	Xichang	LM-3A	MEO	21,000 km

The Beidou provides PNT services within China and contiguous areas between Latitude 700 ~1400 E and from 5°N to 55°N with a positional accuracy of 100 metres which, Western sources claim, that by using ground correction stations, can be increased to 20 metres[27] whereas the Chinese claim that the system, coupled with their wide area augmentation system, can enable an increased accuracy of up to 12 metres[28].

In spite of its participation in the Galileo project with an investment of Euro 200 million in 2003, China still aspires to have an independent PNT system which will help it to have a global reach in future, consistent with its regional and other aspirations. In consonance with these ambitions, in 2007, China announced plans for a complete global positioning system (GPS) called "Compass" which would feature a total of 35 satellites[29], over the next several

27. Ibid.
28. Ministry of Science and Technology, *Newsletter No. 382,* dated October 20,2004.
29. Peter B. de Selding, "China Satellite Navigation System Planned for 2010," *Space News*. China's original application to the International Telecommunications Union (ITU) for Beidou radio frequencies clearly mentioned a future expansion to a 35-satellite system. But it appears that at the time, no one took it seriously.

years, at a cost of the US $ 2 billion. Thirty of these satellites will fly in MEO at around 21,000 km altitude, similar to that of the US GPS, while the remaining five will be equally spaced around the equator in WAAS-like geostationary orbits and perform a similar service.

Use of Beidou/ Galileo updates will enable China to make significant improvements in its missile guidance capabilities.

Navigation services (under the Compass system) open to commercial customers will provide users with positioning accuracy within 10 metres (33 feet), velocity accuracy within 0.2 m/s and timing accuracy within 50 ns. It is implicit that the Chinese military would have access to higher accuracies via encrypted signals. China has taken adequate steps to ensure that in the future, its PNT system is not subjected to intentional jamming by the US in a conflict scenario. Towards this, China's frequency filings with the International Telecommunications Union (ITU) indicate that its frequencies could overlay both Galileo's Public Regulated Service and the highly encrypted military GPS M-Code[30], where attempts to jam "Compass" would jam both the others.

Use of Beidou/Galileo updates will enable China to make significant improvements in its missile guidance capabilities. For example, the updates will provide the potential to significantly improve missile accuracy through in-flight real-time correction. Moreover, the use of such updates will increase the operational flexibility of China's newer mobile missiles and its ever increasing arsenal of precision-guided munitions (PGMs). Beidou's potential for use as a force-tracking mechanism (e.g. for logistics) could be vital in a future conflict[31]. There seems to be no doubt that China has the capability to develop its Compass system.

30. John Berthelsen, "GPS, Galileo and the China Factor," *Asia Times Online*, May 02, 2003; available at http:==www.atimes.com=atimes=Global Economy=EE02Dj01.html. Denial of the military specific Premium Regulated Services (PRS) as well as many commercial applications available to other European partners may eventually see China pulling out of the project.
31. The benefits of such a force-tracking mechanism were demonstrated during the opening stages of Operation Iraqi Freedom, when Coalition soldiers wore uniforms containing integrated GPS technology. Indicating the potential for such a military use, a recent report by Xinhua, the official Chinese state-run news agency, boasted that Beidou already was capable of tracking and monitoring vehicles transporting dangerous chemicals throughout the country.

Microsatellites (Microsats)

China realised the potential uses of microsatellites in both civil and military applications and joined the bandwagon of microsatellite development in the late 1990s and the first microsatellite, Tsinghua-1, was launched on June 20, 2000. The satellite also carried out in-orbit maneouvring and rendezvous with another nanosatellite SNAP-1 (Surrey Nanosatellite Applications Platform), enabling China to gain experience in precise tracking and orbital manoeuvring. The Tsinghua-1 is a precursor to a larger 07 satellite Tsinghua constellation aimed at providing high resolution imagery. Microsatellite efforts were later formalised and financed under the aegis of the 10th Five-Year Plan (FYP). Under the 10th FYP, a major project, "high performance microsatellite ground observation technology and associated applications" was approved. Beijing-1 or Tsinghua-2 was a product of the same project. The Tsinghua-2, launched in October 2005, has a resolution of 4 metres and a swath of more than 600 metres which is of significant military value.[32] Overall, China has the following microsatellites in orbit which are set to multiply as it progresses into its 11th FYP.

Developments of microsatellites could allow for a rapid reconstitution or expansion of China's satellite force in the event of any disruption in coverage.

These developments of microsatellites could allow for a rapid reconstitution or expansion of China's satellite force in the event of any disruption in coverage, given an adequate supply of boosters. The primary military appeal of microsatellites lies in the fact that they are expendable, cheap to produce and launch and are flexible and difficult to detect. In the years to come, microsatellites will increasingly become the mainstay for shaping the battlefield by providing a cheap and affordable option in an operationally responsive space environment for carrying out the entire spectrum of military space missions ranging from "force-enhancement" to "counter-space operations". Nevertheless, their gainful military utility demands a high degree of technological sophistication, precise tracking and orbital manoeuvring accuracy as well as commensurate launch capabilities which China is

32. Ministry of Science and Technology, *Newsletter No. 441*.

Table 7: Chinese Microsatellites in Orbit as on June 30, 2008

Micro-Satellite	Launch Date	Weight in Kgs	Role	Remarks
Tsinghua-1[a]	20 Jun 2000	50	Imagery	Res: 39 metres, 03 optical bands (NIR, green, blue) Swath: 600 km.
Tsinghua-2[b] (Also named as Beijing-1.)	27 Oct 2005	150	Imagery	Res: 04 metres panchromatic camera + 32 metres resolution 3-band multispectral camera. Swath: 600 km.
Tansuo-1	18 Apr 2004	150	Imagery	Carries 10 metres stereo resolution camera.[c]
Tansuo-2	18 Nov 2004	300	Imagery	Not Known (N/K)
Naxing-1	18 Apr 2004	25	N/K	N/K
Chuangxin-1	21 Oct 2003	100	Data relay	Launched piggy-back on CBERS-2.

a. Data on Tsinghua sourced from a variety of sources, weight sourced from site of SSTL, technical parameters from W.E. Stoney, "Guide to Land Imaging Satellites," *The American Society for Photogrammetry and Remote Sensing*, Updated February 2, 2006, available at http://www.saniita.com/pdf/Guide%20to%20Land%20Imaging%20Satellites.pdf

b. For details, see "Beijing-1 (China-DMC + 4, Tsinghua-2)...." Space News Feed, October 30, 2005, at http://www.spacenewsfeed.co.uk/2005/30October2005_25.html

c. Brian Harvey, *China's Space Program: From Conception to Manned Space Flight* (UK: Praxis Publishing), p. 162.

hoping to acquire through its mobile and air launched versions of the "Pioneer."

Benefits of Manned and Moon Mission.

China has demonstrated its high-tech capabilities with the successful completion of phase-1 of its manned and moon missions. These have accrued immense benefits to China, apart from national prestige. The military benefits from the manned mission accrue in areas such as in-orbit manoeuvring, mission management, launch on demand, miniaturisation, and computational analysis.[33] The lunar exploration programme, on the other hand, benefited China[34] in areas such as such as long

33. Johnson-Freese, n. 17.
34. Johnsin-Freese, Ibid.

Its space programme spans the entire spectrum of activities ranging from manufacture and launch of satellites, manned missions, space research, space applications and increasing deep space missions.

distance data transmission, telecommunication and sensor technology.

Analysis of China's Current Space Capabilities

From the foregoing, it is evident that China has a comprehensive, integrated and focussed space programme. Its space programme spans the entire spectrum of activities ranging from manufacture and launch of satellites, manned missions, space research, space applications and increasing deep space missions. Unlike the US and India, where clear demarcation can be made between the military and civil organisational structures, the Chinese space programme has a strong military bias which permeates even the scientific, domestic, and commercial elements of the space effort. Although a civilianised Commission on Science, Technology and Industry for National Defence (COSTIND) sits at the apex of the Chinese defence-industrial complex, it is responsible to both the Central Military Commission of the Chinese Communist Party and the General Armaments Department of the PLA on whose behalf it coordinates the activities of the major aerospace holding companies, the principal research academies, and the third-line industrial organisations that perform work on contract to these institutions. In this context, the China National Space Administration is essentially a civilian front for international cooperation and liaison between the military and the Chinese defence industry. It is this dual nature and opacity of the space programme that also kept China from being a partner in the International Space Station (ISS), as any collaboration with China's "civilian" space programme inevitably ends up aiding its military. With a limited budget estimated at between US $ 1-5 billion[35], China realises that it cannot compete with the US nor achieve indigenously the requisite technical competence available with the US. Hence,

35. Ashley J. Tellis, "China's Space Capabilities and Their Impact on US National Security," Congressional Testimony, May 20, 2008.

China has focussed on goals that would allow it to garner benefits of space for socio-economic development while allowing it to retain the military edge over other Asian countries. Thus, China's real constraints notwithstanding, it is poised to become an international player at least in the launch services market and perhaps as a niche provider of low-cost satellites to other developing countries.

In order to ensure seamless integration of their armed forces, second artillery and space capability, the Chinese have been incorporating doctrinal changes into their concept of operations with a bias towards space and cyberspace predominance. These are examined below.

CHINA'S EVOLVING SPACE DOCTRINE

It is normal activity for strategists and war planners in any military to consider how advances in technology and weapons affect warfare and to explore how to adapt to these changes. The same is true in case of the People's Republic of China. Though China's overall doctrinal percepts underwent a change post-Gulf War, the modernisation drive was, in fact, fuelled by the announcement in the US of its Strategic Defence Initiative (SDI) programme in 1983 and a similar one by the Russians to counter the US. China feared its loss of nuclear deterrent and retaliatory capability in the face of the US SDI programme. By 1986, studies on the impact on China of such a move by the US came up with three responses to counter both the US and the USSR[36]. These were: expansion of offensive forces; development of counter-measures, such as shielding and spinning of ballistic missiles to penetrate BMD systems; and deployment of ASAT weapons to destroy space-based BMD systems. Thus, China embarked on a force modernisation of all its three Services. The 1991 Gulf War brought home the lessons and advantages of space assets in enhancing the success of conventional operations. Since then, China has undertaken a massive transformation drive in all aspects of its military. The transformation features new doctrine for modern warfare, reform of military institutions and personnel systems, improved exercise and training standards, and acquisition of advanced foreign and indigenous weapon systems. China's military expansion is already such that it is likely to alter the regional military

36. Stokes, n. 23.

China realises that the application of non-nuclear technologies can bring about strategic effects similar to those of nuclear weapons, and, avoid the great political risk of transgressing the nuclear threshold.

balance. China today is in the process of integrating space into its overall concept of operations. Though one cannot say authoritatively that the PLA has a well established space doctrine like those for land, air and naval operations, the increasing transparency and availability of research material by Chinese think- tanks in the public domain forces one to accept that the PLA is evolving a doctrine for space operations and this is a culmination of a careful study of the US' exploits of the ultimate high ground, specially in the last two decades. The PLA has modelled its doctrine at three levels, namely, strategic, environmental and operational. While the strategic doctrine encompasses the actions to be taken by all the three Services, the environmental and operational doctrines focus more on specific space missions.

Strategic Doctrine

China's overall doctrine appears to be premised on the fact that it cannot wrest control of space from the US during any future war. China realises that the US and its superior military power remains the biggest objective constraint on its ability to secure its own political interests, whether related to immediate concerns over the Taiwan crisis or more remote challenges of constructing a Sino-centric order in Asia and perhaps globally. China realises that the application of non-nuclear technologies can bring about strategic effects similar to those of nuclear weapons, and, at the same time, it can avoid the great political risk of transgressing the nuclear threshold. Hence, at the strategic level, the PRC's military doctrine advocates using asymmetric means to level the playing field against a technologically superior opponent like the US. Thus, China has graduated from the concept of "people's war" to "local, limited war" to "limited war under high-tech conditions" and now to "local wars under conditions of informatioalisation," in which the use of space and cyberspace is emphasised to

seize the initiative. In the realm of space, the broad strategy pertains to employing anti-access and space denial means against the adversary. The elements of China's approach to asymmetric warfare can be seen in its heavy investment in ballistic and cruise missile systems, undersea warfare systems, including submarines and advanced naval mines, counter-space systems and computer network operations.

Doctrine at Environmental Levels

There is still no clear definition of where the medium of air ends and that of space begins in order to evolve a separate doctrine for the environment of space-based operations. And also, unlike the doctrines of land, sea and air which evolved with significant inputs of experience, technology and geographical characteristics, no hostilities have taken place in space in the last half decade of the space age. Hence, it is difficult to envisage an exclusive space doctrine in the case of emerging space-faring nations like China, India and Japan to name a few. Even the two superpowers came out with their doctrine largely based on theoretical and technological advances in the late 1970s and 1980s. The 1978 edition of the *Soviet Military Encyclopedia*[37] described "space war" as "military operations using space and anti-space resources with the aim of weakening the enemy's space forces or achieving supremacy in outer space." On the other hand, the first specific space doctrine of the US was released in 1982, identifying three roles for space power, these being to strengthen the security of the US, to maintain American space leadership, and to maintain space as an environment where nations could enhance the security and welfare of mankind. However, the existing and globally accepted operational space doctrine, after five decades of largely theoretical experience, largely builds on the premise that air and space comprise a unitary entity for the conduct of

The existing and globally accepted operational space doctrine, largely builds on the premise that air and space comprise a unitary entity for the conduct of military operations.

37. Michael Sheehan, *The International Politics of Space* (US: Routledge Publishers, 2007).

military operations. As a result, the entire spectrum of air operations, ranging from offensive counter-air operations to counter-surface force operations to defensive operations are replicated in the case of space into four broad missions as space support (e.g. launch and satellite maintenance); force enhancement (capabilities to increase the advantages of the war-fighter, such as precision guided munitions and C4); space control (the ability to use space when needed, and deny it to the adversary); and force application (space weapons). The Chinese have given their own interpretation to these terms while retaining the meaning, and for them, the spectrum ranges from[38]:

- **Space Safeguard Operations**. Roughly equivalent to space support operations but only including the launching and recovery of space vehicles and not operations involving satellite control.
- **Space Support Operations**. This mission area corresponds entirely to force enhancement missions or what China interprets as "power enhancement and support capabilities."
- **Attack Operations**. This mission area is very expansive and includes all elements of the mission areas of space control and force application. It includes the use of space-based weapons against terrestrial targets, the use of terrestrial weapons against space-based targets, and the use of space-based weapons against other space-based assets.

China's Operational Doctrine

At the operational level, China envisages the integration of air and space operations and the control of the space environment as the primary missions. China, for all its new found successes and technological prowess in space, understands that it still cannot dominate in space or even reach parity with the US because it doesn't feel it needs to. Hence, it is developing only those capabilities to retain its sovereignty and freedom of action on issues of critical national interest such as Taiwan, or at a more regional level, to fight its

38. The characterisations are based on thinking of Chinese authors as described by Kevin Pollpeter in "The Chinese Vision of Space Military Operations," in Mulvenon, David Finkelstein, *China's Revolution in Doctrinal Affairs*, Centre for Intelligence Research and Analysis Publications, available at http://www.defensegroupinc.com/cira/pubs.htm

adversaries over the future boundary disputes or energy resources. Hence, at the operational level, China yearns for a limited and temporal ability to control space. Though in most Chinese texts, the questions of sovereignty in space are treated as analogous to the extension of national sovereignty into the exclusive economic zone (EEZ) and are viewed as an inherent right of a nation, like the control of its air space, a most complete explanation of how space control is related to the PLA's military theory on outer space has been put forward by Cai Fengzhen and Tain Anping in their writing on aerospace operations[39]:

At the operational level, China envisages the integration of air and space operations and the control of the space environment as the primary missions.

> Space control is the capability of one belligerent in a state of war, in a specified period of time, in a defined area of space to carry out its own operations with freedom while hindering or preventing an enemy from carrying out its own operations or using space.

Hence, Chinese strategists realise that at the operational level, control of space and even cyberspace in a given theatre for a quantifiable time would let them realise their theatre specific integrated air land and sea operations.

China certainly appears to be putting its theories into practice, as witnessed by its burgeoning military space apparatus and the fast pace at which its air and space capabilities are growing in the new millennium. In addition to the space capabilities discussed, a broad examination of China's counter-space and cyber capabilities will provide a useful canvass to discuss the implications of China's space programme on India.

CHINA'S COUNTER-SPACE CAPABILITIES: IS CHINA FUELLING AN ARMS RACE IN SPACE?

Space deterrence has been a major consideration behind Beijing's development of counter-space programmes. The goal of this deterrence is to ruin an opponent's economy, its C4ISR network and, thus, the ability to function in space. For

39. Larry M. Wortzel, "The Chinese People's Liberation Army and Space Warfare," American Enterprise Institute at http://www.aei.org/publications/pubID.26977/pub_detail.asp

Space was "militarised" five decades ago and the "weaponisation" of space has already taken place. Though there are no weapons deployed in space, the satellites in space are integral to the weapon systems on earth.

deterrence to be credible, one must demonstrate the capability and, hence, the ASAT test in January 2007. The test drew much international criticism for the debris creating element as well the blatant attempt at "weaponising space." Though the ASAT does not fall within the purview of existing definition to be called a "space weapon," one needs to look at the test in a more pragmatic manner.

Space was "militarised" five decades ago and the "weaponisation" of space has already taken place. Though there are no weapons deployed in space, the satellites in space are integral to the weapon systems on earth. For that matter, all the long range ballistic missiles in the world, as well as the Chinese ASATs are really "space weapons" because even though they may not be launched from space, they are launched into space and transit through space to their targets. In a broader sense, even tools for jamming satellite transmissions could be counted as "space weapons" as they unquestionably bring war to space. A year and half later, putting the ASAT test into perspective, it emerges that the test did not, in any way, change the geostrategic balance in Asia or globally, or challenge US space superiority. But the test did demonstrate the offensive missile technology and the limits of that technology by China. The US, which had prior information of the test, as borne out by Ashely Tellis,[40] chose to play along and did not lodge any international protest for its own self-serving purposes. The test helped the US galvanise support for its space-based ballistic missile defences and legitimised the shooting down of one of its own satellites, the US-193, in February 2008 in the garb of saving lesser mortals from the harmful effects of the hydrazine fuel carried by the satellite.

