Contributors

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In a scintillating address to the officers of the armed forces and the broader strategic community at the Centre for Air Power Studies, New Delhi, on October 11, 2006, Admiral Arun Prakash PVSM, AVSM, VrC, VSM, ADC, Chief of the Naval Staff and Chairman COSC, spelt out the direction in which our maritime power should be moving in the coming decades.

2. STRATEGIC ROLE OF AIR POWER: HOW WE NEED TO THINK, TRAIN AND FIGHT IN THE COMING YEARS
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5. DEFENCE MANPOWER IN INDIA: SOME SALIENT ISSUES

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6. NUCLEAR SECURITY: CRITICAL FOR FUTURE NUCLEAR EXPANSION

India's growing civil nuclear power programme for enhanced human development, argues Dr. (Mrs) Manpreet Sethi, requires the greatest attention to safety and security of installations and facilities since the margin for error is zero if a catastrophe is to be avoided. Safety standards and practices have developed enormously and would need to be monitored with the greatest care, and implemented meticulously.

7. LOGISTICS MANAGEMENT PRACTICES

Emphasising the need for sound logistics, Napoleon had once remarked that armies march on their stomachs. Brigadier Rahul K. Bhonsle (Retd), citing the examples of some recent wars,
argues that the complexities of modern wars demand the employment of modern techniques and technologies to ensure the best practices in logistics for winning wars

8. HAS IT WORKED? THE GOLDWATER NICHOLS REORGANISATION ACT

Two decades after it came into force, Mr. James R. Locher III, in an incisive analysis of the Act and its functioning, reemphasises the importance of the higher defence organisation; hence, it deserves continuous and innovative attention. He also concludes that the Goldwater-Nichols Act once again brings to the fore the struggle of each officer to find the right balance between loyalty to the Service and devotion to the larger needs of the nation.
EDITOR'S NOTE

It is axiomatic that the nature of war keeps changing with changes of environment, technology and military capability. It would follow that, if for no other reason than the changing nature of war, the higher defence organisation and its management require regular reviews and adaptation if joint planning and operations are to be successfully undertaken. Similarly, intelligence, especially intelligence assessments of military significance, would continue to be crucial for the higher management of defence and employment of military power at all levels. This has been a weak area in the past and would need to be continually addressed on priority.

Our economic growth and technological development also imply an expansion of interests well beyond our land borders. These interests, like security of energy supply lines, would require protection, as much as our borders would demand continued attention to their defence. Air power from this perspective would have to undertake additional tasks and responsibilities, as the Lebanon War again highlighted the need for evacuation of Indians living abroad, by air and sea.

The war between Hezbollah and Israel during the summer led to questions on the efficacy of air power in neutralising short range missiles fired from mobile launch facilities, with very little reaction time available to strike them. The result was that while the longer range missile launchers were destroyed very rapidly, Hezbollah kept firing an average of 150 such missiles and Katyusha rockets into Israeli populated areas every day throughout the 34-day war. This is likely to provide incentives to non-state actors and even states to use this low cost offensive weapon system on targets close to the borders. Considering that political measures to eliminate such threats are unlikely to be successful, technological and operational solutions would need to be evolved sooner rather than later.
Meanwhile, serious thought needs to be given to arms control measures like agreements not to deploy missiles within a specified distance of borders and lines of control (similar to the 1993 India-China agreement).

As part of the Platinum Jubilee celebrations, our 3rd "Subroto Mukerjee Seminar on Aerospace Power" was devoted to the theme of the "IAF at 75: From Subcontinental to Continental Force." We have had to start the numbering of the journal afresh with effect from the July 2006 issue due to technical requirements of the Registrar of Indian Newspapers which also led to the delay in publishing this volume. Kindly accept our apologies. We will be back on schedule from the next issue.
Air Power Essay Competition 2006

Group Captain Arjun Subramaniam being congratulated by Marshal of the IAF Arjan Singh for winning the First Prize in Air Power "Essay Competition 2006" on December 30, 2006.
INTRODUCTION
Most of you would recall the stir caused when Secretary of State Condoleezza Rice generously offered US help to make India a "major world power," last March. History, and, of course, common sense tells us that no nation has ever achieved greatness by external help or intervention, and that is possibly the reason why her statement gave rise to much scepticism and also raised hackles in India.