The kinetic ASAT test was not a one-off development but a carefully orchestrated plan to reinforce the beliefs of the vulnerabilities to US space assets, as articulated by the Rumsfeld Commission in 2001. Apart from this, the test was

40. Ashely Tellis, "China's Military Space Strategy," *Survival*, vol 39, issue 3, September 2007.

also an attempt by China to bring the US to the negotiating table for an arms control agreement which it has so far been unsuccessful in doing, along with Russia, at the United Nations. China gambled that it can stop the US from developing space-based weapons under the guise of arms control agreements while it can continue to do so, given the opaque nature its defence spending and research and development. The ASAT test and the dazzling of an American satellite by ground-based laser in 2006 are the only visible attempts by China to target space-based assets. If official policy statements are to be treated as indicators of government intent, then China has been discreetly shifting its position since 2002 from opposing militarisation of space to opposing the weaponisation of space, thus, removing the political hurdle to its own space use in such applications as reconnaissance, navigation and positioning for military purposes.

The 2006 White Paper on space even omits reference to opposition to weaponisation of space, fuelling speculations about the intentions of the Chinese. The available Chinese literature on the subject points to the fact that China is actively exploring a variety of space weapons through theoretical, basic and applied research as part of "attack operations" to counter the US dominance of the high ground. These are examined below.

Available Chinese literature on the subject points to the fact that China is actively exploring a variety of space weapons through theoretical, basic and applied research.

Hard Kill Means

The means to be adopted for hard kill envisage:

- Co-orbital ballistic missiles.A strategic ballistic missile which is a multi-task, multi-role attack weapon capable of implementing random orbit transfer from earth orbits and can serve the functions of an intercontinental ballistic missile, an anti-satellite weapon, and an orbital bomber weapon.
- Orbital space mines which will detonate when they come in contact with

the adversary's satellite in their orbit.

- Development of ASAT weapons to be launched from submarines or surface ships to provide it a flexible option of destroying the adversary's space assets.
- Physical destruction of an adversary's ground control infrastructure.

Soft Kill Means

- Electronic jamming and blinding of satellites in orbit as part of temporary and reversible means through ground-based laser attacks.
- A thermo-nuclear explosion in LEO to disable the satellite by electro-magnetic pulse (EMP).
- The jamming of inter-satellite and satellite-to-ground station downlink/uplink which will degrade the C4ISR network of an adversary.

With the US moving ahead on its space-based ballistic missile defence-programme, a "counter-ASAT"[41] weapon called attack identification detection reporting system (Raidrs) Bloc 20 and the prompt global strike weapons, China can be expected to follow suit to enable it to maintain the space deterrence.

Hence, from the foregoing, the conditions exist to conclude that China is in fact fuelling an arms race in space, along with the US, notwithstanding its "histrionic" calls for demilitarisation of space along with Russia at the United Nations. But in spite of its advances in counter-space capabilities, China is found wanting in enhanced space situational awareness which is the prerequisite to conduct warfare in space.

Space Situational Awareness

The present telemetry, tracking and control (TT&C) infrastructure consists of eight domestic tracking sites[42], two sites on foreign soil (one in Kiribati in the South Pacific; one in Namibia), and six Yuanwang-class tracking ships. In addition, China has two S-band dish antennas[43], at Beijing and Kunming, to

41. Marko Beljac, " Arms Race in Space," April 1, 2008, at www.fpif.org
42. "China: Launch Capabilities: Tracking, Telemetry and Command Network," <http://cns.miis.edu/pubs/week/020722.htm#fnB8>
43. Bradley Perrett, Frank Morring, Jr. and Craig Covault, "China Hopes Chang'e Will Pave Way for Lunar Rover," *Aviation Week & Space Technology*, October 28, 2007.

support its deep space missions. These will not only help China in deep space tracking but also of its geostationary satellites.

China claims that its space control network has reached an orbiting accuracy at the metre level, which makes the flawless control and management of 85 orbiting vehicles possible.[44] It also claims to have developed software to enable it to orbit multiple satellites at the same time, with an accuracy reaching centimetre level. Trial applications show that the system has centimetre-level positioning accuracy, with an advanced function to orbit multiple satellites in multiple arcs at the same time[45]. If the above claims made in the year 2005 are taken as accurate, then the possibility of China successfully undertaking satellite interception missions becomes enormously credible. It would have the requisite orbital data to calculate the proper path to the target, to launch the booster at the precise moment, the ability to track and plot the precise intercept course to the target and detonate, dock, rendezvous or inspect, as need be.

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China is earnestly pursuing the acquisition of better technologies related to spacecraft navigation, attitude control, simulation, integrated rocket measuring and launching control some of which it has perfected with the successful launch of the moon orbiter.[46] However, China's present TT&C does not cover the entire globe. It continues to rely heavily on shared and leased space tracking facilities, which might not be available in the event of a conflict. The TT&C has obvious military implications, as evidenced by the ASAT test. China would require space-based tracking and early warning satellites like the US DSP constellation if it wishes to undertake more counter-space operations like putting objects in the

44. Ministry of Science and Technology, *Newsletter No. 370*.
45. Ministry of Science and Technology, *Newsletter No.397*.
46. Chinese engineers have perfected the technique to successfully keep the spacecraft's sensors facing the moon to collect their data, while communications antennas face the earth and the solar panels face the sun. "During the flight orbiting the moon, the three bodies of the earth, the moon and the sun [revolve] relatively, so the attitude control is a three-vector control process."

Increasing exploitation of space-based ISR by China. It allows China to monitor armed forces' activities across the vast expanse of the Indian landscape.

orbital path or aiming ground-based lasers for destroying sensors during overpass timings or taking deception, camouflage and concealment measures to deceive space-based surveillance.

IMPLICATIONS FOR INDIA

The cumulative consequences of China's space and counter-space capabilities for India's national security will manifest over the years in multiple ways, as discussed in the succeeding paragraphs.

The increasing exploitation of space-based ISR by China with hyper spectral and SAR payload will enhance its battlespace awareness. It allows China to monitor armed forces' activities across the vast expanse of the Indian landscape, irrespective of the time of the day and prevailing weather conditions. China will know in advance the preparations for deployment of troops, movement of the strike corps elements, squadrons, air defence radars, movement of naval fleet, mobility of short range ballistic missiles (SRBM) and intermediate range ballistic missiles (IRBMs) and the like. This will enable China to acquire precise coordinates of the location of these assets, both at the tactical battle area and the hinterland, thus, increasing its targeting capability. The use of its Beiodu (and subsequently Compass)/Galileo, will enable in-flight update of target coordinates for its PGMs and thereby increase their efficacy and destructive potential. By virtue of having good battlefield awareness and transparency, China will be able to prioritise target selection and carry out effect-based operations while prosecuting its air, land and sea campaigns

China's data relay satellites would enable the ISR satellites to download data in near real-time even when out of sight of the ground control, which will enhance its battle damage assessment functions and help in retargeting, if required; this will help it to shape the battlefield in consonance with its concept of operations(CONOPS).

As brought out earlier, the Beidou/Galileo will increase the navigation capabilities of China's air force, increasing its choice of ingress routes into the

Indian air space, forcing India to divide its scarce air defence resources for surveillance and targeting.

China has been investing in nuclear submarines and development of anti-ship ballistic missiles[47] as part of its anti-access and sea denial strategy. The use of these assets in combination with the space capabilities like accurate weather updates, SAR imagery, use of GPS for in-flight updates of cruise missiles will erode the Indian Navy's freedom of access to the sea lanes.

While these are some of the implications of China's exploitation of space for force enhancement operations, India needs to concentrate more on evolving counter-measures to overcome the impact of the counter-space capabilities of China.

The Indian armed forces, like the PLA, are undergoing a process of transformation with acquisition of sophisticated weapon systems to survive and dominate the net-centric battlefield of the future. China may or may not use the hard kill options like the kinetic ASAT to target India's limited but valuable satellites in space. However, that may be cold comfort to a nation whose dependence on satellites for prosecuting wars of the 21st century is set to grow at a steady pace. India has an array of ISR satellites, with only the TES claimed for military use. However, with sub-metre resolution payloads on board the CARTOSAT series and India's plans for a comprehensive ISR network planned to be completed by 2012, the dependence on space-based ISR capabilities will only increase. In a possible limited conflict scenario, China would not hesitate to blind or dazzle these ISR satellites selectively to degrade India's capabilities, denying India the much needed overall battlespace awareness.

In a possible limited conflict scenario, China would not hesitate to blind or dazzle these ISR satellites selectively to degrade India's capabilities, denying India the much needed overall battlespace awareness.

47. Annual Report to the Congress on Military Power of the People's Republic of China for the year 2008. China is developing an anti-ship ballistic missile (ASBM) based on a variant of the CSS-5 medium-range ballistic missile (MRBM) as a component of its anti-access strategy. The missile has a range in excess of 1,500 km and, when incorporated into a sophisticated command and control system, is a key component of China's anti-access strategy to provide the PLA the capability to attack ships at sea, including aircraft carriers, from great distances.

While China continues to improvise on its capabilities, indirectly it also makes Pakistan a "proxy space power".

The armed forces' exploitation of the existing INSAT network is limited but increasing bandwidth requirements will necessitate a dedicated military satellite. It is not clear whether the upcoming launch of GSAT -4 and GSAT-5 will meet the expectations and the need. However, with the operationalisation of networks like the army's Tactical Communication Network (TCS) slated to replace the Army Radio Engineering Network (AREN) and the IAF's Integrated Air Command and Control Network (IACCS), and Operational Data Links (ODL), for communicating between various airborne assets like the airborne warning and control system (AWACS), unmanned aerial vehicles (UAVs), air refuellers and multi-role aircraft, to name a few, the armed forces are set for network-enabled operations. The increasing reliance on satellites will make them vulnerable to soft kill approaches. China has the ability to disrupt data links between various airborne and space-based platforms which will be critical to the successful outcome of conflicts. The proposed fielding of India's regional navigation system (IRNSS), while enabling India with independent navigational services, will also make it vulnerable to attack by China.

While China continues to improvise on its capabilities, indirectly it also makes Pakistan a "proxy space power" given its penchant for proliferation of technology and capabilities. Exploitation of China's capabilities for use by Pakistan against India cannot be ruled out in any future conflict.

While the necessity for India to exploit space for military needs in an enhanced way cannot be underscored, there is need for a realistic threat evaluation, not only for its space-based assets but even for the ground infrastructure. With no launch capability of its own, Pakistan may not pose a major threat to our assets in space from the likes of ASAT but blinding or dazzling by laser attacks and/or jamming of uplink/downlink data cannot be ruled out. China has already demonstrated its capability and intent. Today, the

48. Geeta Vardhan, programme director (Special Projects) Indian Space Research Organisation (ISRO), speaking at a session on "Space Applications for Military Use in India," DRDO Bhavan, New Delhi on June 16, 2008.

major gaps for a credible Indian response to such an eventuality are in early warning and in space-based ELINT, as was evident in the Chinese ASAT test. India had to depend on the delayed US response to know that such a test had been conducted. India has announced plans for a monitoring facility[48] to protect its space assets against threats from ASATs and space debris. The plan involves a single GEO satellite that will detect threats to space assets and transmit them to the ground station, enabling the satellite to be steered to safety. While this may suffice in the near term for protection, India needs to expand the capability for increased space situational awareness. India has the means to deal with an airborne attack against the ground infrastructure but lacks the capability to deal with exo-atmospheric threats. Though India has taken toddler steps by its successful demonstration of exo-atmospheric and endo-atmospheric tests towards validating a BMD, it is still miles away from operationalising even a theatre-specific system. Further, the enormous costs of defending an area the size of New Delhi that have been estimated at more than US $ 512 million[49] (Rs 22,000 crore) would limit the inclination of the government to develop the system on priority. Notwithstanding the financial and political constraints, India needs to put in place a credible and limited BMD as well as pursue temporary and reversible measures to have offensive counter-space capabilities.

The most pressing requirement for India is to institutionalise an organisation for overseeing the entire gamut of militarisation of space with a national perspective.

The most pressing requirement for India is to institutionalise an organisation for overseeing the entire gamut of militarisation of space with a national perspective. The need for an Aerospace Command has been articulated since the beginning of the 21st century. However, it continues to be seen as a "need" and not a reality. Piecemeal actions like setting up Service specific "space cells" may enable them to understand the exploitation of space for Service specific use but the "cells" have to be integrated to complete the joint exploitation of the "new high ground."

49. Figure quoted by representative of DRDO, New Delhi, during CAPS Seminar on June 20, 2008.

CONCLUSION

China has taken its place at the forefront of space-faring nations. It joins only the US and Russia in operating an independent manned space programme. Moreover, its space programme is a full-spectrum, comprehensive concept. From microsatellites to manned space missions, from satellite and rocket design to launch capabilities, it spans both civilian and military requirements. The aims and principles of China's space activities are determined by their important status and function in protecting China's national interests and implementing the state's development strategy.

China's military modernisation programme is underscored by the need for space capability. Without it, China feels that it cannot credibly deter possible hostile military action, or threat of such action, from the United States. Chinese pursuit of counter-space capabilities also raises the spectre of increasing contests in the battleground of space. While the US responds to the Chinese threat by the development of various counter-measures, India needs to institutionalise its organisational structure for militarising space and accelerate its military space programme for more robust and comprehensive C4ISR capabilities in an integrated manner for force enhancement operations and also pursue non-lethal counter-space 'weapons of mass disruption'. This will enable India to achieve symmetry with China in ensuring the survivability of its space assets while developing means to degrade/deny China battlespace awareness, and, thus, erode its combat potential. India must realise that just as achieving air dominance was the central mission of the 20th century, securing space dominance is vital to operations in the 21st century.

NUCLEAR DETERRENCE AND CONVENTIONAL WAR: A TEST OF INDIA'S NUCLEAR STRATEGY

MANPREET SETHI

The essence of power is to know the limits upon power. The linkage between nuclear deterrence and conventional war rests upon this crucial understanding. While the relationship between the nuclear weapons of two nations and the establishment of credible nuclear deterrence is fairly well understood owing to the Cold War experience between the superpowers, the practice of nuclear deterrence with respect to conventional war is a subject that has been far less studied. The US and the USSR deterred each other at the nuclear level and any conventional wars between them were fought by their proxies, not by them directly.

India's practice of nuclear deterrence, however, deals with a unique predicament where its nuclear weapons are certainly meant to deter the adversary's nuclear use or blackmail. But, at the same time, India's nuclear deterrence, especially with Pakistan, is tasked to function in a fragile situation where Pakistan's nuclear weapons seek to deter India's conventional superiority even as it engages in sub-conventional conflict. Therefore, the interlinkages between sub-conventional, conventional and nuclear war are far more complex in the Indian case. In fact, India's nuclear strategy has to grapple with the challenge of building credibility of its nuclear deterrence in such a way as to counter the adversary's attempt to blur the lines between conventional and nuclear war. While it threatens to lower the bar for breakdown of nuclear deterrence in order to deter conventional attack, India must not only raise the nuclear threshold, but also devise adequate conventional responses that can be

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The true test of India's nuclear strategy lies as much in establishing mutual nuclear deterrence, as in tackling sub-conventional warfare with conventional tactics that are aware of the presence of nuclear weapons.

safely executed in the situation of nuclear overhang. Of course, this is easier said than done. As long as nuclear weapons exist, none can deny the potential danger of a conventional war escalating to the nuclear level. But, the true test of India's nuclear strategy lies as much in establishing mutual nuclear deterrence, as in tackling sub-conventional warfare with conventional tactics that are aware of the presence of nuclear weapons, but can operate without bringing them into the calculations.

Is this possible? What impact do nuclear weapons have on the conduct of conventional warfare? What are the relevant lessons that can be discerned from the experiences of Kargil and Operation Parakram? How does 'limited war' offer an option to create space between conventional and nuclear war? How best can India use this option to nullify the advantage of nuclear weapons that Pakistan seeks? These are some of the questions that the paper attempts to answer.

ADVENT OF THE 'ABSOLUTE WEAPON'

The dropping of the two atomic bombs, *Little Boy* and *Fat Man*, on Hiroshima and Nagasaki starkly illustrated the destructive potential of the new weapons. Even more significantly, the two bombs showcased the power they brought to the possessor to influence the behaviour of the adversary by implicitly or/and explicitly threatening the use of such horrific destruction. In one instant, therefore, nuclear weapons altered the criteria for measuring national power and the dynamics of conflict interaction in international politics.

Before the advent of nuclear weapons, states could risk war or even engage in it for a stake they felt was high enough to justify the action. After all, according to the Clausewitzian concept, war was only an extension of politics by other means. So when politics was unable to achieve a desired objective, war was the

tool to be employed. But nuclear weapons completely changed this equation by increasing the difference between the value of the interest at stake and the potential cost of war. In fact, war in a situation where nuclear weapons were present with both sides, led to the inevitable consequence of mutual assured destruction (MAD), thereby nullifying its use as politics by other means. Consequently, the purpose of the new weapon, for the first time in military history, became to avoid its use instead of crafting strategies to incorporate it into military operations. Bernard Brodie captured the essence of this thinking soon after 1945 in his seminal work, *The Absolute Weapon*. He argued that the purpose of the nuclear weapon, the absolute weapon as he described it, was to prevent wars, not fight them. This basic premise has remained unchanged since then. True to his original conclusion, over the last six decades, countries possessing nuclear weapons have used them for deterrence against other possessors of these weapons of mass destruction (WMD), or for compellence against non-possessors, but not for war-fighting.

Nuclear deterrence may be described as a strategy that stops an adversary from indulging in any nuclear use by instilling the fear that the cost of the action would entail assured damage of a kind that would be much more than the gain sought to be made. Of course, it is a different matter that in order to prevent breakdown of nuclear deterrence, countries project the image that they are prepared to handle just such a situation, which means being ready to use the weapon. As per the strange logic of nuclear deterrence, the equation is simple: better planning for deterrence failure leads to higher credibility of deterrence, which in turn reduces the possibility of deterrence failure. Driven by this paradoxical reasoning, the superpowers during the Cold War, consistently expanded and upgraded their nuclear arsenals and altered doctrines and strategies to accommodate new capabilities. While deterrence was the primary focus of their foreign policy and bilateral interactions, nuclear capabilities were

Better planning for deterrence failure leads to higher credibility of deterrence, which in turn reduces the possibility of deterrence failure.

nevertheless always shown as being ready to be pressed into military use, if required. Elaborate standard operating procedures were adopted in both nations to indicate an almost automatic launch of nuclear weapons once the decision had been made.

The only instance of two nuclear countries fighting a direct war with one another, prior to 1999, was the Ussuri river conflict between China and the Soviet Union in 1969.

However, the fact that no actual use of nuclear weapons[1] ever happened is taken as the success of nuclear deterrence. It is widely assumed that the presence of these WMD and the concomitant fear of MAD kept the superpowers from engaging in any direct confrontation. Of course, the nuclear stability at the level of the two rival superpowers contrasted with a more volatile situation at lower levels of their allies. This came to be known as the "stability-instability paradox" and was used to explain the proxy wars that happened between the two ideological blocs. But the risk of escalation and cost of miscalculation cast a constraining influence on states' behaviours and kept them away from any direct confrontation.

The only instance of two nuclear countries fighting a direct war with one another, prior to 1999, was the Ussuri river conflict between China and the Soviet Union in 1969. Triggered off by an ambush of Soviet troops by Chinese forces at Zhenbao Island along the Sino-Soviet border, it led to the killing of 31 Russian soldiers. The Chinese action which, according to their accounts, was a response to Soviet provocations along the border from the mid-1960s onwards, was taken in the belief that "the border clash was a *controllable military conflict*" that would serve the "larger domestic political purpose of mobilising the Chinese people for further revolution."[2] However, the Chinese act was not perceived as a limited attack in Moscow and the Soviet leaders did consider a number of military options, including a disarming strike on China's nuclear arsenal. The tension lasted several months, during which the Soviet Union even probed the US on

1. There are several instances, however, of the use or threat of use of nuclear weapon for blackmail and coercion.
2. David Ochmanek and Lowell H. Schwartz, *The Challenge of Nuclear-Armed Regional Adversaries* (Santa Monica, CA: RAND Corporation, 2008), pp. 33-34. Emphasis added to highlight the perception.

their response if the Soviets were to attack China's nuclear facilities. The US remained ambiguous, and both China and Russia refrained from taking very provocative actions. The crisis finally wound down after Chinese Premier Zhou Enlai categorically stated to the Soviet premier that China had no aggressive intentions and that its nuclear weapons posed no threat to the USSR. As the crisis subsided, it revealed the overarching influence of nuclear weapons on two adversaries when both possess nuclear weapons.

CONVENTIONAL WAR IN PRESENCE OF NUCLEAR WEAPONS

In 1991, Martin van Creveld, a well known analyst on war, wrote, "From central Europe to Kashmir, and from the Middle East to Korea, nuclear weapons are making it impossible for large sovereign territorial units, or states *to fight each other in earnest without running the risk of mutual suicide*."[3] Of course, a number of factors other than nuclear weapons are also responsible for changing the nature of warfare from total to limited wars in contemporary times.[4] However, the most important limitation on war in situations where both adversaries possess nuclear weapons is cast by the presence and impact of these weapons. While wars may still have to be fought, the shadow of nuclear weapons, nevertheless, imposes constraints on the range of military options and the nature of coercive use of force that nations can indulge in. It demands greater caution so as to avoid potential costs of miscalculation. Leaders of nuclear-armed nations must be constantly aware of the risks involved, especially in the show of force, and are required to walk a tightrope in case of a crisis. On the one hand, the desire to win the dispute requires a demonstration of resolve and a willingness to fight. But simultaneously, the fear of nuclear war demands caution and restraint in the use

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3. Martin van Creveld, *On Future War* (London: Brassey's, 1991), p. 194. Emphasis added.
4. For a detailed analysis of the many factors that are leading the trend to limited wars, see Jasjit Singh, "The Dynamics of Limited War,"*Strategic Analysis*, vol. 24, no. 7, October 2000.

of force. Unrestrained coercive manoeuvring by either or both sides could end up committing them to a war neither wanted in the first place. And the risks of such unplanned and uncontrollable escalation in the presence of nuclear weapons could be catastrophic for both.

As war starts to move down the intensity spectrum, victory and defeat shift more into political and psychological dimensions.

Therefore, the conduct of war in the presence of nuclear weapons has to follow a different set of rules. At one level, in fact, nuclear weapons mean the end of classical conventional war of the kind envisaging acquisition of large swathes of territory, or a *blitzkrieg* effort to cause high attrition. Any such measure is certain to breach the threshold of the adversary's levels of tolerance, especially one with weaker conventional capabilities. This could increase its dependence on the resort to use of nuclear weapons, thereby leading to deterrence breakdown. If deterrence is to be maintained, then the war needs to be fought differently, in a manner where the risk of escalation to the nuclear level is minimised because the targets are so chosen so as not to threaten the survival of the state or its critical elements.

This obviously has an impact on how victory and defeat can be defined in such a situation. In an all out conventional war, the difference between the victor and the vanquished is clearly evident, based on the estimation of which side has suffered greater losses and damage. But, in limited wars, in which the level of destruction has to be carefully calibrated and imposed, this distinction is blurred. In fact, as explained by Jasjit Singh, "As war starts to move down the intensity spectrum, victory and defeat shift more into political and psychological dimensions."[5]

An illustration of this is manifest in the experience of India and Pakistan during the Kargil crisis in 1999 and Operation Parakram in 2001-02. Coming soon after the overt demonstration of nuclear capability by India and Pakistan in May 1998, the start of these crises was greeted by strategic analysts everywhere with great pessimism and they were quick to dub them as the realisation of their worst fears

5. Singh, Ibid. It is also worth noting here that in modern warfare, the media plays a very important role in declaring who the winner is. It shapes perceptions and public mood that could be sometimes quite different from the reality on the ground. The 2007 Israel-Lebanon War presents a good illustration of this point.

when regional powers acquire nuclear weapons. Given the prevailing regional reality where nuclear-armed adversaries shared unsettled territorial disputes, a relationship marked by mutual hostility and distrust, routine border skirmishes and terrorist violence as a result of Pakistan-fomented proxy war in India, the apprehensions of the international community of conventional war quickly escalating to the nuclear level were perfectly understandable. However, the manner in which Kargil and Operation Parakram unfolded holds several lessons for Pakistan, India and the larger international community on how use of force is possible even in the shadow of nuclear weapons.

THE EXPERIENCES OF KARGIL AND OPERATION PARAKRAM

In May 1999, barely one year after going nuclear, Pakistan infiltrated approximately 5,000 soldiers in the guise of Mujahideen across the Line of Control (LoC) separating the Indian and Pakistani controlled regions of Kashmir. Their mission was to seize strategic pieces of territory and then compel the Indian government to negotiate the future status of Kashmir. Pakistani leaders believed that their recently demonstrated nuclear capability would deter India from using its conventional military superiority against Pakistan. Indeed, Pakistani leaders, military and even civilian, believed that the danger of nuclear escalation insulated them from Indian conventional attack, thus, allowing them to not only ensure their national security, but also pursue a provocative strategy in Kashmir.

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Accordingly, the Pakistani nuclear doctrine encapsulates a more offensive form of deterrence that seeks to change the status quo by holding out the threat of nuclear blackmail while deterring an Indian conventional attack. According to one analyst, "Islamabad is convinced that the mere threat of approaching the nuclear threshold will prevent India from

seizing the strategic initiative and military dominance of events, permitting Pakistan to escalate the crisis at will without the fear of meaningful Indian retribution."[6] Even amidst fighting in Kargil, the Pakistan Army leaders insisted, "There is no chance of the Kargil conflict leading to a full-fledged war between the two sides."[7] Interestingly, this was similar to the advice given by senior US military officers to President Kennedy during the Cuban crisis in 1962. They believed that the US could afford to launch a limited attack on Cuba because the USSR would not dare counter-attack in Germany. Pakistani military counsel to the civilian government too dismissed the chance of a total war because nuclear deterrence afforded it greater impunity and immunity. As a senior Pakistani official maintained, "The Indians cannot afford to extend the war to other areas in Kashmir, leave aside launching an attack across international boundaries" because of the "risk of nuclear conflagaration."[8]

This assumption was based on the Pakistani projection of a carefully cultivated strategy that escalation to the nuclear level was inevitable if India were to launch a major conventional attack. By suggesting this linkage, the military was sure it could raise the military and economic costs for India without endangering its own security to the risk of retaliation against the proxy war. In Western literature, this has been described as the "risk maximizing approach" that relies on the enemy's fear that pressure exerted from its side could "provoke a viscerally violent response rather than a rationally restrained one."[9] By making nuclear threats, it seeks to manipulate risks to its advantage even if following through on them would be nothing short of suicidal for itself. Whether this would really happen or not, Pakistan banks on uncertainty or irrationality about its actions for deterring India.[10]

6. Yossef Bodansky, "Pakistan's Nuclear Brinkmanship," Freeman Centre for Strategic Studies, Israel. Available at http://www.freeman.org
7. Ihtasham ul Haque, "Peace Linked to Kashmir Solution," Dawn Weekly Wire Service, June 26, 1999. As cited in Peter Lavoy, Scott Sagan, J. Wirtz, eds., *Planning the Unthikable* (Ithaca, NY: Cornell University Press, 2000), pp. 248-249.
8. Quoted in Zahid Hussain, "On the Brink," *Newsline*, June 1999, pp. 24-25.
9. Thomas Schelling, *The Strategy of Conflict* (London: Oxford University Press, 1960).
10. Interestingly, in his book *In the Line of Fire*, Gen Musharraf has alluded to his commando personality that prodded him to be a risk taker.

Subscribing to this logic, Islamabad assumed that India would find its military options checkmated by the presence of a nuclear overhang and would be compelled to negotiate. The achievement of a rough nuclear parity was considered enough to offset asymmetry in conventional capabilities. Also, given that ever since May 1998, an anxious US had consistently described South Asia as a dangerous nuclear flashpoint, Pakistan hoped that Washington would not hesitate to intervene to resolve the crisis and even formalise a new status quo in Kashmir, which could then be claimed as victory for Pakistan. This internationalisation, it was naturally believed, would work in Pakistan's favour.

However, that is not how the saga unfolded. India's response, hesitant in the first two weeks whilst the military still believed that the action in the area was by unusually well armed irregulars and terrorists, became far more considered and calibrated as soon as greater clarity about the ground situation emerged. The army and air force undertook coordinated actions with a clear objective of dislodging the Pakistani forces without foreclosing any future options. But the political leadership imposed on them the constraint of confining their military operations to the Indian side of the LoC. While this imposition came with its challenges, two factors worked in India's favour. Firstly, having first claimed that the intruders were not really its own troops but independent Mujahideen, Islamabad found itself constrained to provide its troops with any reinforcements to fight the Indian military offensive that came in the form of artillery barrages as well as air attacks. Secondly, once the international community knew of the subterfuge, Pakistan was seen as the aggressor and pressured, even by its traditional friends, Washington and Beijing, to withdraw from the occupied heights. In fact, the US, which had shied away from assigning blame to a particular party for having initiated a crisis in previous wars between India and Pakistan, squarely condemned Pakistan's incursions and intentions across the LoC and refused to mediate. China too counselled

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Prime Minister Sharif, during his visit to Beijing, that Pakistan should abandon its plans. A more sympathetic response from its traditional allies might have emboldened Pakistan to carry on. But faced with escalating casualties, economic losses due to sanctions and diplomatic isolation, Prime Minister Nawaz Sharif was compelled to reconsider continuing military operations, even in the face of advice to the contrary by his own military commanders.[11]

The war highlighted the politico-diplomatic dimensions of modern wars, especially where nuclear weapons are concerned. Even as the Indian military moved on the ground to oust the infiltrators, attempts were simultaneously mounted to diplomatically isolate Pakistan and expose its offensive designs to alter the status of the LoC, a line whose sanctity had long been upheld as the very basis of a negotiated settlement for the disputed territories in the region. In fact, Kargil, for the first time, made India reap the benefit of "internationalisation" of the Kashmir issue, a ploy often used by Pakistan and desisted by India. In this instance, the US intervention sought by Pakistan turned to India's advantage for two reasons: one, as the Indian Army routed back Pakistani forces and moved closer to the LoC, the risk of extension of war across the LoC increased. With this also increased the fear of military escalation. Having already limited the Indian Air Force (IAF) to operating in a difficult situation on its own side of the border, New Delhi was willing to

11. In fact, there has been a war of words between Pakistan's political and military leadership of the time, with each blaming the other for the Kargil debacle. Gen Musharraf has never tired of recounting the "political mishandling" of the situation and the attempts to "spin the events disingenuously." See Pervez Musharraf, *In the Line of Fire: A Memoir* (New York: Free Press, 2006), pp. 95-98. On the other hand, then PM Nawaz Sharif has maintained that he was never briefed on the military operations in Kargil. Meanwhile, Benazir Bhutto has stated that the army had shared the plan with her when she was PM, but that she had vetoed it even though she had sensed that the army chief was taken in with the "brilliance of military strategy." See Samina Ahmed, "Nuclear Weapons and the Kargil Crisis," in Lowell Dittmer, ed., *South Asia's Nuclear Security Dilemma: India, Pakistan and China* (London: East Gate, 2005), p. 143.

accept US intervention to control Pakistan; secondly, flowing from the show of Indian maturity and self-control in handling a provocative situation, the US' perception of India and its nuclear status underwent a change. This enabled the blossoming of a strategic relationship that has been far more understanding of the Indian security environment and compulsions.

Kargil ended in July 1999, roughly two months after it had started, as an ill thought out misadventure by Pakistan. However, it was useful to the extent that it illustrated (to those on both sides of the border who are willing to rationally assess it) the limits that nuclear weapons cast on the actions of nations. Pakistan realised that the acquisition of nuclear weapons had not provided it with a *carte blanche* on disruptive actions across the border. Rather, the presence of nuclear weapons placed clear limits on how far it could, or should, go, so as not to breach the limits of Indian tolerance. This, in fact, has several lessons for the major assumptions that underlie Pakistan's nuclear strategy.

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Meanwhile, the Kargil episode made India realise the constraints that the presence of the adversary's nuclear weapons cast on its own exercise of military options. Despite the widely expressed opinion to strike against Pakistan, once the identity of the Mujahideen as regular Pakistani soldiers was established beyond doubt, the political leaders imposed upon the military to undertake operations in such a way that the threat of escalation was minimised. Therefore, in an unprecedented gesture, the use of air power was limited to the Indian side of the LoC in order to oust the illegal occupants of the heights. No strikes were authorised across the border, not even at the terrorist infrastructure known to exist in Pakistan Occupied Kashmir (POK). This was in stark contrast to the Indian response to Pakistan's Operation Gibraltar in 1965. Even then, Gen Ayub Khan's military regime had sent Pakistani regular forces disguised as Kashmiri dissidents into the region. This operation was premised on the belief that India would not have the stomach to spread the conflict beyond the disputed territory and, thus, enable Pakistan to

The political leaders imposed upon the military to undertake operations in such a way that the threat of escalation was minimised.

succeed with its revisionist plans of occupying some chunks of territory. But, at the time, India, despite its weak military position so soon after the 1962 defeat at the hands of China, had not hesitated to extend the conflict beyond the international boundary.

The case with Kargil was just the opposite since despite its position of conventional superiority, India exhibited the ability to wage a war with self-imposed limits. This proved to be as much a revelation to Pakistan as to the larger international community that had described this very region as the most dangerous flashpoint. The sense of responsibility and maturity in action displayed by India did help to shape a range of perceptions across several capitals. The nuclear Non-Proliferation Treaty (NPT) ordained nuclear weapon states realised that nuclear weapons in the possession of regional powers were no more or less dangerous than when in their own arsenals. Islamabad and New Delhi, meanwhile, realised the strengths and limitations of nuclear weapons.

Some of these lessons were again put to test in December 2001 after the Pakistan-supported terrorist attacks on the Indian Parliament. It is a striking coincidence that this incident took place three months after 9/11 when a hijacked airliner was believed to be headed for a collision with Capitol Hill, the seat of the American Parliament. While the aircraft failed to reach the target, the terrorists in New Delhi partially succeeded in breaching the security of the Indian Parliament and managed to reach till one of its gates before being shot dead. However, a strike against a potent symbol of Indian democracy, and at a time when Parliament was in session, the incident ignited aggressive sentiments from the Indian polity, public and military. A significant section of the political voices, military advice and editorial opinion clearly argued in favour of targeting terrorist training camps in POK. In a show of resolve, the political leadership did authorise the mobilisation of military forces on the international border and the LoC in Kashmir. The move elicited a reciprocal response from across the border. The international community

watched with concern as Operation Parakram unfolded. At one time, some governments even issued travel advisories to their nationals visiting or residing in this part of the world to indicate the seriousness of the situation between two nuclear-armed nations with fully mobilised militaries on high alert on the borders. However, despite the high level of military preparedness, India and Pakistan did not actually go to war. While this is attributed to a range of reasons, including external influence, diplomatic parleys, economic constraints, etc., the presence of nuclear weapons is not something that can be overlooked.

In this instance, India practised compellence or what has been described as "coercive diplomacy"[12] that involved a combination of diplomatic and military pressure. The basic aim was to force the Pakistan government to accede to India's demands of halting all support to cross-border terrorism and to take action against terrorist outfits known to be operating from its soil or else be prepared for military action. However, Jaswant Singh, then foreign minister has listed three aims for the mobilisation[13]:

(a) To defeat the cross-border infiltration/terrorism without conflict. To this end, the government tried to contain Pakistan diplomatically.

(b) To contain the national mood of 'teach Pakistan a lesson.' This required managing the country's sense of outrage and desire for revenge and retaliation by not necessarily waging a war but providing a sense of achievement to the country by diplomatically defeating the enemy.

(c) To destroy and degrade Pakistan's war-fighting capabilities in the event of war. In readiness for such eventuality, the military was placed on a state of high alert. However, the challenge lay in getting the armed forces leadership to recognise the value of restraint as a strategic asset.

Despite the high level of military preparedness, India and Pakistan did not actually go to war.