Such is our preocupation with internal matters that this statement took most of us by surprise. We are acutely conscious that if India is to attain the status of a major power, we will need to overcome enormous internal challenges. And then, it will not be with help from the USA but only by the contribution of Indians themselves.

The significance of this statement, therefore, must be sought elsewhere; and perhaps it lies in the fact that a great deal of indepth research must have been undertaken by the State Department on India's immediate and long-term prospects in every field before this unprecedented and magnanimous but, one presumes, hard-headed offer was made to us.

I quote this just as an example of the change that has come about in perceptions about India worldwide: India's steady economic growth, her emergence as a nuclear power, our staunch adherence to a secular democratic
A vital influence on the external perceptions of India is our maritime capability.

tradition, professional and apolitical armed forces, the intellectual calibre of our people, and the growing availability of a young working population—these are all factors that contribute to a very favourable matrix which influences external perceptions.

While examining this complex matrix, I would venture to suggest that a decisive but perhaps unstated factor which has had a vital influence on the external perceptions of India is our maritime capability. And this capability is a function of many factors, including our geographical location, and our navy, with special reference to its force levels and professional competence.

MARITIME PERSPECTIVES

Geographically speaking, India holds centrestage in the only ocean in the world which is named after a country. Her peninsular configuration juts out 1,500 miles into the sea and places her at the focal point of shipping lanes which are the arteries of world trade. Apart from other vital commodities, millions of tons of hydrocarbons travel from the Persian Gulf and Middle East to feed the hungry industrial and economic engines of China, Japan and many Southeast Asian countries. Whether we like it or not, geography has placed a heavy responsibility on India’s shoulders and made her the natural sentinel of these trade routes.

Nature has also given India a long, serrated coastline studded with nearly 200 harbours, big and small, which support coastal as well as overseas trade. Off each coast we not only have extensive island territories, but also vast exclusive economic zones which are like treasure-houses laden with unimaginable and as yet unexploited mineral wealth. Currently, one-third of our hydrocarbons come from offshore fields which lie in the Bombay High and Krishna-Godavari basins. With oil prices moving relentlessly upwards (the recent dip notwithstanding), drilling to depths as much as 10 km under the ocean now appears economically viable. It is, therefore, quite likely that we may find fresh exploitable hydrocarbon reserves off the east coast and in the Andaman Sea.

So much for geography; let us now look at our history.
For a very long time, Indians deluded themselves into believing that India was a continental power guarded by the Himalayas which ruled our destiny. The truth is quite different, because most Indians are blissfully ignorant about the fact that from about the third millennium BC, till the 13th century AD, India was a thriving maritime power.

While our western seaboard undertook extensive commercial activity with the Persian Gulf, Red Sea and the Mediterranean, successive kingdoms in peninsular and eastern India created a powerful maritime vision and tradition. Dynasties like the Mauryas, Sattavahanas, Pallavas and Cholas sent out fleets that were instrumental in spreading India’s trade, culture, and religions by sea to Southeast Asia and further. It was the decline of our maritime power and tradition in the 13th century that coincided with the domination by foreigners for the next 600-700 years.

Historically, the fertile Indo-Gangetic plains of north India have been the magnet for incursions for centuries. There was an incessant succession of invaders, who came over the northwestern mountain passes, stayed on and were absorbed into the resilient Indian culture and became Indians. So that today, many of us probably carry in our veins the blood of Aryans, Huns, Bactrians, Greeks, Persians, Turks, Mongols, and Arabs – to name just a few of the invading races who stayed on in India and were assimilated.

We continued to remain inwardly focussed even when danger loomed large from the seas. From the 15th century onwards, European merchants obtained commissions from their sovereigns and set out on ships to seek the fabled gold and spices of the Orient. The Portuguese came first, followed by the French, the British and the Dutch. They all came by sea, across our shores, ostensibly to carry on peaceful trade. Assimilation with India’s culture was the last thing on their minds; they came only to exploit our weaknesses, divided and conquered us, and stayed on to rule India and to plunder her wealth.

The fact that India was subjugated and ruled by invaders who came not over mountain passes, but from the sea across our shores, is a fact that should remain embedded in our memory forever.
The fact that India was subjugated and ruled by invaders who came not over mountain passes, but from the sea across our shores, is a fact that should remain embedded in our memory forever. It should also influence our current and future attitude to maritime power.

It is, therefore, not only fortuitous but most appropriate that the kind of maritime resurgence that is taking place in India should coincide with her rise as an economic power and a nation of substance because there is a deep linkage between the two factors.

PRIMACY OF MARITIME INTERESTS

Today, the maritime environment encompasses a wide array of national interests, some of which I have just mentioned in passing. I will focus briefly on just two, overseas trade and energy security, since our economic prosperity is inextricably linked to them.

Foreign trade contributes about 20 per cent of India’s gross domestic product (GDP) but as a share of world trade, it currently hovers at just under one per cent. The government plans to double this figure in the next five years. Considering that 97 per cent of this trade is seaborne, one can imagine the degree of dependence on the seas that the future will bring. We have a large merchant fleet of about 756 ships totalling over 8.6 million gross registered tonnes (GRT). They carry only 16 per cent of our trade, and the rest comes in foreign flagged ships.

Similarly, India is a net importer of hydrocarbons and about 70 per cent of our energy resources come from overseas by sea. Currently, we rank 4th in energy consumption, and by 2050, it is expected that India will be the largest importer of oil in the world. A new development is our acquisition of oil and gas fields stretching across the globe, from Sakhalin in the Russian Far East, to Africa and South America. Apart from the billions of dollars that we have sunk into our own offshore assets, the investment overseas assets too will warrant some thought for their protection in the future.

These invaluable maritime assets can, in times of tension, become liabilities which must be safeguarded at all cost. So what kind of a maritime force do we envisage to protect these maritime interests, and to implement our maritime strategy?
THE CONCEPTUAL UNDERPINNING OF FORCE PLANNING

It is an accepted tenet that in international relations there are neither permanent friends nor permanent enemies; only permanent interests. The maritime force that we seek to create is, therefore, conceived, not so much on the basis of threats to our security, as on safeguarding our consideration the capabilities existing in our neighbourhood and the potential challenges they could pose. The underlying premise is that if a capability is being acquired by a country with which we share interests or boundaries, it could have a bearing on our security in the future.

After clearly identifying the navy’s roles and missions, vis-a-vis our maritime interests, and demarcating its areas of responsibility, the essence of our planning process has been to identify the capabilities considered necessary to discharge them effectively. The saying that “numbers have their own logic” is perhaps valid; but only up to a point. Beyond that, you just cannot ignore the even more compelling logic of technology and economics.

In the 1980s, we acquired guided missile destroyers at Rs. 150 crore apiece. A current generation destroyer will cost around Rs. 1,500 crore and is unaffordable in the same numbers. But we cannot overlook the fact that it also has a capability which is proportionately higher, so that smaller numbers will do. At the same time, for policing roles close to the coast, you do need low-end platforms; and these will have to be in sufficient numbers.

Having consciously decided to focus on the “capabilities” required by us in the future, and followed an iterative process which took into account, amongst others, the all important budgetary factor, we find that we have considerably reduced the numbers we had originally aimed for. We hope that we now have a “right-sized” navy which can fulfill its assigned roles very effectively.
We are clear in our minds that while wars may well be fought at sea, they are finally won only on land. Therefore, it will now be an article of faith with us that all operations by maritime forces at sea will be designed to produce a direct or indirect impact on the land battle in progress.