However, as is often the case in any war, these aims appear far more clearly articulated in retrospect than when they came out at the time of the crisis. At that time, the Indian

12. Jaswant Singh, *A Call to Honour* (New Delhi, 2006), p. 266.
13. Singh, Ibid., p. 268.

In both cases, Kargil and the attack on the Indian Parliament, Islamabad was emboldened to take the step in the belief that the hands of India's military would be tied, preventing it from taking any decisive military action against Pakistan.

policy seemed a bit rudderless, especially once Islamabad denied its involvement in any such activities and reciprocated with its own military preparations. At this juncture, the presence of nuclear weapons did compel India to reconsider and reevaluate its military options because neither could it ratchet up the crisis, given the possibility of the conflict escalating to the nuclear level and leading to destruction far higher than anticipated, nor could it wind down the mobilised war machinery without having achieved the political objectives first articulated. Some of these were claimed to be met on January 12, 2002, when President Musharraf, in an address to the nation, announced that Pakistan would no longer be used as a base for terrorism of any kind, and that it would ban the Lashkar-e-Tayyaba and Jaish-e-Mohammed, implicated in the attack on the Parliament. However, the Indian military remained mobilised and the Indian resolve to take action against Pakistan strengthened after the Kaluchak terrorist massacre in May 2002 when families of troops mobilised at the border were killed. Help from the US at this point to coerce President Musharraf to make a public statement decrying terrorism and banning the outfits came in useful in defusing the tension. After Pakistan's commitment, made in a public announcement in early June 2002, to halt its support for cross-border terrorism, the war machinery wound down after a half-year-long mobilisation, and it was business as usual.

In both cases, Kargil and the attack on the Indian Parliament, Islamabad was emboldened to take the step in the belief that the hands of India's military would be tied, preventing it from taking any decisive military action against Pakistan. Simultaneously, Pakistan played the nuclear card at the international level, leaning heavily on the international community to restrain India if it wanted to avoid nuclear use in the region. Pakistan's ambassador to the UN made it clear

in May 2002 that Pakistan would not "expend our limited resources on building up a conventional defence which will completely debilitate our development... We have to rely on our means to deter Indian aggression. We have that means and we will not neutralise it by any doctrine of no first use."[14]

Indeed, India did feel the weight of nuclear weapons on its possible courses of action. But it also discovered that there was scope for retaliatory action that had to be intelligently discovered and exploited and astutely meshed with politico-diplomatic measures best suited to the prevailing international political environment. This, if effectively employed, brought the possibility of achieving important political gains without actual resort to military action, or use of force without war. Pakistan failed to understand this basic feature of modern warfare during Kargil and Operation Parakram. As stated by one American strategic analyst, "The loss of its vital US ally and the non-appearance of Chinese support suggest a poor appreciation for alliance considerations and international reactions to the attack."[15]

India needs to understand the role of external players in a bilateral relationship between two nuclear-armed neighbours. While such interference and the possibility of "internationalisation" of the Kashmir dispute were considered anathema to the Indian administrations in the past, the experiences of the two crisis situations post-1998 have shown the benefits of US mediation. This is not to suggest that India should depend on the US or other states to deal with its security concerns vis-a-vis Pakistan, but to highlight that in the Indo-Pakistan relationship, especially in the presence of nuclear weapons, the role of external powers would be greater, given that their apprehensions of nuclear use are more. Nevertheless, India would have less to fear

Pakistan is able to exploit far greater space at the lower level of sub-conventional conflict. It derives immunity against conventional war by raising the risk of escalation to the nuclear level.

14. As quoted by Timothy D. Hoyt, "Strategic Myopia: Pakistan's Nuclear Doctrine and Crisis Stability in South Asia", in Dittmer ed., n. 11, p. 120.
15. Hoyt, Ibid., p. 130.

from this influence in the future since a mature handling of the situations by India has helped create the distinction in American mind on the behaviours of the two nations. Therefore, the US that earlier never tired of straitjacketing its nuclear policies into the same mould for India and Pakistan, is today willing to treat them differently. An adept use of growing Indian influence with the US could certainly help to keep Pakistan from playing the game of nuclear brinkmanship.

THE CONDUCT OF LIMITED WAR

As explained in the previous section, the nature of warfare changes with the entry of nuclear weapons into the calculations, and, hence, the concepts, doctrines and capabilities must also keep apace. Of course, at one level, the regional reality for India remains unchanged as its security grapples with two adversaries, both of whom are nuclear armed and close to one another, and with both of whom India has unsettled territorial disputes, mutual hostility and distrust, and routine border skirmishes. None of this has diminished with the establishment of nuclear deterrence. Rather, the challenges have been further complicated since the presence of nuclear weapons considerably raises the threshold of provocation. So, Pakistan, for instance, is able to exploit far greater space at the lower level of sub-conventional conflict to indulge in acts seeking to destabilise India. It derives immunity against conventional war by raising the risk of escalation to the nuclear level. This is a strategy that Pakistan has crafted to perfection. The challenge for India, therefore, lies in nullifying the advantage that the adversary seeks to exploit from the linkage between nuclear deterrence and conventional war.

Limited war offers one possible response to the situation without the danger of nuclear escalation. As the very term indicates, limited war means a restrained, calibrated use of force instead of an all out employment of military capabilities. Normally, militaries do not welcome constraints on the use of their resources. For them, the achievement of victory in war is the final and singular objective and their military might is meant to be effectively used as a tool in the pursuit of this goal. However, if an all out war was to be fought with nuclear weapons, then victory at the cost of losing a nation would appear self-defeating if not downright foolish. Hence, the significance of limited war. Obviously, this would involve a

revision of conventional warfare tactics that hold the risk of breaching the adversary's nuclear threshold to a version where short, sharp wars, limited in time, scope and intent, are undertaken. Therefore, military strikes would either need to be restricted in depth into enemy territory and spread in geographical expanse, or limited in scope to carry out deeper, narrow thrusts into adversary territory in order to remain well away from the expressed/perceived 'red lines' of the nuclear threshold.

In the case of Pakistan, with whom the chances of deterrence breakdown are deemed to be higher than with China[16], red lines of some sort were spelt out by Gen Khalid Kidwai of the Strategic Plans Division, the organisation in charge of Pakistan's strategic assets and policy in 2001. These were: loss of large parts of territory (space threshold); destruction of large parts of land or air forces (military threshold); economic strangulation (economic threshold); and political destabilisation or large-scale internal subversion (domestic destabilisation threshold). Evidently, the broad areas covered by this articulation are clearly meant to indicate a very low nuclear threshold for Pakistan's nuclear use. However, it is imperative that the Indian national security establishment draws up its own estimation of the credibility of these threats. For instance, on the space threshold, it can be safely determined that even a deep penetration by India into the barren desert area of Pakistan is unlikely to breach its nuclear threshold though a similar depth in the populated areas of Punjab would be viewed differently. Similarly, air strikes against terrorist infrastructure and assets in POK are likely to evoke less response than targeting of military assets elsewhere in Pakistan. Such

Military strikes would either need to be restricted in depth into enemy territory and spread in geographical expanse, or limited in scope to carry out deeper, narrow thrusts into adversary territory.

16. Even though China is considered the larger potential threat for Indian security owing to the possibility of clash of interests for resources and spheres of influence in the coming decades, it is with Pakistan that the dangers of deterrence breakdown are more pronounced owing to its pursuit of asymmetric warfare with India and a more aggressive offensive defence military strategy. Meanwhile, the doctrinal similarities of no first use and the acceptance of nuclear weapons as a political tool of deterrence rather than war-fighting, make nuclear deterrence between India and China appear far more stable.

Display of such military preparedness in the absence of political resolve to use even limited capabilities also sends wrong signals to the adversary, thereby degrading the deterrence at even the conventional level.

assessments are necessary in the case of every threshold if India is not to be self-deterred from undertaking action against provocative conduct of sub-conventional war by Pakistan. The possible military response, meanwhile, would have to be in keeping with the concept of limited war along the following parameters.

One, there is an urgent need to reconsider the existing model of troop mobilisation. As was learnt from the experience of Operation Parakram, full mobilisation of that kind in the presence of a nuclear-armed adversary is hardly an effective proposition, besides being dangerous. Moreover, display of such military preparedness in the absence of political resolve to use even limited capabilities also sends wrong signals to the adversary, thereby degrading the deterrence at even the conventional level. Therefore, the Indian military has to look for options that allow it to undertake short, shallow strikes/thrusts into adversary territory in areas that would make a difference.

Those arms of the military that offer the maximum possibility of highly calibrated escalation and the ability to deescalate must undertake these operations. Therefore, use of such instruments as special forces (especially raised and trained for the purpose) or air power or even maritime power with the requisite capabilities would be preferred options. Such employment of force could be best conducted with maritime or air power because they enjoy, in varying measure, the advantage of flexibility of employment, as well as better control over military engagement and, hence, over escalation. Air power provides the greatest benefits in this regard while land forces have little advantage in terms of escalation control. Once engaged in combat, the army cannot be disengaged unless one or the other side either concedes defeat or a ceasefire is agreed upon. Meanwhile, air power helps show resolve and, at the same time, offers the flexibility of disengagement, thereby making it possible to

control escalation. Therefore, as a second measure, adequate attention must be given to understanding the advantages and limitations of each Service in different scenarios. Such issues need to be adequately considered and deliberated upon in peace-time in order to meet the requirements during a period of crisis.

Thirdly, India must consistently build up its conventional capability in order to keep the nuclear threshold as high as possible. The thrust areas for modernisation must include reconnaissance, surveillance, and intelligence capabilities that can enable precise target acquisition and attack, as well as air attack capabilities with precision guidance in order to minimise risk of collateral damage. This would not only reduce chances of escalation but also garner greater acceptance from major powers that could then be counted upon to bear down upon the adversary to see reason and temper its responses accordingly.

Fourthly, and most importantly, it is imperative that India continuously works at enhancing the credibility of its nuclear deterrence. This demands moving towards a survivable second strike capability. Given its no first use posture, India has committed itself to a retaliation only policy and, hence, is required to concentrate on increasing the survivability of not just the warhead or the delivery vehicle but also the entire command and control structure, communication networks and, above all, the survival of the political will to retaliate. Survival of the weapon would mean little in case the political leadership is not adequately prepared to understand the demands of nuclear deterrence. Also, it must be appreciated that political will in a democracy depends a great deal on the perceived legitimacy of action. National will arises from, and can be built by, articulating and encouraging a clear understanding of national interest and policy options to pursue them. These are challenging issues and must be accorded the attention they deserve.

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In conclusion, it may be stated that while nuclear deterrence imposes restraints on conventional war, it is not possible for all

While nuclear deterrence imposes restraints on conventional war, it is not possible for all wars to be obviated in their presence.

wars to be obviated in their presence. In difficult regional circumstances such as the kind that India finds itself in, the possibility of conventional wars exists. Theoretically, therefore, there is also the possibility of escalation of a conventional conflict into an unwanted nuclear exchange. However, if India was to be self-deterred by this thought, it would mean complete erosion of both its conventional and nuclear deterrence capabilities. In order to deter war, India must maintain and project a high level of conventional capability that would be intelligently applied in a calibrated manner to keep the use of coercive force well below the assumed red lines of the adversary. In order to deter nuclear war, India must illustrate its ability to handle deterrence breakdown and retaliate against the adversary with enough capability and resolve to inflict damage that would impose a cost far beyond the value of the stake that made the first use of nuclear weapons against India thinkable.

DEFENCE PROCUREMENT: CHALLENGES AND NEW PARADIGM SHIFT

J.V. SINGH

INTRODUCTION

Defence procurement has been a challenging task from the beginning. The reasons for the peculiar characterstics of procurement for the armed forces emanate from the fact that they are capital intensive, have long gestation periods, involve detailed and meticulous planning, and are prone to public scrutiny, hence, transparency is desirable in today's scenario. The armed forces need to acquire fresh capabilities to optimise their operational effectiveness, in tune with the country's growing economy and rising role in world affairs. India is one of the largest importers of defence products. Russia continues to be the biggest supplier of defence equipment and technology, with backlog valued at more than $ 8 billion, including the $ 1 billion refit of the *Admiral Gorshkov*, $ 750 million for the 16 MiG-29 Ks that will be based on the carrier, $ 850 million for upgrading 67 MiG-29s in the service of the Indian Air Force (IAF), $ 700 million for upgrading 140 Mi-17 helicopters, and $ 900 million for acquiring 80 new Mi-117s. Israel has emerged as a valuable partner in meeting India's modernisation requirements. The US, the biggest arms producer and exporter in the world, is also keen to enter the Indian defence market. Both countries signed a 10-year Indo-US defence framework in June 2005, for collaboration on multinational operations of common interest, including ballistic missile defence. The UK, Australia and some of the Commonwealth of Independent States (CIS) countries are also supplying defence goods to India.

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The process of globalisation and competitiveness has brought a discernible shift in the defence production with the emergence of joint ventures and conglomerates with networked dual use production.

The government has been repeatedly declaring that it wants to procure 70 per cent of its defence requirements from indigenous sources by 2010. However, the road is difficult and despite the best intentions and policy shift, the target looks distant. The process of opening of the Indian defence industry to the private sector began in 2001. It gathered pace with the constitution of the Kelkar Committee. In the recent past , the Ministry of Defence has introduced many bold and innovative policy initiatives through periodic revision of the defence procurement procedure. Offsets have since been made mandatory for all all high value imports costing more than Rs 300 crore. The government is keen to push the procurement process in the direction where the objective of hastening of the procedural intricacies with a view to ensure optimal utilisation of the allotted budget is coupled with the required transparency which is so very essential after the impact of cloud of kickbacks in previous major defence deals.

The process of globalisation and competitiveness has brought a discernible shift in the defence production with the emergence of joint ventures and conglomerates with networked dual use production. In such an environment, the Indian defence industry and defence procurement have to become increasingly collaborative with the private sector, in order to enhance the capabilities and core competencies in the emerging military technology sectors. The security concerns of India, due to its strategic location, its long coastline, distant island territories, and the continuing acts of terrorism from across the border, require India to maintain a high level of vigilance and defence preparedness. To this end, the armed forces are required to be adequately equipped with the best equipment available in the world, within the shortest possible time because in modern, state-of-the-art warfare, speed is the key to success in operational matters.

The aim of this paper is to examine the intricacies of the defence procurement, look at our experience so far, discuss the procurement policies and analyse various steps taken by the Government of India to streamline the procurement regime and steps needed to fine tune the process.

BACKGROUND

Defence procurement in India has been the subject of consistent and intensive scrutiny by Parliament as well as by the media. Attempts have been made from time to time to refine and improve the procurement process so as to ensure the purchase of the latest equipment in the shortest possible time and to get the 'best' value for the money spent. The criticism of defence procurements either on account of charges of corruption or not taking timely decisions, resulting in cost over-runs and delays in inductions, have surfaced at regular intervals. This was in a large measure due to the lack of transparency in procurement as well as because of the complaints and counter-complaints made by vested interests, including vendors as well as non-vendors who represented them in the country.

Acquisition of defence equipment is a complex and intricate process which has evolved over the years taking into account the threat perceptions, security environment and requirements of the defence forces.

Defence expenditure accounts for nearly 13 per cent of total central government expenditure, 23 per cent of non-Plan expenditure and around 2 per cent of gross domestic product (GDP) as of financial year 2008-09 budget estimates. In order to ensure better management of public money and procure defence equipment in the shortest possible time, a fast and transparent defence procurement policy is the need of the hour. Acquisition of defence equipment is a complex and intricate process which has evolved over the years taking into account the threat perceptions, security environment and requirements of the defence forces. Unlike procurement of other items, it is a long, deliberate and arduous process involving a number of steps like evolution of qualitative requirements (QRs) by the Services, acceptance of necessity,

The system governing defence procurement suffered from a lack of integrated planning, weaknesses in linkages between plans and budgets; cumbersome administrative, technical and financial evolution procedures; and an absence of a dedicated, professionally equipped defence procurement structure within the Ministry of Defence.

identification of suitable vendors, issuance of requests for proposals (RPFs), technical evaluation of offers, invitation for trials of selected equipment, General Staff evaluation and, finally, opening of the commercial quotes of the acceptable equipment. Care has to be taken at each step to maintain transparency and probity to ensure that the country gets best value for the money.

After the Kargil War in 1999, the government had set up a task force under Shri Arun Singh, former minister of state for defence, to look into the various aspects of defence management.This was in the light of the serious deficiencies which had been identified in India's security management system by the Kargil Review Committee (K. Subrahmanyam Report). The main focus of the task force's recommendation was "on bringing about improvements in the organisations, structures and processes through integration of civil and military components and by ensuring jointness amongst the armed forces to the extent desirable." This included defence procurement also.

The Group of Ministers that went into the recommendations of the Arun Singh Report felt that the system governing defence procurement suffered from a lack of integrated planning, weaknesses in linkages between plans and budgets; cumbersome administrative, technical and financial evolution procedures; and an absence of a dedicated, professionally equipped defence procurement structure within the Ministry of Defence. The Group of Ministers also came to the conclusion that the existing structure for procurement, has led to the sub-optimal utilisation of funds, long delays in acquisition and has not been conducive to the modernisation of the Services. They recommended the creation of a separate and dedicated institutional structure to undertake the

entire gamut of procurement functions, which was expected to facilitate a higher degree of professionalism and cost-effectiveness in the process. It was felt that such a structure would also enable an institutional memory to be built up and taken advantage of to obtain best value for the money spent by the government. While on the one hand, the Procurement Board, as envisaged, would ensure much closer participation by the armed forces in the entire process of decision-making, on the other hand, it would also result in higher operational efficiency and cost-effectiveness with better coordination and flow of information.[1]

The process of major defence procurement involves consultations, concurrence and approval of all departments under the Ministry of Defence (MoD), that is, the Departments of Defence Research, Defence Production, Defence Finance as well as the user organisations under the Department of Defence, namely, the army, navy and air force.

Parliament has also, from time to time, been examining defence procurements. The Parliament's Standing Committee on Defence in its 10th, 11th, 15th , 16th and 19th Reports had critically commented on the defence procurement procedures. It had recommended that the inefficiencies and bottlenecks in procurement processes and procedures, which had been identified by the government, should be removed. The committee had also repeatedly stressed the need to simplify, rationalise and bring transparency into the acquisition procedure together with ensuring timely procurement of defence equipment. In its report to the government, it had brought to the notice of the Defence Ministry that the defence procurement procedures were coming in the way of time-bound acquisitions of the armed forces where time was an important factor in equipping them , especially when India is facing a hostile security situation.

The defence procurement procedures were coming in the way of time-bound acquisitions of the armed forces where time was an important factor.

A large quantity of defence equipment is procured by the Ministry of Defence from diverse sources every year. In the earlier years, the procurement

1. Dr. Yogendra Narain, *Indian Defence Review*, vol. 18, October-December 2003.

It is not possible to have all equipment of the same generation at any given time as complete inventories cannot be turned over en-masse.

used to be mainly from the erstwhile Soviet Union. Even today, nearly 70 per cent of the hardware and weapons are of Soviet/Russian origin. An important factor in the earlier purchases from Russia was the 'friendship prices' at which India received all the equipment. Russia also offered easy payment terms stretched over 15 years. However, with the end of the Cold War, these simpler terms have given way to the successor nations wanting hard cash in dollars for their equipment and spare parts. It is now strictly business. The need, therefore, is for the MoD to lay down standard formats for different types of contracts. These standard formats should lay down the detailed structure as well as basic terms and conditions of the contracts. Although, efforts should be made to conclude contracts in the standard formats, the need for flexibility based on the country of origin, type of supply, length of contract and urgency of requirement would have to be catered for. The details of the contract can be jointly worked out. The factual modalities will follow. The Group of Ministers has recommended that the Ministry of Defence may, as far as possible, use the system of rate contracts.

CHALLENGES IN DEFENCE PROCUREMENT

India is heavily dependent on imports to meet its military hardware requirements for the three Services. Even after over 60 years of independence, cutting edge technologies have have not been developed in the country. This has resulted in the large scale dependence on foreign suppliers for defence procurements which are subjected to various constraints like technology denials, sanctions, higher costs, to name a few, by the exploiting countries. The reasons for the limited role of indigenous sources for high end technology hardware required by the three Services are many. Some of the unique features of defence equipment are as discussed below.

- **Cutting Edge Technology.** Most of the important defence equipment pertains to high end technology. It is quite natural since the Services seek the latest

high-tech systems with cutting edge technology with a view to maintaining superiority over a potential adversary. But the procurement of such technology is not easy as it is well protected and not available freely.

- **System Integration.** No original equipment manufacturer (OEM) produces a complete system. Invariably, sub-systems based on different types of hardware and software are to be procured from varied sources and then integrated into complex weapon systems. This entails close coordination amongst various agencies, making it a time consuming process.
- **Rapid Upgradation of Equipment**. It is not possible to have all equipment of the same generation at any given time as complete inventories cannot be turned over en-masse. Modernisation is a continuous process and is implemented in a planned phase and for which a three-tier approach is adopted. At the lowest tier is equipment of obsolete technology whose useful life-cycle is over and which needs to be phased out. The middle tier consists of the equipment which still has considerable residual life. Their technology is mature but still relevant. Most of our inventory falls under this category. The upper tier consists of the state-of-the-art equipment which acts as a force multiplier and is generally expensive.

Moreover, evaluation of such frontline technologies to ascertain their suitability to our environment is a time consuming process. The three-tier system implies maintenance and overhaul and upgradation of various systems assumes significance. Availability of spares and product support has to be ensured.

- **Constraints of Transparency.** Procurement of any major military equipment cannot be carried out by open advertisements most of the time. The degree of secrecy required to be maintained would vary. Also, the defence sector is usually under close government monitoring.On the other hand, transparency demands that maximum publicity be given and open competition be generated. These are contradictory requirements necessitating delicate handling.
- **Limited Vendor Base.** Due to unique requirements and restricted market friendliness, the vendor base for most of the defence equipment is limited. This often results in either a single vendor situation or a clear case of OEM dependence.

- **Quality Imperatives.** The defence equipment has to be of very exacting standards due to operational requirements and is usually ruggedised for use in extreme terrains and manoeuvring conditions. This often results in repeated user trials and frequent rejections, thereby, upsetting the supply chain.
- **Unique Requirements.** The requirements of defence spares are usually specific in nature and very rarely have commonalities of use elsewhere. Therefore, competitive manufacturing and vendor development practices prevalent in the automobile or retail industry may not always be applicable here.
- **Maintainability Costs.** The product's cost and its life span are considerably high. Typically, a combat aircraft has a life span of about 30 to 40 years. Therefore, after sales support is revenue intensive. Maintainability and system reliability are the key considerations in determining life cycle costs.[2] The product support is also governed by a very rigid and tight resupply window, particularily in operations.
- **Procurement Time.** Due to a combination of the factors enumerated above coupled with administrative and procedural requirements and related financial sanctions, the lead time of procurement in most of the cases is considerably high. This results in multi-layered and multi-tier holding of stocks to meet user criteria. This obviously jacks up the inventory carrying cost, a phenomenon which is scrutible in a democracy.
- **Insurance Holdings.** Quite often, the Services are forced to stock and maintain assets for which there may be no requirement in the foreseeable future; however, holding of the stocks becomes mandatory either due to OEMs going out of the supply line, denial regime scenario, lack of alternate sources of supply or due to operational reasons where non-availability ex-stock would be prohibitive when the chips are down. This results in financial strain and political leveraging by interested countries.
- **Problem of Obsolescence.** The rapid advances in military technology and frequent upgrades result in faster obsolescence of military equipment. This calls for a balanced and well thought out strategy to manage obsolescence to

2. Samir Chabra, *Air Power,* vol.3, no.3, Monsoon 2006 (July-September).

avoid a situation of landing up with non-moving and surplus inventory. The management of spares holdings has to be, therefore, well calibrated.

The procurement for the defence sector is undertaken under capital and revenue heads and budgetary allocations are made accordingly. The ratio of procurement from imported sources and that from indigenous sources has been gradually tilting favourably towards the indigenous component.[3] The ratio also varies from Service to Service. As per the data available from sources of the MoD, the percentage-wise break up of procurement made through imports and from indigenous sources during the last five years starting 2001 is as follows (Table 1).

Table 1: Percentage-wise Break up of Procurement from Imported and Indigenous Sources

Year	Navy		Army		Air Force	
	Imported	Indigenous	Imported	Indigenous	Imported	Indigenous
2000-01	36	64	46	54	81	19
2001-02	49	52	34	66	74	26
2002-03	50	50	65	35	70	30
2003-04	58	42	52	48	76	24
2004-05	58	42	42	58	62	38

From the data given above, it is evident that there has been a gradual but steady increase in percentage of indigenous procurement except in the case of the Indian Navy. Hopefully, this trend will continue and with new initiatives, including the offsets clause, the indigenous defence industry will flourish. Details of capital and revenue procurement from imported and indigenous sources between 1995-2005 are as follows (Table 2).

As evident, the sum total of capital and revenue procurement is also tilting in favour of the indigenous sources.

DISTINCTION BETWEEN ACQUISITION AND PROCUREMENT

At times, the terms acquisition and procurement are used synonymously. There is a difference as acquisition includes design, engineering, test and evaluation,

3. Sixth Report Standing Committee on Defence (2005-2006), December 2005.

Table 2: Percentage of Capital and Revenue Procurement Imported Vs Indigenous 1995-2005			
Year	Procurement Stores(Revenue+ Capital) (Rs. in crore)	Percentage of Indigenous Procurement	Percentage of Imported Procurement
1994-95	12,610	31%	69%
1995-96	14,857	31%	70%
1996-97	15,953	31%	69%
1997-98	18,006	44%	56%
1998-99	20,882	54%	46%
1999-2000	26,674	54%	46%
2000-01	27,440	53%	47%
2001-02	31,353	58%	42%
2002-03	31,089	54%	465
2003-04	34,021	59%	41%
2004-2005	40,347	58%	42%

production, operations and support of defence systems. The term "defence acquisition" generally applies only to weapons and related items, such as military specialised vehicles, and information technology systems, processes, procedures, services and end products. An acquisition programme is a directed, funded effort that provides a new, improved, or continuing material, weapon or information system or service capability in response to an approved need. On the other hand, procurement is the act of buying goods and services from the government. Procurement is, in fact, one of the many functions performed as part of the acquisition process. For example, non-weapon and non-information technology items required by the MoD, such as passenger vehicles, office supplies, and maintenance items are "procured", they are not subject to the full range of functions inherent in the acquisition process of weapons and information technology systems. Information technology systems include both national security and automated information systems. National security systems used for intelligence and cryptogenic activities and command and control, are integral to a weapon system, or critical to the direct fulfillment of a military or intelligence mission. On the other hand, information systems that are usually

associated with performance of routine administrative and business tasks such as payroll and accounting functions are to be procured.

DEFENCE PROCUREMENT ORGANISATION

The defence procurement organisation consists of the Defence Acquisition Council (DAC), Defence Procurement Board (DPB), Defence Production Board (DPB), Defence R&D Board, and Acquisition Wing. The composition and functions of each of the above are given below.

Defence Acquisition Council (DAS)

It is an overarching structure under the Raksha Mantri (RM). It consists of the Raksha Rajya Mantris, Chief of Army Staff (COAS), Chief of Naval Staff (CNS), Chief of Air Staff (CAS), defence secretary, secretary, department of defence production (DP), secretary, research & development (R&D), secretary (defence finance), Chief of Integrated Defence Staff (CIDS) and special secretary (acquisition). The DAC has been tasked to give approval in principle to capital acquisitions in the Long-Term Perspective Plan (LTPP) covering a 15-year time span at the beginning of a Five-Year Plan period. It also approves all capital acquisition projects, identifying them as "buy" and "make" cases (purchase followed by licensed production). Monitoring the progress of projects based on the feedback from the Defence Procurement Board is also its responsibility.

The DAC has been tasked to give approval in principle to capital acquisitions in the Long-Term Perspective Plan (LTPP) covering a 15-year time span at the beginning of a Five-Year Plan period.

The decisions of the RM, based on DAC deliberations, flow down for implementation to the Defence Procurement Board, Defence Production Board and Defence R&D Board.

Defence Procurement Board (DPB)

It functions under the defence secretary and has the secretary (defence

production) secretary (defence R&D), secretary (defence finance), vice chiefs of the three Services and special secretary (acquisition) as members. It oversees all activities related to "buy" and "buy and make" decisions of the DAC. It is responsible for the coordination , supervision and monitoring of the acquisition process. It has been tasked to examine proposals from the Acquisition Wing regarding procurement procedures and make necessary changes in the procurement process after obtaining the approval of the RM.

Defence Production Board

It functions under the secretary (DP) and oversees all activities related to the indigenous manufacture under the Department of Defence Production flowing from the "buy" and "make" decisions of the DAC.

Defence R&D Board

It is chaired by the secretary (defence R&D)and is responsible to progress, monitor and report on all indigenous proposals flowing out of the "buy" and "make" decisions of the DAC. The board is responsible for providing project specific recommendations for the "design, production, induction" planning process, for the approval of the RM.

Acquisition Wing

The Defence Procurement Board is assisted in its functioning by an Acquisition Wing in the Department of Defence. All matters concerning acquisition of capital nature are dealt with by it. it is an integrated set-up, with officers from the Department of Defence and Finance Division and Services Headquarters. It is headed by an additional/special secretary (acquisition) and is assisted by financial adviser (acquisition) who also functions as the integrated financial adviser and heads the finance branch in the Acquisition Wing. The wing consists of four divisions namely land, maritime, air force and systems. Each division has a joint secretary designated as acquisition manager, and a Service officer of two-star rank designated as technical manager.

Need for Changing Defence Procurement Procedure 2002 (DPP 2002)

With the experience gained in the last three years, the Ministry of Defence realised that there are some problems in implementation of DPP 2002 that need to be resolved to further streamline the process of acquisition. This has been necessitated due to the realisation that there is a need to compress the time-frame and delineate clear time-frames at each stage of acquisition to ensure optimal utilisation of the capital budget allocation, reduce the time taken at the acceptance of the 'necessity' stage, evolve a system of open tendering for non-sensitive security equipment, and put in place a nodal mechanism for formulating joint qualitative requirements (QRs) for equipment of tri-Service nature. In addition, it is required to provide guidelines in regard to application of discounted cash flow (DCF) for evaluating offers with different payment terms and involving cash flow over a period of time and exchange rate variation (ERV) in respect of Defence Public Sector Undertakings (DPSUs) in order to make the procurement process more transparent and objective, expedite processing of indents placed on the Ordnance Factory Board (OFB) and schemes entrusted to the Defence Research and Development Organisation (DRDO) and include "offsets" in the request for proposal (RFP) on a case to case basis to avail of direct benefits like technological transfer and exports, etc. and integrity pact as part of the standard conditions of contract.

DEFENCE PROCUREMENT PROCEDURE 2006

The Defence Procurement Procedure 2002 (version June 2003) needed a review in the light of experience gained over the years and also to incorporate suggestions received from the Central Vigilance Commission, Comptroller and Auditor General, and Ministry of Finance from time to time, to streamline the procedure and to remove the impediments in the acquisition process. In order to meet the objectives of greater transparency and accountability in all acquisition processes, and reduction in the acquisition time cycle as also in view of the mandatory requirement of a review of DPP-2002 after two years, the government brought forward a new DPP-2006. DPP-2006 has come into effect from July 1, 2006. The salient features of the DPP-2006 have made the qualitative requirements further broad-based to avoid single vendor situations, and provisions have been incorporated to obtain up to 30 per cent direct

offsets in acquisition cases of more than Rs. 300 crore. This is in line with the Kelkar Committee's recommendation and has been incorporated to benefit Indian industry. Provision for an integrity pact has been made in the RFP for purchases over Rs. 300 crore, and the standard contract document has been made a part of the RFP soliciting techno-commercial offer. This will provide a level playing field to the bidders and, in addition, bring objectivity and transparency into the process of preparation of joint Services qualitative requirements for common equipment of the three Services. Also, evaluation criteria have been made more objective, incorporating some of the suggestions made by the Ministry of Finance, and a broad time-frame for the completion of different procurement activities has been prescribed for processing procurement cases to expedite the acquisition process.

DEFENCE PROCUREMENT MANUAL-2006

While the Defence Procurement Procedure addresses predominantly the procedure for capital acquisition flowing out of "buy" or "buy or make," with the transfer of technology (TOT) option, there was no uniform manual for revenue expenditure, which accounts for nearly 55 per cent of total revenue expenditure of the Government of India. The government, therefore, announced the Defence Procurement Manual-2006 for revenue procurement.

The salient features of the Defence Procurement Manual-2006 (Revenue Procurement) have made the RFP for both indigenous and foreign procurement transparent, enumerating short listing and award criteria; uniformity has been brought in for the interpretation of various contracting clauses and issues. A broad time-frame has been prescribed for each state and process of procurement so as to cut down delays and bring in accountability and general guidelines for assessing reasonability of prices.

Procurement Objectives

The procurement agency is responsible and accountable to bring efficiency, economy and transparency in procurement and to provide fair and equitable treatment of suppliers and promotion of competition in public procurement. Hence, the procedure must conform to the criteria that invitation of offers

should be fair, transparent and well disseminated, the specifications must incorporate the quality, less superfluous and non-essential features, and quantity, to avoid unwarranted expenditure. Further, the selected source should meet the requirement in all respects, ensure that the price of the selected offer is reasonable and consistent with the quality required, bring transparency at each stage of procurement and, the facts to be recorded, in precise terms, including the considerations which weighed with it while taking the procurement decision.

TYPES OF PROCUREMENT

Defence procurement is mainly of the following types:

Capital Procurement

The procurement which increases the assets of the material, for example, new construction equipment or its initial maintenance. The detailed procurement procedures for capital procurement are given in the DPP-2006. The revised DPP-2008 has also been issued.

Revenue Procurement

All expenditures relating to maintenance and working activities such as renewal, replacement for equipment sub-systems components to maintain and operate already sanctioned assets are called revenue procurement. These are procured under the delegated financial powers as per rules.

Indigenous Procurement

Most of the defence equipment is of foreign origin. Government policy is to achieve self-reliance through indigenising systems and sub-systems of such equipment. The indigenous firms are encouraged to produce and supply goods conforming to the specifications.

Foreign Procurement

The procurement of equipment ex-foreign origin or a foreign source, where the

technology or knowhow is not available from indigenous sources falls in this category.

Central Procurement

Central procurement is done for items which are beyond the local purchase powers of the functionaries and against the indents resulting from the provisioning process. This is being done by a central agency to cover the entire requirement of the item during the provisioning period.

Local Procurement

This is restricted to urgent requirement of the department and is undertaken under the powers of the local authority.

PURCHASE POLICY

The salient features of the purchase policy of the government contain three important clauses pertaining to product reservation, price preference and purchase preference. The product reservation clause entails that certain items have been reserved for the small scale and handloom sectors and Khadi Bhandars. Such units are also exempted from payment of security deposit as per the financial rules 2005. The price preference entails that as per the government rules, the small scale industries (SSIs) sectors are given price preference upto 15 per cent, subject to certain conditions. The purchase preference clause contains that the central public sector units are given purchase preference in case the Central Purchase Scrutiny Committee (CPSC) quoted price is within the 10 per cent of the L1 (lowest bidder) price. This is applicable in the case of procurement is over Rs. 5 crore and where the government holding in the CPSC/joint venture is more than 51 per cent, and certain other conditions.

FAST TRACK PROCEDURE (FTP)

With a view to facilitating acquisition of defence equipment in a shorter time-frame, a need was felt to have in place an FTP to ensure quick procurement during a crisis situation. Thus, an FTP was promulgated in September 2001

after its approval by the Cabinet Committee on Security (CCS). The salient feature of the FTP is that the need for adoption of FTP must emanate from the Service chief. It is routed through the DPB for the consideration of the RM. The requirement should relate to an imminent operational situation or a crisis without warning. The procurement process starts only after the RM's approval. Further, it is confined to items which are likely to be available within the laid down time-frame of 12 months. Items should preferably be those which are in service or which have already been trial-evaluated. In exceptional cases, a trial team may be sent to the vendor's premises for a quick evaluation. The financial powers of the various competent financial authority (CFA) under the fast track procedure entail the powers of the RM as Rs 300 crore, the RM and FM from Rs 300 to 400 crore and the Cabinet Committee on Security (CCS) for all purchases above Rs 400 crore.

During the period between October 2001 and July 2006, a total of 62 cases were approved under the fast track procedure. An analysis of the time taken in the process of procurement in these cases is as follows (Table 3).

It is evident from the above information, that in 31 per cent of the cases approved by the DPB under the FTP, it had taken more than 12 months to finalise the contract, hence, they qualify to be processed under the FTP. However, these cases were for meeting urgent operational requirements on the recommendations of the chiefs of the concerned Services. It is true that in 31 per

Table 3

	Cases Approved	Contracts Signed	Contracts Signed Within 06 Months	Contracts Signed Within 7-12 Months	Contracts Signed Within Over 12 Months	Deliveries Completed	Deliveries Partially Completed	Total
Army	50	37	14	11	12	21	13	34
Navy	7	7	6	0	1	5	1	6
Air Force	5	5	3	0	2	5	0	5
Total	62	49	23	11	15	31	14	45
		(79%)	(47%)	(22%)	(31%)	(63%)	(29%)	(92%)

A well documented offset policy envisages that any contract with a foreign concern for defence equipment over Rs 300 crore must have a minimum offset of 30 per cent.

cent of the cases approved by the DPB under the FTP, it had taken more than 12 months to conclude the contract. However, as per the MoD, the delay in signing the contracts occurred due to reasons which include that substantial time was taken in negotiating the contract, in a few cases the decisions were taken to conduct trials at a later stage, and verifying/confirming the claims and allegations of competitors about the capability of the vendor to supply the item .