Amongst the capabilities that we seek at sea are long-range air defence and anti-missile defence, airborne early warning, anti-submarine warfare, anti-ship and land attack missiles, trade warfare, maritime reconnaissance, amphibious assault, special forces, and mine counter-measures. An overarching requirement is that of shipborne logistics and support, which endow the fleet with long range and endurance or a “blue water” capability.

We are fortunate that the vision of our predecessors created a sound warship-building base in the country. Consequently, the platforms that we seek are largely going to be built in Indian shipyards. In an unprecedented naval construction programme, we have on order today, 35 vessels which include patrol boats, landing ships, hydrographic ships, corvettes, offshore patrol vessels (OPVs), destroyers, frigates, submarines, and an aircraft carrier.

In addition, we are acquiring an aircraft carrier, three frigates, a landing platform dock (LPD) and a tanker from abroad.

CAPABILITIES, FORCES AND PHILOSOPHY

We have hoisted in the lessons of history, and are clear in our minds that while wars may well be fought at sea, they are finally won only on land. Therefore, it will now be an article of faith with us that all operations by maritime forces at sea will be designed to produce a direct or indirect impact on the land battle in progress. All our planning will be undertaken jointly, and we hope that it will result in an irresistible all-arms synergy.

We aim to exercise selective sea control in the waters of the Indian Ocean by deploying task forces built around the core of aircraft carriers with fighters, and airborne early warning (AEW) as well as anti-submarine warfare (ASW) helicopters on board. While protecting our own trade, sea denial operations will
be undertaken by our submarine force, working in close cooperation with
missile armed maritime reconnaissance aircraft.

Closer home, our coastal forces will undertake mine counter-measures and
the defence of offshore and onshore assets against attacks from the sea.

It is the navy's business in war-time to seek out and destroy the enemy's fleet
units wherever they may be, using all the means at its disposal. However, in
order to make a palpable impact on the land battle, there are only two options
available to it. Firstly, by engaging in trade warfare or "commodity denial"
operations which will over time bring the enemy's industry and war machine to
a grinding halt. And, secondly, by making a direct approach to the enemy's
littoral through what is called "maritime manoeuvre from the sea."

This manoeuvre aims to unbalance the enemy and to shatter his morale and
cohesion, by bringing to bear concentrated force from the sea at a selected point
on his littoral at a time of our own choosing. This concentrated force can consist
of a combination of special forces, land-attack missiles, amphibious assault and
naval aviation, all of which we possess.

Our operational philosophy now places the highest importance on littoral
warfare, which is notionally divided into a number of phases. Having attained
"sea control" and/or "sea denial" as required, we will then aim for
"information dominance" which encompasses the electronic warfare as well as
information warfare domains. This will be followed by certain "support
operations" which may be required to precede manoeuvre from the sea in all or
some of its manifestations against the littoral. In the support operations, we will
be placing heavy reliance on the availability of Indian Air Force (IAF) support at
a time and place that we would indicate.

THE FOUR PILLARS OF OUR STRATEGY
Our evolving maritime strategy rests on four main pillars, and I shall dwell
briefly on them in turn. The first of these is self-reliance.

Self-Reliance
Having made a very early start in the field of indigenous ship-building, we have
There is no alternative but to develop systems at home; and the sooner we get serious about it, the better. Traditionally, we have maintained a very close relationship with the Defence Research and Development Organisation (DRDO) labs, three of which are exclusively dedicated to the navy.

We have discovered two things. First, that having reached a level of about 70-80 per cent indigenisation, we have plateaued over time, and are unable to go beyond, because we lack the capability to produce weapons and sensors. Second, we find that no matter which foreign supplier we go to, by importing systems, we place ourselves at the mercy of that country; product support is universally unreliable, suppliers can raise prices at will or even choke off supply whenever they feel like it.

We are now firmly of the view that there is no alternative but to develop systems at home; and the sooner we get serious about it, the better. Traditionally, we have maintained a very close relationship with the Defence Research and Development Organisation (DRDO) labs, three of which are exclusively associated with all our research and development (R&D) projects, and we often commit funds to the DRDO. As a manifestation of our support, we have sometimes even accepted the DRDO products which have fallen short of qualitative requirements (QRs), on the understanding that they will more than make up the shortfall in the Mark II product. We have received torpedoes, sonars, radars, early warning (EW) and communication systems and many other products from the DRDO and look forward to the light combat aircraft (LCA) (navy) in the future.

Another pioneering navy initiative in this context has been a three-cornered tie-up among the DRDO, navy and a foreign company for joint development and collaborative manufacture of an advanced weapon and sensor system. We hope to replicate this model wherever necessary.

We have created a full fledged Directorate of Indigenisation which is in dialogue with our private sector to involve their participation in our major projects like the submarine and aircraft carrier building programmes.
Networked Operations

Today, we find that our platforms have weapons of formidable range, but their sensor capabilities do not match up. Nor are widely separated units able to know what each other is seeing or hearing.

Therefore, in order to exploit the full potential of our surface, submarine and airborne platforms, it is essential that they are networked with each other and with shore operations centres. We will then have a composite picture of what every one of our platforms can detect by radar, sonar and EW devices, conveyed through the medium of a geo-stationary communications satellite dedicated to naval use. This would then establish what is known as “sensor to shooter” connectivity over long distances, and act as a tremendous force multiplier.

We have adopted an incremental approach, and a basic networking system, developed in-house, is already in place on most of our ships and aircraft. The main network-centric operations project is a complex task and will take some time to evolve and implement. We aim to have compatibility among the systems of the three Services.

Foreign Cooperation

It is because we already had a level of mutual comfort with navies in the area that we could undertake humanitarian operations successfully during the tsunami, and more recently during the Lebanon crisis. The lesson that emerges is that in order to ensure the success of our operations at sea, it is essential to shape the maritime environment carefully in peace. It is, therefore, obvious that foreign cooperation is going to be a major preoccupation of the navy in peace-time.

The Ministry of External Affairs (MEA) is now cognisant that the navy is an important instrument of state policy and it must be used as such, whenever necessary. In this

In order to ensure the success of our operations at sea, it is essential to shape the maritime environment carefully in peace. It is, therefore, obvious that foreign cooperation is going to be a major preoccupation of the navy in peace-time.
context, working closely with them, we have drawn up a Foreign Cooperation Roadmap which is being systematically implemented by a dedicated organisation within the Naval Headquarters (NHQ).

We are focussing on countries in our maritime neighbourhood and evolving programmes which envisage assistance and/or cooperation in the fields of training, hydrographic survey, technical expertise or hardware transfer. Exercises and joint patrolling are other features of our foreign cooperation initiative.

This brings me to the fourth and last pillar, which is the evolution of doctrines and concepts.

Doctrine and Concepts
While countries will eagerly sell us platforms and systems, no amount of money will make them part with doctrines or tactical and operational concepts. In any case, we need to develop these to suit our own peculiar conditions and environment.

Since we import much of our hardware, for good reasons, our system of doctrine evolution has always lagged behind the introduction of systems into service. In order to streamline this process, we have, in the recent past, set up a number of institutions which will provide the intellectual underpinning for our long-term policies and plans, and synergise maritime doctrine and strategy with force planning and acquisitions. To this end, we have put in place the National Maritime Foundation, an autonomous think-tank, a Directorate of Strategy Concepts and Transformation in NHQ, and very recently, Flag Officer Doctrines and Concepts in the field.

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Our Maritime Doctrine was promulgated in 2004, and last year we produced a Maritime Capabilities Perspective Plan. During the forthcoming Commanders' Conference, we will release a companion document on Maritime Strategy.