Regarding the shortcomings of the fast track procedure, it was revealed that it was made with a certain kind of situation in mind. It is not supposed to be the normal procedure, to be carried out on a day-to-day basis. It was meant to meet certain unforeseen eventualities or situations which create a kind of an emergency or when something is imminent. In such circumstances, the MoD could not afford to have a long drawn out process. If the Services need something in an emergency situation, it has to be procured fast. For such contingencies, the fast track procedure was envisaged. It was supposed to be put into effect only under certain given situations and the chief of the defence force concerned, the army, navy or air force, and the minister would have to certify that it is an urgent, operational, imminent emergency kind of a requirement.

It is only then that the fast track procedure was to be adopted. Somehow, down the line, it got into situations which were not really falling strictly into the category. Therefore, a number of cases that were initiated under the label of fast track procedure were not really falling into the category. While implementing them, it took longer than expected and the whole idea of having a fast track procedure seemed to be defeated in that sense. So the RM has recently directed to see how this whole business of fast track procedure could be made more relevant and streamlined, and made applicable only in the required conditions—accordingly, these are being reviewed.

OFFSET PROVISIONS

A well documented offset policy envisages that any contract with a foreign concern for defence equipment over Rs 300 crore must have a minimum offset of 30 per cent. This implies that the vendor has to compulsorily invest a minimum 30 per cent of the order amount through the purchase of sub-systems or services from India. The reciprocal trade or offset can be directly or indirectly related to the purchased system and related services, such as sub-contract for sub-systems, co-production, technology transfer, licensed production, credit assistance, foreign direct investment, services such as maintenance, overhaul, upgradation, life extension, engineering, design, testing, defence related software or quality assurance services, etc. Initially, offsets may be used by companies for the manufacture and assembly of defence systems within the country. Eventually, the arrangement will be expanded to include technology packages—these provisions will apply to all capital acquisitions categorised as "buy (global)," i.e outright purchase from foreign /Indian vendor, or "buy and make" with transfer of technology, and purchase from foreign vendor, followed by licensed production, where the indicative cost in the RFP is Rs 300 crore or more.

DEFENCE OFFSET FACILITATION AGENCY (DOFA)

The Department of Defence Production (DDP) has set up the Defence Offset Facilitation Agency (DOFA), as a single window agency functioning under the chairmanship of the joint secretary (exports), to facilitate implementation of the offset policy. The DOFA will assist potential offset vendors in interfacing with the Indian defence industry for identifying potential offset products/projects as well as to provide the requisite data and information for this purpose.

PROCEDURE FOR IMPLEMENTING OFFSETS PROVISIONS

These provisions will apply to all capital acquisitions categorised as "buy (global)," i.e. outright purchase from foreign/Indian vendor, or "buy and make" with transfer of technology, i.e. purchase from foreign vendor followed by licensed production, where the indicative cost in the RFP is Rs 300 crore or more.

Initially, a uniform offset of 30 per cent of the indicative cost of acquisition in the "buy (global)" category acquisitions and 30 per cent of the foreign exchange component in the "buy and make" category aquisitions will be the minimum required value of the offset. Based on a review of the experience of implementing these provisions, the minimum offset percentage for the following two years will be prescribed with the approval of the DAC.

The DAC may, after due deliberation, also prescribe varying offset percentages above 30 per cent for different classes of cases or for individual cases, depending upon the factors involved such as strategic importance of the acquisition or technology, enhanced ability of the Indian defence industry to absorb the offset, export potential generated, etc. These provisions will also apply with appropriate modifications to "buy" and "buy and make with TOT" components for warship construction, where the value of individual contracts is Rs 300 crore or more. In such cases, references to the Acquisitions Wing will mean the DDP or shipyard which is building the ship and procuring the systems or sub-systems.

DEFENCE OFFSET OBLIGATIONS

For the purpose of defence purchase made under DDP-2006, offset obligations shall be discharged by any combination of the following methods:

- Direct purchase of, or executing orders for, defence products and components manufactured by, or services provided by, Indian defence industries, i.e.; DPSUs, the Ordnance Factory Board, and any private defence industry manufacturing these products or components under an industrial licence granted for such manufacture. For the purpose of defence offsets, "services" will mean maintenance, overhaul, upgradation, life extension, engineering, design, testing defence related software or quality assurance services.
- Direct foreign investment in Indian defence industries for industrial infrastructure for services, co-development, joint ventures and co-production of defence products.
- Direct foreign investment in Indian organisations engaged in research in defence R&D as certified by the DOFA.

The Indian defence industries or organisations are often referred to as the Indian offset partner.The offset obligations are to be fulfilled co-terminous within the period of the main contract. All offset offers which satisfy the minimum eligibility conditions will be placed on par, and no preference will be given for any extra amount offered. The advisability of giving additional weights to offers having multiplier effects in terms of exports generated or building indigenous capability in strategic technology products, or other issues, may be considered after reviewing the experience of implementing the above policy.

The offsets policy of India was enunciated for the first time in DPP-2005. The scope was enlarged in 2006. The minimum threshold for the offsets has been kept at all arms purchases over Rs 300 crore and at 30 per cent of the total deal. The offsets provisions entailed aim at the defence industrial development of the country. The provisions of the clause in DPP-2006 talk of direct offsets involving export of defence products and services in addition to direct foreign investment in the defence sector industries and R&D establishments. However, a closer examination of the actual provisions would suggest that India has adopted a middle path as a combination of both direct and indirect offsets.

The DOFA will assist potential vendors in interfacing with the Indian defence industry for identifying potential offset products/projects as well as provide requisite data and information for this purpose. The agency will function under the supervision of the designated joint secretary of the Department of Defence Production, and have representatives from Service HQ, HQ IDS, DRDO, and DPSUs and OFB as well as from the Confederation of Indian Industry (CII), Federation of Indian Chambers of Commerce and Industry (FICCI) and Association of Chambers of Commerce (ASSOCHAM) and other agencies as deemed necessary. The DOFA may set up committees and sub-groups as considered necessary or based on the inputs received from DRDO. The DOFA may also engage, following a fair, rational and transparent process, reputed independent professional expert bodies, to assist in its functions, and commission studies by such bodies on offset policies, their implementation, utility and impact.

The Indian experience in the field of defence offsets is yet to truly commence. In fact, the first such effort has been made in the upcoming medium multi-role

combat aircraft (MMRCA) deal which is in the pipeline. The DOFA has been formed under the MoD to facilitate implementation of the offset policy. However, TOT, which is a very important issue in offsets, has not been included. Another important issue of providing banking of offsets credit has also not been incorporated in the policy.

The current policy is limited to direct offsets, involving only export of defence equipment and services. There is a need to expand the scope of the current policy to the entire Indian aerospace industry, both military as well as civil industry. Also, the offsets policy needs to be flexible in nature. The fine tuning of various clauses, including the penalty clause, will make the policy a win-win situation for the vendor as well as the arms importing country. Further, there is no monitoring agency envisaged to actually ensure and assess the impact of offsets utilisation. The DOFA is more of a facilitation agency and may not be in position to monitor the implementation of offsets. There is a need to have a proactive approach and identify the areas wherein defence offsets would be gainfully utilised. The present policy leaves this initiative to the prospective vendors, to identify potential areas for offset utilisation.

E- PROCUREMENT INITIATIVE BY DGS&D

The Director General of Supplies and Disposals (DGS& D) has taken an initiative on e-procurement for the obvious advantages. A well designed and comprehensive DGS&D website[4] facilitates the indenters, and vendors, and the staff indenters/DDOs (direct demanding officers) are advised to place supply orders, issue consignee receipt certificates, report complaints and other related activities through the website. All new users are advised to install web support files to enable them to access the application software for the above activities. Details regarding use of the vendor's page, including sending the notice for inspection calls and uploading of details, are available on the vendor's page. The vendor's page gives a brief introduction to rate contracts, advantages in associating with DGS&D, benefits of DGS&D, computerisation project to vendors, requirements and expectation from vendors, obtaining digital certificates for

4. http://www.dgsnd .gov.in

secure transaction, and guidelines to vendors for usage of the vendor's page.

The website provides a single access point for DGS&D staff, suppliers and customers, besides availability of the details on the net, including the DGS&D Manual, forms, conditions of contract, circulars and notices, agenda and minutes of consultative meetings, summary and the full text of parallel rate contracts. Also, there is provision for supplier's registration online. The e-procurement process has the sub-processes which include e-purchases, e-registration, store coding, technical particulars, evaluation of bids and award of rate of contract. The e-inspection and supply clause includes the details of supply orders, inspection, and dispatch and receipt details. The e-tendering system has online availability and download facility of tender enquires, supplier registration, bid submission by suppliers, bid opening and the spot price comparative chart e-payment system has components of documents receipt, bill submission, processing, payments and debit adjustments. For e-payment, all supporting documents for bills have to be submitted through the software available in the vendor's page of the website. The vendor's page also has the provisions of sending notice for inspection calls, entering dispatch particulars, online submission of bills and suggestions for bringing new items on the rate contract (RC). Indentors and DDOs are advised to place supply orders, issue consignee receipt certificates, report complaints and other related activities through the indenter's page. Details are available on the DGS&D web.[5] The indenters and vendors are advised to familiarise themselves with the complete e-procurement. All new users are advised to install web support files to enable them to access the application software for the above activities.

The Indian experience in the field of defence offsets is yet to truly commence.

EMERGING OPPORTUNITIES IN ELECTRONICS AND IT

The world over, there has been a discernible shift in defence products and the market through the process of internationalisation, with focus on competitiveness and profitability. The process of restructuring leads to the

5. https://dgsnd.govtprocurement.com

Despite having an advantage over others due to the large domestic market which provides strategic opportunity and competitive advantage, sadly, India is the largest importer of defence systems.

emergence of international joint ventures and growth of defence conglomerates, with networked dual use production and financial leverage. As on date, our infrastructure in defence production and R&D does not have the capabilities and core competencies in the emerging military technology sectors. The recent policy framework related to offset business creates business opportunities for the Indian information technology (IT) and electronics industry. The reciprocal trade or offset can be directly related to the purchase system and related services, such as subcontract, purchase, co-production technology transfer, licensed production, credit assistance, overseas investment, training, etc.

Despite having an advantage over others due to the large domestic market which provides strategic opportunity and competitive advantage, sadly, India is the largest importer of defence systems, despite high investment and time. In such an environment, the Indian defence industry can take advantages of the opportunities by partnering with the IT sector. The new products, with world class dual use technology, necessitate significant shifts in the nature, scope and working of the Indian defence industry. The offsets can, indeed, create economic value by adoption of a proper policy approach and selecting partners with the right capabilities. It is essential that the IT industry take advantage of emerging business opportunities for the IT and electronics industries through defence offsets. They need to understand the requirements and expectations of actual users in the field and integrate with global/Indian defence industries, and fill the gap. Indian companies have to move up the outsourcing value chain by being able to cater to a wide range of IT activities such as application software, engineering technology, digitisation of engineering design, and equip themselves with capabilities as per international standards . Some of the future technologies/areas need exploitation.

CONCLUSION

The defence procurement policies and procedures have been revised, especially after the Kargil experience. However, it is significant to note that for nearly 25 years after 1962, capital expenditure on defence procurement grew at an average rate of 16.17 per cent. During the next 10 years, that is, from 1978-1987, the growth rate had gone up to 20.4 per cent. However, immediately after 1987, the average annual growth rate of capital expenditure came down to nearly about 11.96 per cent. This apparently is due to the Bofors fallout. The present position is that in the previous three to four years, the defence allocations have been more than what the ministry could spend. The Defence Procurement Board has to ensure that the amounts allocated for such capital expenditure are fully utilised. This will depend upon the initiative and vision of the members who constitute the board.

It is well known that thousands of crores from the Ministry of Defence budget have been surrendered over the 10th Defence Plan (2002-07) because of slow defence procurement procedures. The Comptroller and Auditor General of India, in a performance audit of the MoD's capital acquisitions between 2003 and 2006, has also examined the reasons for the MoD's surrender of over Rs 3,500 crore between 2003 and 2006 (Rs 600 crore were additionally surrended on March 31, 2007). The ministry advised that the surrenders were due to complexities involved in the acquisition process. Sometimes, the cases could not be finalised due to various factors such as delays in equipment trial evaluation, commercial negotiation and approvals.

The defence minister announced at the inauguration of Defence Expo 2008 in February this year that India will bring its procurement procedures for purchasing military hardware in line with the best international practices. Based on the experience gained during the two years since implementation of the DPP-2006, a number of suggestions (over 40 in all) for improvement in capital and revenue procurement have been received. He added that a revised and improvised document, the DPP-2008, is almost ready and will be issued in May or June this year.[6] The offset policy that was part of the Defence Procurement Procedure announced in 2006 was at a nascent stage and was still evolving. He

6. http://www.domain-b.com/defence/general/20080218_procurement.html

India plans to spend US $ 100 billion on capital expenditure during the Seventh Plan period (2007-2012).

stated that the discharge of the offsets will give the necessary fillip to the participation of the private sector in a big way. The DPP-2008 is being fine tuned with a great degree of diligence and raking in all inputs from the stakeholders, that is, the Services and the industry. The new policy will address issues related to banking of offset credits, ToT, licensing requirement for software industry, and so on. There is a greater need for synergy between the private players and the government. The government is keen to maintain transparency in defence procurements. Defence procurement procedures are very arduous as the requirements of the sector are for high-end technology, stringent quality control and commercial negotiations, which require transparency and integrity of the highest order.

India plans to spend US $ 100 billion on capital expenditure during the Seventh Plan period (2007-2012). Imports account for close to 70 per cent of capital expenditure and offsets are required equal to 30 per cent of import contracts. Thus, India expects offset trade worth US $ 21 billion during the next five years. Currently, Indian defence exports amount to a paltry US $ 50 million annually, i.e. US $ 250 million in five years. From US $ 250 million to US $ 21 billion, it will be a quantum jump of enormous proportions. The public sector cannot handle it by itself. The private sector has to be closely integrated and its potential fully harnessed for beneficial absorption of the proposed offset business.

Finally, it is also necessary to set up an institutional mechanism whereby the working of the Defence Procurement Board is reviewed every two years and further improvements brought about. The efficiency of the board will, to a large extent, affect the modernisation of the Services.

LEVERAGING OFFSETS IN ARMS TRADE: OPTIONS FOR INDIA

V.N. SRINIVAS

For over four decades, India has been one of the major arms importing countries among the developing countries. The trend of imports has, however, not always been uniform. There have been high and lows in the volume of arms imports depending on the nature of budgetary resources allocated for defence from time to time. This allocation of budgetary resources for defence has always been a huge challenge for policy-makers in the government as they were confronted with the problem of making optimal defence allocations, taking into consideration other economic compulsions and meeting social obligations such as poverty alleviations programmes, expenditure on education and health, etc. At the same time, the nation had to confront hostile neighbours from the very beginning after independence and, therefore, the imperatives of meeting the national security needs could never to be relegated to a secondary importance. In the absence of indigenous capability to produce arms and weapon systems, imports became a natural choice in gearing up to meet the ever pressing national security needs. Such import dependency in arms continues till date even as the noble intentions of building indigenous capability in defence production remain a distant dream.

The liberalised economic policies of the early 1990s unleashed the true potential of the nation as these policies began paying dividends in the late 1990s and post-2000 in the form of accelerated economic growth, unseen before. With the rapid growth of the economy, the defence allocations too

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The arms market, which was hitherto a sellers' market, began to turn itself into a buyers' market.

started reflecting an upward trend, particularly after 2000-01. Increased defence allocations also meant burgeoning arms imports. Meanwhile, with the end of Cold War in the late 1980s, there has been a paradigm shift in the international relations, with the acrimony among the superpowers coming to a virtual end, resulting in decreased world defence expenditure. The arms producing companies, particularly those belonging to the developed world that thrived during the Cold War era, suddenly found themselves at a cross-roads as their very survival became doubtful, resulting in a series of mergers and acquisitions by larger companies. The arms market, which was hitherto a sellers' market, began to turn itself into a buyers' market. Intensified competition among the arms producing companies resulted in huge choices for the buyer countries from among the various options available. Such exercise of choice also led to various attractive offers being made by the arms producing companies, aided by the arms export policies of the respective countries in which these companies operated. The competition among the arms producing companies led to efforts to reduce the cost of acquisitions of weapons for the importing countries in the form of counter-trade, buy-back, co-production, licensed production, etc. Offsets are one such mechanism of compensating the arms importing countries by the arms exporting countries. Such compensatory measures became even more pronounced in the case of the developing countries, with limited defence budgets, that sought to leverage their arms purchasing potential by seeking a variety of benefits from the exporting countries.

SCOPE OF THE PAPER

This paper discusses the nature of defence offsets, the various types of defence offsets and a brief analysis of beneficial effects of offsets. The Indian policy on defence offsets has been analysed in detail, bringing out the need for strengthening the current policy.

NATURE OF DEFENCE OFFSETS

There are various definitions of offsets. It would perhaps be appropriate to quote the one offered by the United States as the country is one of the leading arms exporting countries and thereby undertakes huge offsets obligations linked to such exports. The US Arms Export Control Act and the International Traffic in Arms Regulations define offsets as, *"Compensation practices required as a condition of purchase in either government-to-government or commercial sales of 'defense articles' and/or 'defense services.'"*[1] As a compensation practice, defence offsets help the buyer country reduce procurement costs and/or result in any other economic benefit. Some of the other terms used for referring to offsets in different counties are: industrial cooperation; industrial participation; counter-purchase/counter-trade; compensatory transaction; buy-back; and swap or barter. In terms of effects, offsets can be classified as "direct" or "indirect." Direct offsets are *"contractual arrangements that involve defense articles and services referenced in the sales agreement for military exports. These transactions are directly related to the defense items or services exported by the defense firm and are usually in the co-production, subcontracting, technology transfer, training, production, licensed production, or financing activities."* Indirect offsets are *"contractual arrangements that involve defense goods and services unrelated to the defense items or services export referenced in the sales agreement. The kinds of offsets that are considered 'indirect' include purchases, investment, training, financing activities, marketing/exporting assistance, and technology transfer."*[2] Another type of offsets are the "semi-direct" offsets, combining the characteristics of both direct and indirect offsets. For example, the Indian defence offsets can be classified as semi-direct offsets even though the offsets policy of the Ministry of Defence (MoD) cites them as direct. They can be termed as semi-direct since, as per the policy, the offsets can be undertaken in the domain of the entire defence sector in various forms, as

The Indian defence offsets can be classified as semi-direct offsets even though the offsets policy of the Ministry of Defence (MoD) cites them as direct.