Apart from induction of high technology, we foresee many other
changes being ushered into the navy in the next few years. A major one will be the enhancement of educational qualifications, including a BTech degree for all officers in the new Naval Academy. We are a conservative Service, and “management of change” will by itself pose a considerable challenge. In order to confront it, we have evolved what we are calling a “Transformation Roadmap”, which we hope will ensure smooth sailing in this somewhat difficult period.

ROLE OF AVIATION
Let me now briefly touch, in general terms, upon the significance of aviation in maritime strategy.

The Indian Navy has been a staunch advocate of air power at sea, and our 53-year-old Fleet Air Arm is today the size of small air force. Every ship over 1,000 tons can carry one or more helicopters. Such is the primacy and importance of air support at sea that maritime operations without it are inconceivable today.

For our surface fleet, the missile threat, both from armed maritime reconnaissance aircraft and submarines is all pervasive. Again, in the context of the littoral, maritime operations would have to be undertaken in the face of shore-based air opposition. The detection and neutralisation of such threats is often best achieved by airborne platforms. Air operations at sea include air-defence, anti-missile defence, AEW, anti-shipping and shore strike, ASW, air-submarine cooperation, and maritime reconnaissance. Our future acquisition plans cater for accretion and upgradation of these capabilities.

The dramatic growth of IAF capabilities has been viewed by the navy with great delight and anticipation. The dramatic growth of IAF capabilities has been viewed by the navy with great delight and anticipation. We are acutely aware that in the years ahead, naval aviation is going to be spread thin over the Indian Ocean and aircraft carriers cannot
We look to IAF support, not just for anti-shipping strike but also in certain circumstances, for air defence. The capabilities of the Su-30, especially with air-to-air refuelling give us great comfort at sea, and our maritime strategy will indeed bank on their support.

We are quite clear in our minds that the IAF is the fountainhead of aviation knowledge and expertise in the country, since this is their core competence. The navy has been the beneficiary of IAF support and assistance in many spheres in the recent past; our Sea Harrier pilots regularly hone their air combat skills with the Tactics and Combat Development Establishment (TACDE). They have recently been taught the art of in-flight refuelling by IAF instructors. We received invaluable advice and guidance from Air HQ during negotiations for the MiG-29K, and we plan that this carrierborne squadron will always have 2-3 IAF pilots on exchange posting.

Let me, however, add that just as we believe that maritime power by itself cannot win wars, we are sceptical about the pronouncements of Guido Douhet and Billy Mitchell. We are quite clear that we will not be seduced by the siren song of air power. It can shock, it can awe, it can be decisive in battle, but it cannot win wars by itself. This is the lesson of history from World War II, Vietnam, Iraq, Afghanistan and now Lebanon. So, for the navy, air power will remain one of the arrows in its quiver – albeit a very potent one.
STRATEGIC ROLE OF AIR POWER: HOW WE NEED TO THINK, TRAIN AND FIGHT IN THE COMING YEARS

ARJUN SUBRAMANIAM

Real exploitation of air power’s potential can only come through making assumptions that it can do something we thought it couldn’t do... We must start our thinking by assuming we can do everything with air power, not by assuming that it can only do what it did in the past.

—Col John Warden

The application of air power to further a nation’s strategic objectives has gained momentum over the last few years ever since it was used with telling effect in Operation Desert Storm, over Kosovo and during Operation Iraqi Freedom. Notwithstanding the tremendous asymmetry displayed in these conflicts, the advent of sensors that provide accurate target intelligence coupled with precision guided munitions (PGMs) has led to “effect-based operations” gaining predominance in speedy conflict resolution, with minimum attrition and collateral damage. The Indian Air Force (IAF) is in the midst of a radical change in mindset and reorientation of its force structure so that it is capable of conducting “parallel” warfare and influencing operations at the tactical, operational and strategic levels. It is in the light of these developments that there is need to “think, train and fight” with a strategic focus.