1. "Offsets in Defense Trade," Twelfth Report to Congress by the US Department of Commerce, Bureau of Industry and Security, December 2007, p. 1.4
2. Ibid.

Normally, the offset implementation costs tend to be low in the case of indirect offsets as against direct offsets, since the former offer flexibility in their implementation by the vendor.

defined in the policy, and not limited to the particular defence item in the prime contract.

The quantum of offsets sought and whether the offsets need to be direct or indirect is the prerogative of the arms importing country. The chosen options depend on the objectives intended to be achieved through offsets. For example, if the nation's economic development is the key objective, it is possible that indirect offsets may be sought. On the other hand, if the intended objective is to fulfill a specific purpose such as the development of the defence industrial base of the country, then direct offsets would be the best option. Some counties such as South Africa, Israel and Malaysia have taken recourse to a combination of both direct and indirect offsets. In the Indian defence offsets policy, the key objective is not stated. But judging from the spirit of the policy, it can be deduced that the core purpose of offsets is to give a fillip to the nation's defence industry as the scope of the policy is limited to direct offsets restricted to the defence sector. Both direct and indirect offsets are the usual norm in the international arms imports. In the case of the US, the ratio of indirect to direct offsets for the period 1993 to 2006 was 60:40.[3] This ratio reflects the tilt towards indirect offsets, compared to direct offsets. Normally, the offset implementation costs tend to be low in the case of indirect offsets as against direct offsets, since the former offer flexibility in their implementation by the vendor.

QUANTUM OF OFFSETS AND MINIMUM THRESHOLD

The quantum of offsets sought (i.e. offsets as a percentage of prime contract value) and a minimum threshold of the main contract for which offsets are sought vary from one country to another, depending on a number of factors such as the objectives behind a country's offset policy and the ability to absorb offsets, etc. Most of the offset implementing countries have adopted a mixed

3. Ibid., p. 25

approach of direct and indirect offsets, with a few countries such as the UK confining their policy to direct offsets. The range of offsets as a percent of prime contract is quite wide, ranging from 20 per cent in the case of Thailand to 100 per cent in most of the European countries. Similarly, the offset threshold also varies quite widely. In the case of Brazil, for example, offsets are sought for all contracts exceeding $ 1 million. In the case Denmark and Poland, the limit is $ 3 million and $ 5 million respectively.[4] As per the Indian defence offsets policy, all arms import contracts in excess of Rs 300 crore ($ 75 million) need to fulfill a minimum of 30 per cent offsets.

Offset Multipliers

Offset multiplier is a negotiated factor used by the arms importing country as an incentive to acquire a specific offset project that provides enhanced benefits. For example, if a country has a policy of 100 per cent offsets, then a $ 100 million import deal would result in an equal amount of offsets in a defined area. In this case, the factor of offsets can be stated as one. If, however, the offsets are undertaken in a specific area that has been accorded a higher order of importance by the buyer country, it is possible that such a prioritised area may be accorded a multiplier factor higher than one for the purpose of counting offsets. If a country considers defence industrial development as a prioritised area, then it is possible that a higher multiplier factor for technology transfer is attached over other factors, say, export of defence equipment. Internationally, an offset multiplier factor ranging from 0.5 to 10 (and, in some cases, ranging up to 20) is permitted by various countries in receipt of offset benefits. In a very few cases, a multiplier factor less than one can also be seen. Multipliers of less than one mean that prime contractors are only credited a portion of the total actual value of a transaction, and that the actual value of contracts will be higher than the credit value.[5] The Indian offset policy does not accord a multiplier of more than one at present, although the issue of higher multipliers may be considered in due course, as and when the policy is revised. In the case of the US, the

4. J. Brauer and J. Paul Dunne, "The Economics of Arms Trade Offsets: A Review," paper presented at the International seminar on Defence Finance and Economics, November 13-15, 2006.
5. n.1, pp. 5-6 and 5-7.

average multiplier factor in offset transactions during the period 1993-2006 was 1.165.[6] Usually, a flexible offsets policy tends to be liberal on the issue of multipliers. Arms exporting companies too tend to prefer higher multipliers as it facilitates focussing on a particular area for discharging their offset obligations.

BANKING OF OFFSET CREDITS

An offset credit is a monetary unit of measuring the achievement of offsets against an offset obligation. It is the product of the value of an offset transaction times a multiplier factor. Banking of offset credits is a mechanism enabling a foreign vendor to commence operations in the importing country even before a contract is awarded. The offset credit banking agreement provides for offset credits to be accumulated either in advance of an offset programme and/or in excess of a fulfilled offset obligation. An offset banking arrangement is usually negotiated between a contractor and the offset authority of the importing country and the credits are applied towards the fulfillment of future offset obligations. Normally, defence procurement contracts are long drawn, and precious time may be lost if a foreign vendor is to wait until the main contract is inked. Banking of offset credits helps the prospective vendor to commence operations as part of future offset obligations. The accounting of such credits is usually maintained by the offset regulatory authority of the recipient country. Many countries such as Israel, Poland and the UK have incorporated banking provisions in their respective offset guidelines. Some countries permit banking of credits on a case-by-case basis. If an anticipated procurement contract is not awarded for any reason, provisions also permit in a number of countries for transferring these credits to another offset obliger. Banking of offset credits is normally considered a positive incentive for foreign vendors to invest in local industry, whether the actual contract is awarded at a future date or not. Inclusion

Banking of offset credits is a mechanism enabling a foreign vendor to commence operations in the importing country even before a contract is awarded.

6. Ibid.

of provisions related banking of offset credits is also a sign of a flexible offset policy. An offset banking credit policy must contain detailed clauses such as: how the credits may be used; how long the credits will hold their value; whether the credits may be traded or sold to other companies that have obligations in that country; and who can bank credits on behalf of the supplier company.[7] Sometimes, it is possible for the vendor to accumulate excess credits over and above the designated offset obligations. A number of countries permit excess credits to be carried forward to count against future offset obligations. The commencement date of offset credits and the period within which these are required to be counted against offset obligations are also usually prescribed in the offset guidelines of the importing country. Such clauses with regard to commencement and extinguishing of offset credits are sometimes referred to as "sunrise" and "sunset" clauses. Incorporation of such clauses in the offset guidelines provides clarity to the vendor. Banking of the offset credits is not permitted as per the current Indian policy on defence offsets and offset contract needs to be executed co-terminus with the prime contract. There are indications, however, that provisions related to banking of offset credits will be included in the policy when it is taken up for revision.[8]

Banking of offset credits is not permitted as per the current Indian policy on defence offsets and offset contract needs to be executed co-terminus with the prime contract.

PENALTIES AND BANK GUARANTEES

An offset agreement may provide for imposing penalties on the vendor, in case of failure to meet the offset obligations within the specified time period. Penalties are usually applied to the unfulfilled balance of the obligation and may be assessed at the end of the performance period for the entire obligation or at specified intervals during the performance period.[9] In addition, performance guarantees may also be

7. Gregory J. Martin, "Offsets: Sharing International Experience," paper presented at the International Seminar on Defence Finance and Economics," New Delhi, November 13-15, 2006.
8. "Defence Purchase Policy: Western Pressure Resisted," *The Hindu* (New Delhi), May 5, 2008.
9. Martin, n.7.

Table 1: Illustration of International Offset Practices*					
Country	**Offset Arrangement**	**Per Cent of Offsets**	**Offset Threshold**	**Multipliers**	**Penalties/ Guarantee**
UK	Direct	100	$ 20 million	Yes	No
Australia	Direct and Indirect	30	$ 2 million	Yes	N/A
Poland	Direct and Indirect	100-170	$ 7 million	Yes	N/A
Sweden	Direct and Indirect	50-100	N/A	Yes	N/A
South Africa	Direct and Indirect	100	$ 10 million	Yes	Yes
South Korea	Direct and Indirect	30	$ 10 million	Yes	N/A
India	Direct	30	$ 75 million	No	Yes

* Compiled from various sources

sought from the vendor in the form of bank guarantees or surety bonds, etc facilitating payment of liquidated damages in case of failure to meet the offset obligations within the stipulated period. It is generally believed that penalties and bank guarantees tend to increase the offset transaction costs. The Indian offset policy contains provisions related to penalties and bank guarantees.

EVALUATION OF BENEFITS OF OFFSETS

Despite defence offsets becoming a preferred choice in the last 2-3 decades, the experience of various countries indicates that there is no conclusive evidence on the positive effect of offsets. A major reason for such a conclusion is non-availability of data, as information related to defence procurements is generally kept guarded by nations. Offsets as part of defence procurement have been resorted to for more than two decades now. Since around 2000, the study of offsets has been pursued with fervour by defence economists across globe. Even with intense academic, political, and media attention, it is remarkable that empirical evidence on offsets deliverables remains sketchy.[10] Yet, ironically, more and more countries are resorting to defence offsets. While only about twenty

10. Ron Matthews, "Defense Offsets: Policy Versus Pragmatism," in Jurgen Brauer and J. Paul Dunne, eds., *Arms Trade and Economic Development* (Routledge, 2004), p. 97.

countries (mostly within the North Atlantic Treaty Organisation) had offset policies in the 1960s and 1970s, by the end of the 1990s, the figure swelled to around 130.[11] By now, it is well established that deals involving offsets tend to cost more than off-the-shelf purchases. Since most supplier companies are privately-owned corporations with a responsibility to enhance shareholders' returns, the cost of providing offset benefits are likely to be passed on to the arms purchasing country. The degree of difficulty of providing the offset benefits and the perceived level of risk to the supplier company will, in large part, determine the cost.[12] It is estimated that offsets transaction costs range between 7 and 10 per cent of the prime contract value.[13] Since offsets are not freebies doled out by the vendors, the benefits for the recipient country must outweigh the cost of offsets, if the offsets have to become a viable proposition. The perceived benefits of offsets by the recipient countries include: (a) reduction of arms acquisition costs; (b) additional job creation and generalised economic development; (c) creation of new and sustainable work; and (d) transfer of technology.[14] Despite a lot of euphoria on the actual or perceived benefits of offsets, there is lack of evidence on such benefits. Two well known defence economists point out that virtually no evidence exists that general economic goals are ever achieved via offsets, with the possible exception of Germany in the 1950s. On similar lines, these economists conclude that there is virtually no positive and certainly no compelling evidence that offsets create new, let alone sustainable, jobs.[15] On the issue of technology transfer, an important perceived benefit of offsets, the finding is that "with regard to general and specific technology transfer directed either toward military or civilian

Even with intense academic, political, and media attention, empirical evidence on offsets deliverables remains sketchy.

11. Susan Willett and Ian Anthony, "Counter Trade & Offsets Policies and Practices in Arms Trade," Copenhagen Peace Research Institute, accessed from website <www.ciaonet.org/wps/wis01/> on May 12, 2008.
12. Martin, n.7.
13. Brauer and Dunne, eds., n.10, p. 71.
14. Brauer and Dunne, eds., Ibid., accessed from website <www.aug.edu/sbajmb/paper-RHaines.pdf>
15. Jurgen Brauer and J. Paul Dunne, "The Economics of Arms Trade Offsets: A Review," paper presented at International seminar on Defence Finance and Economics, New Delhi, November 13-15, 2006.

industry, the record is mixed,"[16] meaning that technology transfer has indeed proved beneficial in certain instances. Despite scepticism surrounding offsets, there is ample evidence to suggest that a few countries have benefited from their offset policies. The aerospace industries of Brazil, South Korea and Poland owe their success to offsets to a large extent. Similarly, countries such as Israel and Malaysia have derived benefits through both direct and indirect offsets.

Absence of clear empirical evidence may pose dilemmas for policy-makers in making choices between direct and indirect offsets, quantum of offsets to be sought and areas of focus for offset implementation.

Thus, the findings on the benefits of defence offsets by defence economists appear to be not only mixed but also dichotomous. For, if lack of credible data on offsets is the reason cited by those criticising offsets, the same argument can also be used by those in favour of offsets. Until reliable data is available on the subject and valid conclusions are drawn thereby, it is difficult to gauge the beneficial or detrimental effect of offsets. It is, perhaps, early days yet to argue either for or against military offsets even as the academic world dealing with the subject awaits credible findings backed by reliable data, before verifiable conclusions can be drawn.

Absence of clear empirical evidence may pose dilemmas for policy-makers in making choices between direct and indirect offsets, quantum of offsets to be sought and areas of focus for offset implementation. In sum, the predicament is not whether offsets deliver the intended results or not. On the contrary, it is a question of making a choice between 'good' offsets versus 'bad' offsets. Offsets would work if they are embedded appropriately in the overall policy matrix, be it indigenous defence industrial advancement or general economic development. For example, direct offsets are often single deals to be completed within a specified time-frame and linked with a specific military project. The programme, to be sustainable, should be able to prolong itself beyond the life of the offset programme. In order to make direct offsets sustainable, the policies should aim

16. Brauer and Dunne, Ibid.

at developing capacities for becoming component suppliers and embed themselves in the international supply chain,[17] continuing beyond the offset programme. Such integration into the global supply chain would be feasible only if competence is achieved in terms of quality, price and delivery parameters. Offsets are incidental or, at best, can become a catalyst in achieving these parameters. A matured and well developed civil industrial base is an important prerequisite for development of the indigenous defence industry through offsets and technology transfer. Lastly, offsets will be effective when an intensive preliminary research regarding what to ask for in the form of offsets and how to utilise such gains is carried out, in addition to having a specific plan of action.[18]

THE BUYER COUNTRY'S PERSPECTIVE

Since the underlying purpose is to reap maximum benefits from defence equipment imports, the natural tendency of an arms importing country is to make most of the associated offsets of the deal. Through the mechanism of offsets, the importing country seeks the latest technology and maximum assistance in licensed or joint production. The buyer country would also expect foreign direct investments in joint ventures in the chosen industry. The purchasing country would attempt to gain maximum advantage from offsets through skilful negotiations to ensure that offsets do not increase the import price or at least the offset transaction costs are kept to the minimum. It is also important from the buyer country's perspective that the vendor does not circumvent his offset obligations by counting and linking offsets to an existing business deal which would take place anyway even in the absence of offsets.

A matured and well developed civil industrial base is an important prerequisite for development of the indigenous defence industry through offsets and technology transfer.

17. Ravinder Pal Singh, "Offsets: Why, How and Why Not?," paper presented at the International seminar on Defence Finance and Economics, New Delhi, November 13-15, 2006.
18. Nam Sung Han and Joon Soo Park, "The Defense Offset Policy in South Korea," Korean Institute of Defense Analyses (KIDA) Papers, January 2004.

It is important to note that mere dependence on offsets would only lead to granting subsidies to state-run enterprises, and may lead to inefficiencies in the buyer country.

THE VENDOR'S DILEMMA IN OFFSETS

From the vendor companies' perspective, meeting offsets obligations has become imperative as these companies operate in a fiercely competitive market. In a competitive arms market, offsets often act as a differentiator in winning arms contracts. However, the dilemma faced by the arms exporting countries is in terms of loss of domestic jobs and preserving their own technological edge in arms production. Transfer of technology in arms production may result in loss of military edge, besides leading to increased competition as more countries tend to develop the ability to produce sophisticated weapon systems. However, the argument that the developed countries lose their technological edge through discharge of their offset obligations is not totally tenable, since the cutting edge or state-of-the-art technology is never parted with by the developed countries. Nor does the capacity exist among the recipients, particularly among the developing countries, to absorb the cutting edge technology. Since arms manufacturing companies operate with a motive of profit maximisation, the attempt on their part would be to minimise the cost associated with offsets. When negotiating an offset agreement, every attempt is made to minimise the offset requirement in order to protect the company's domestic labour force, its established supplier base, and its core technologies. At the same time, it is also important for these companies to complete their offset commitments satisfactorily, as their reputation is at stake.[19] Similarly, the vendor country's fears of the importing country piecing together the transferred technologies over a period and building competencies and, thus, becoming a competitor in the market place, are also not unfounded. China is an example of this gradual building of competencies. In the field of aerospace, China started with Russian technology and later undertook co-production with McDonnell Douglas. Thereafter, they started doing minor pieces for Boeing before

19. "Policy Issues in Aerospace Offsets," report based on a National Research Council Workshop held on June 9, 1997, in Washington DC. Report edited by Charles W. Wessner and Alan Wolff

producing rear fuselage and tail pieces. Then they have entered into a memorandum of agreement with Europeans and other Asian nations to build a 100-seater aircraft. Perhaps this process of competency building could have also happened without offsets, but not as quickly.[20]

A WIN-WIN SITUATION FOR ALL

A brief analysis of the buyer's perspective on offsets in order to gain maximum advantages and the vendor's reluctance to give away too much, may lead to the impression that offsets aspirations of the buyer and a possible recalcitrant approach towards the same by the vendor are dichotomous in nature. However, this need not be the case at all times. It is quite possible that offsets could lead to a win-win situation for both the parties to a deal. Offsets pave the way for marketing of the vendor's equipment, and for the buyer, these could result in various concomitant benefits in addition to the prime contract. In fact, offsets work best only when they result in a win-win situation for both the vendor company and purchasing country. It is important to take note that offsets must become an incidental consideration and not the main motivation in weapon procurement. Offsets will succeed along with other holistic measures of defence industrial development and not in isolation. Further, it is important to note that mere dependence on offsets would only lead to granting subsidies to state-run enterprises, and may lead to inefficiencies in the buyer country. Finally, offsets will work best when the aspirations of both the vendor and buyer country are fulfilled thus, resulting, in a win-win situation for both the seller company and the purchasing country.

CORE OBJECTIVES OF INDIA'S DEFENCE OFFSETS POLICY

The offset policy was introduced in the Defence Procurement Procedure (DPP) for the first time in 2005 and subsequently its scope was enlarged in 2006. Ideally, any policy must bring out the core objectives behind its formulation. However, the Indian offsets policy, as contained in the DPP-2006, does not list out the objectives. In fact, Appendix 'D' of the DPP calls it a "Procedure for Implementing Offsets Provisions" and not a policy as such. Assuming the

20. Ibid.

Defence offsets policy in India appears to have adopted a middle path i.e. a combination of both, despite using the term "direct offsets" in the policy.

existence of a thin line between a policy and a procedure, one would expect clarity and articulation of the objectives in implementing the defence offsets. Although the objectives of defence offsets are not listed out as such in the current policy, it can be deduced from the provisions contained in the policy that it aims at defence industrial development of the country. The provisions of the policy, in its present form, only talk of direct offsets involving export of defence products and services, in addition to direct foreign investment in the defence sector industries/R&D establishments.

Since defence offsets are resorted to for a variety of perceived benefits, it is vital that the policy brings out the main and secondary objectives in unambiguous terms. Such a focus and clarity are of significance, as the subsequent chain of actions involving among others, designing the offsets provisions, implementation and monitoring mechanisms, and offset contract negotiations, etc revolve around the core objectives of the policy as the backdrop. This vital aspect is missing in the existing Indian defence offsets policy.

Nature of Defence Offsets in India

Strictly in terms of definitions of direct and indirect offsets mentioned in this paper, the defence offsets policy in India appears to have adopted a middle path i.e. a combination of both, despite using the term "direct offsets" in the policy. Accordingly, for the purpose of defence purchases made under DPP-2006, offset obligations shall be discharged directly by any combination of the following methods[21]:

(a) Direct purchase of, or executing export orders for, defence products and components manufactured by, or services provided by, the Indian defence industry, i.e. Defence Public Sector Undertakings (DPSUs), the Ordnance Factory Board (OFB), and any private defence industry

21. Defence Procurement Procedure-2006, Appendix 'D', Ministry of Defence, Government of India.

manufacturing these products or components under an industrial licence granted for such manufacture. For the purpose of defence offsets, "services" will mean maintenance, overhaul, upgradation, life extension, engineering, design, testing, defence related software or quality assurance services.

(b) Foreign direct investment (FDI) in Indian defence industries for industrial infrastructure for services, co-development, joint ventures and co-production of defence products.

(c) Direct foreign investment in Indian organisations engaged in defence R&D as certified by the Defence Offset Facilitation Agency (DOFA).

Capability of Indian Defence Industry

The offsets can be undertaken under any of the above mentioned categories. Of late, there has been a debate on the issue of the Indian defence industry's capability to absorb a huge amount of offsets. This is even more pertinent considering that armed forces' modernisation has been stepped up in recent years, with a relatively higher proportion of the defence budget being allocated for capital expenditure. The capital budget for 2007-08, for example, was over $ 10 billion. For the current financial year (2008-09), this figure is around $ 12 billion. If one assumes that 70 per cent of capital budget (i.e. $ 15 billion out of $ 22 billion) is catered for meeting import requirements, the same should result in offsets worth $ 4.5 or Rs 18,000 crore for these two years alone, with a minimum threshold of 30 per cent of the main contract. It is pertinent to note that in some cases, such as the proposal to acquire 126 medium multi-role combat aircraft (MMRCA), the offsets have been pegged higher, at 50 per cent of the contract value. Against such huge potential of offsets, the current value of defence exports from the country appears too small. For the year 2007-08 (up to December 2007 or the first nine months of the financial year), the value of Indian defence exports stood at Rs 342 core ($ 85 million).[22] On an annualised basis, the value of exports works out to around Rs 456 crore ($ 114 million). As against such defence export figure, offsets between Rs 3,000-4,000 crore ($ 750 million-1 billion) need to be undertaken every year, given the current ratio of capital expenditure

22. Ministry of Defence, Government of India Annual Report, 2007-08, Para 7.56.

In the absence of defence export potential and with limited scope for FDI, it may become an arduous task for undertaking the offset obligations by the vendor companies.

allocation in the defence budget.[23] In other words, the value of defence exports needs to go up by 8 to 10 times their current level. Thus, the gap between the existing quantum of exports and what is required to be undertaken as part of offset obligations of the vendors is too huge. To be able to undertake such a huge amount of exports requires investment of a large magnitude in the indigenous defence industrial infrastructure. In addition, such large infrastructural investments may take years before the production can be stepped up. Therefore, one is left wondering whether any study on the potential of indigenous defence industry has been undertaken prior to embarking on an ambitious defence offsets programme. Apart from export of defence equipment and services, the two areas for implementing offsets are in the form of FDI in the Indian defence industry or defence R&D organisations. The entry of the private sector in the defence industry has been permitted as recently as 2001 with a maximum cap of 26 per cent foreign equity. The initial response to such a liberalised policy was muted as no major private company came forward for investment in the defence industry, until recently. Of late, a few joint venture (JV) proposals and memorandums of understanding (MoUs) have been announced involving major Indian companies such as Tata, L&T and leading arms manufacturing companies such as Boeing, Lockheed Martin, etc. But the amount of investments announced in these proposed tie-ups is only a trickle in what is seen as a huge ocean of offsets, and the road ahead is rather long. One way to absorb the huge quantum of offsets is to hike the FDI in the defence industry from 26 per cent to 49 per cent, as demanded by a section of the industry. In the absence of defence export potential and with limited scope for FDI, it may become an arduous task for undertaking the offset obligations by the vendor companies. This, in a way, is also a major challenge for those in the government responsible for implementing the policy.

23. As per the present Indian defence offsets policy, offsets can be undertaken under three broad categories i.e. (a) export of defence equipment and services; (b) FDI in defence industry; and (c) FDI in Indian defence R&D organisations. On a rough approximation, these three segments must account for 1/3rd of offsets each every year.

NEED FOR STRENGTHENING THE POLICY

A few other issues which are of relevance from the Indian policy perspective are discussed below. At the moment, certain teething troubles seem to be coming in the way of a smooth implementation of the policy. In any case, it would be too early to expect any tangible results as a fallout of the offset policy, since the same has been introduced only recently. The benefits flowing out of the policy can only be gauged after about five or more years. Some of the impediments in the policy and suggested ways to overcome the same are enumerated below:

(a) **Structural Strengthening**. The Defence Offset Facilitation Agency (DOFA) has been created within the MoD to facilitate implementation of the offset policy. Creation of an exclusive agency for providing guidance on defence offsets is a step in the right direction. A few other countries with considerable experience in implementing offsets also have similar organisational structures, be it in the Economic Ministry or Defence Ministry to handle defence offsets. The DOFA is represented by the Services, MoD, defence industry and the Defence Research and Development Organisation (DRDO). One of its important assignments is to vet the offset proposals technically. Technical evaluation and appraisal of the proposals is a critical task as it could have a significant impact on the future technological map of the defence industrial base. The evaluation process must be able to distinguish the key technologies that are required for augmenting the defence production as against the low end technologies that may have insignificant impact. The industry experts must also be in a position to assess whether the domestic defence industry is in a position to absorb the high-end technologies. Apart from technological assessment of the proposals, the DOFA also plays a key role in policy formulation and its revision from time to time. Ability to formulate provisions requires a long-term and holistic vision of a variety of issues and a deep understanding of the offset experiences of other countries so as to learn from their successes and pitfalls. In addition, the offset contracting process requires skills in acquisition management. Lack of negotiating skills among the civil servants/military staff involved in acquisition and offset contracts is a

Technology transfer is a common element of offset programmes and often accompanies co-production and sub-contract activities.

common drawback as against professionally experienced representatives of the arms suppliers, who are skilful in developing one-sided contracts with an ability to have them swung to their advantage.[24] Therefore, involvement of experts in the DOFA, fully conversant with the implications and all facets of defence offsets, is essential.

(b) **Transfer of Technology (ToT)**. Transfer of technology, a vital issue in offsets, has not been incorporated in the present policy. One possible explanation could be that in most of the acquisition cases, ToT is a condition attached to the main contract itself, as is the case with the MMRCA deal. If the core aim of the policy is the defence industrial development of the country, ToT must be accorded topmost priority as part of offsets, as compared to other provisions of the policy such as defence exports, FDI, etc. While defence exports, unarguably, facilitate foreign exchange earnings, additional job creation, and so on, what is of significance from a long-term perspective is to lay thrust on ToT that would create a knowledge bank, in terms of codified as well as tacit knowledge. Technology transfer can take place in a variety of forms such as data knowhow (drawings, processes, procedures, manuals/instructions); licences (design, production, sales, marketing territory, support); material (critical component material, production process equipment); training (on-job-training, classroom, product-specific or general business training); and education (funded R&D, scholarships, sponsorship). Technology transfer is a common element of offset programmes and often accompanies co-production and sub-contract activities.[25] A number of countries have accorded a multiplier of more than one for ToT under offsets. Technology transfer was the third most important offset obligation undertaken by US companies, after direct purchase and sub-contracts. Technology transfer formed 16.5 per cent of the

24. Pal Singh, n.17.
25. Martin, n.7.

total value of offsets undertaken by US companies between 1993-2006.[26] However, there are many practical difficulties associated with ToT such as identification of core technologies and the ability to overcome tough export controls imposed by the supplying countries. Overcoming such strict export controls requires a strategic manoeuvring of our foreign policy. Another difficulty associated with ToT is its valuation. In most cases, the value of the technology transfer is negotiated between the supplier company and buying country. The negotiated value of the technology is often based on the supplier company's prior investment in R&D, the market value of the technology, or the amount the foreign government would otherwise need to invest for developing the technology itself.[27] Certain intangible factors also need to be considered when valuing technology transfer. Such qualitative measurements could include the anticipated revenues from implementing the technology, jobs created by the transfer, and flow-down benefits to the local economy.[28] ToT being an intangible element, attaching a monetary value to it is a complex task, which requires expert handling involving multiple agencies. Structural strengthening of the DOFA is also important from the viewpoint of handling the various complex issues associated with ToT.

The negotiated value of the technology is often based on the supplier company's prior investment in R&D, the market value of the technology, or the amount the foreign government would otherwise need to invest for developing the technology itself.

(c) **Banking of Offset Credits**. An important criticism of the present policy is that it does not provide for banking of offset credits. The current policy is rigid to the extent that the offset contract commences only after the primary contract has been

26. "Offsets in Defense Trade," Twelfth Report to Congress by the US Department of Commerce, Bureau of Industry and Security, December 2007, p. 2.9
27. Martin, n.7.
28. Martin, Ibid.

entered into and terminates along with the main contract. A variety of reputed lead manufacturers of defence equipment in other parts of the world are looking forward to key tie-ups with Indian industries, eyeing the benefits of low labour costs, software development skills, etc. Through the mechanism of offsets, the bonding between global players and Indian industry can be strengthened in a variety of ways. Offset banking credits is one such mechanism. Incorporation of a procedure for offset banking credits would encourage the prospective foreign vendors to enter into joint ventures with their Indian counterparts in the defence industry, with a hope that the offsets credits earned by them in the past (after a notified cut-off date or what is usually referred to as a "sunrise" clause) would count against future contracts. A clause should also be inserted facilitating transfer of offset banking credits, so that a vendor is in a position to benefit from such a transfer even if he is not awarded a contract at a future date.

(d) **Offset Multipliers**. The practice of assigning additional weights to the offsets greater than one is in vogue in some countries. On this issue, the present Indian offsets procedure states, "The advisability of giving additional weights to offers having multiplier effects in terms of exports generated or building indigenous capability in strategic technology products, or other issues may be considered after reviewing the experience of implementing the policy."[29] Now that the policy is expected to be taken up for revision shortly, the issue of multipliers must be addressed. Inclusion of multipliers, as deemed fit for each offset obligation, is crucial as multipliers act as incentive for foreign vendors to accept a particular type of offset obligation that the country considers as crucial. Normally, ToT (involving key technologies as against routine or low-end technologies) and R&D collaborations tend to receive multipliers greater than one, as can be seen from the experiences of some countries. It is not feasible to suggest an across the board weightage, and each case has to be evaluated on its individual merits before assigning a suitable multiplier. However, the issue needs to be included in the policy, with scope for flexibility for assigning multipliers.

29. n.21.

(e) **Broadening the Scope of the Policy**. The current policy is limited to direct offsets, involving only export of defence equipment and services. However, there is an imperative need to expand the scope of the current policy without diluting the well intended purpose of developing the defence industrial base. There is a need to extend the offset credits for investments made in, or technology transferred to, the entire aerospace industry, without differentiating between the civil or military aerospace industry. The whole of the aerospace industry engaged in the manufacture of aircraft or aircraft related components or engaged in services related to aircraft manufacturing must be covered for receiving credits by the offset provider. Such extension of offsets, covering the entire aerospace industry is logical because, the world over, most of the aircraft manufacturing companies such as Boeing, Embraer, etc are engaged in the business of manufacturing both civilian as well as military aircraft. The basic technology, processes and components tend to overlap in the manufacture of both types of aircraft, with minor variations at the end stage of production. Though there are companies in the highly industrialised countries exclusively engaged in, or specialising in, manufacture of either a civilian aircraft or military aircraft, economies of scale dictate that the aerospace industry in a developing country like India cannot afford such an exclusivity. It becomes imperative for the aerospace industry to engage itself in the manufacture of both types of aircraft since basic technologies and manufacturing processes tend to be similar in both versions of aircraft manufacturing. The Indian aerospace industry has the potential to manufacture a 100-seater passenger aircraft, which could cater for both military and civilian purposes. Hence, any investments made, or technology transferred by, a foreign vendor must be counted against offsets of such

There is a need to extend the offset credits for investments made in, or technology transferred to, the entire aerospace industry, without differentiating between the civil or military aerospace industry.

A complex and cumbersome offsets policy would only result in increasing the offset costs and may prove to be counter-productive.

vendor as long as the recipient of technology or investments in the Indian aerospace industry happens to be engaged in the production of dual use aircraft or components thereof. The current policy does not permit investments made in, or technology transferred to, the civil aerospace industry to be counted against defence offsets. The scope of the policy, therefore, needs to be extended.

(f) **Need for a Flexible Offsets Policy**. The Indian defence offsets policy is mandatory in nature, involving defence procurements beyond the threshold of Rs 300 crore, with penalty clauses attached in the case of a vendor's failure to meet his offset obligations. However, the offsets policy needs to be flexible without in any way diluting the core objectives of the policy. Such a fine balancing act requires dexterous designing of various provisions and clauses of the policy. A fine tuned objective must result in a win-win situation for both parties. After all, a foreign vendor seeks to reap maximum financial benefit from offsets as well as the main contract. Therefore, instead of creating difficulties for the vendor through cumbersome clauses and conditions, offset provisions must be simple, easy to understand and the prospective vendors should be in a position to seek clarifications without any difficulty usually encountered in dealing with the bureaucracy. A complex and cumbersome offsets policy would only result in increasing the offset costs and may prove to be counter-productive. Penalties and bank guarantees tend to raise the cost of offsets, thereby, increasing the overall cost of the main contract. Certain countries such as the UK, which has a policy of 100 per cent offsets, do not impose penalties in case offset obligations are not met by the vendor. The sole penalty is that consideration of future bids by an offshore vendor will be influenced by its performance in an earlier offset programme.[30] Considering that all major defence acquisition deals involve internationally reputed arms manufacturers,

30. Ron Matthews, "Defense Offsets: Policy Versus Pragmatism," in Brauer and Dunne, eds, n.4, p. 90.

whose credibility is at stake in case of failure to meet their offset obligations, a flexible offset policy can easily do away with penalties and bank guarantees and, thus, help bring down the offset costs.

(g) **Offsets Monitoring Mechanism**. Although there is a lot of initial pre-offsets enthusiasm surrounding defence imports, what does not get adequate attention is the issue of whether the offsets result in intended benefits. This occurs due to a lack of effective monitoring being put in place. Weak monitoring of offsets implementation has been experienced in quite a few countries as there is not much evidence that institutional structures have been put in place for overseeing the actual implementation of offsets. In the Indian case, the DOFA can only facilitate and assist in implementation of the policy. An implementation agency cannot be expected to take on the role of monitoring as well. Therefore, a separate and exclusive structure must be created and entrusted with overseeing and monitoring responsibilities. If it were only a financial audit, perhaps an agency like the comptroller and auditor general (C&AG) could have taken on this role. But monitoring the implementation of offsets involves more than the financial aspects. It involves systematic supervision of the entire gamut of the defence offsets implementation mechanism and ensuring that the intended benefits of technological development of the defence industrial base actually occur. Hence, creation of a separate organisational structure for this exclusive purpose is vital.

A separate and exclusive structure must be created and entrusted with overseeing and monitoring responsibilities.

(f) **Need for Proactive Approach.** The present policy is vague on implementation of offsets with regard to areas in which the implementation potential exists. Instead of listing out the nature of defence exports and the type of equipment that the Indian industry is capable of manufacturing, it appears that the offsets policy requires the vendors to come out with the

nature of defence equipment that they would like to import from the country. In other words, the policy, instead of being proactive in prescribing various areas of growth, appears to be reactive leaving the initiative to the prospective vendors in identifying the potential areas in the nation's defence industry. The recently issued request for proposal (RFP) for the MMRCA is an example for such a phenomenon. Further, the roadmap on reaping the benefits of offsets does not clearly come out in any of the government policy documents. The subject of defence offsets and their potential to develop the defence industrial base of the country requires enormous research and the DOFA must take lead in undertaking such research. Arrangement of workshops, conferences, seminars and brainstorming sessions involving industry experts, think-tanks and academic institutes would be of immense help in such a process.

CONCLUSION

National offset policies, as part of defence equipment imports, have gained prominence in the last 2-3 decades. Offsets have, indeed, resulted in a variety of intended benefits such as economic and indigenous defence industrial development in some countries, even as conclusive empirical evidence on the overall impact of offsets is yet to emerge. The very fact that the number of countries seeking offset benefits has gone up manifold within a couple of decades is an indication that offsets do result in positive outcomes. India's initiative in introducing the offsets policy in defence procurement couldn't have been more timely, at a time when the acquisition budgets have been reflecting impressive growth levels, as a result of buoyant economic progress by the country. What is now required is a careful steering of the policy from here onwards, with carefully chosen objectives and a clear roadmap to convert policy intentions into reality.

(The views expressed in the paper are those of the author and not of any organisation)

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