CONCEPTUAL DEVELOPMENT

The use of air power to further a nation’s strategic aims, and objectives has come a long way since the pounding of Nazi Germany’s ball bearing factories on the
Rhine by Allied bombers and the obliteration of Hiroshima and Nagasaki, both of which had a significant bearing on the outcome of World War II. The conversion of World War II vintage bombers like the B-17, B-24 and the B-52 along with their Russian counterparts like the TU-126 to carry nuclear missiles and warheads added a new dimension to strategic air power, that of deterrence. The application of air power to further strategic objectives and engage in coercive diplomacy has seen tremendous success over the last 40 years, barring an odd failure. Without constantly harping on the contribution of the strategic application of air power at Hiroshima and Nagasaki as the prime catalyst for the surrender of Japan, numerous examples that cut across intensities of conflicts can be cited to push the case for a reappraisal of the swift benefits of the strategic air campaign. Whether it was Operation Linebacker I and II that allowed the US to draw the Viet Cong back to the negotiating table in 1971-72, or the surgical strikes on Arab airfields by the Israelis in 1967, target selection was the key to the achievement of strategic objectives. As against this, poor target selection during Operation Rolling Thunder from 1965-68 led to its total failure. The strategy of targeting the Ho Chi Minh Trail and centres of population in North Vietnam proved to be blunders that were rectified in Operation Linebacker where only military and infrastructure elements of national power were targeted.

Next came the redefinition of platforms to prosecute the strategic air campaign and the consequent understanding that the strategic air campaign was better focussed when one looked at the “effect” of destruction on the ability or will of a nation to wage war rather than the target and platform itself. The choice of attack platforms today also represents a radical shift from the strategic bomber

1. Air Chief Marshal Sir Michael Knight, Strategic Offensive Air Operations (Brassey’s Airpower Series, 1989), pp. 48-60.
3. Ibid.
Role reversal of strategic and tactical aircraft commenced in Vietnam where B-52s carried out missions in support of ground operations while F-4s and F-105s flew against strategic interdiction targets deep inside North Vietnam. Years later, eight F-16s, primarily considered in the United States Air Force (USAF) and Israeli Air Force as tactical platforms, destroyed the Iraqi nuclear reactor at Osirak in what was considered a classic strategic strike. The final fillip to the case for strategic air power is, without doubt, the emergence of highly accurate PGMs coupled with real-time intelligence and "just-in-time targeting" that allow a nation to exert its will on another without committing ground forces, and paving the way for negotiated settlement of conflicts without unnecessary collateral damage and loss of life. A classic example of this redefinition, which may not be palatable to the counter-air purists, would be the destruction of Arab aircraft on the ground in 1967 during the classic counter-air campaign launched by the Israeli Air Force. Were not the effects "strategic" in terms of breaking the Arab coalition's ability and will to fight? Enough has been articulated over the years on the spectacular success of the Coalition air forces in Operation Desert Storm where an "effect"-based strategic air campaign, conceived by Colonel Warden and executed by General Horner, achieved President Bush's "Strategic Objective" of driving Iraq out of Kuwait with minimum attrition. If one were to pinpoint one failure of the use of strategic air power in recent years, it would be the failure of the USAF to eliminate Osama Bin Laden and the top Taliban leadership that was one of the main strategic objectives of Operation Enduring Freedom. If mass, tonnage, widespread area bombing due to lack of hard intelligence, collateral damage and indiscriminate loss of life were the prime characteristics of the strategic air campaign of yesteryears, stealth, precision, intense shock effect and speedy capitulation of the enemy along with the achievement of objectives are the results of the 21st century strategic air campaign.

Sceptic may say that the next few generations may not see a world war and that force structures of developing countries like India need to be focussed on

The coming years would see a struggle for strategic resources, strategic points and strategic markets, most of which could spread across the globe, thousands of miles from a country’s geographical boundaries.

Waging local wars under hi-tech conditions, low intensity conflicts and counter-insurgencies. They could not be farther from the truth as the coming years would see a struggle for strategic resources, strategic points and strategic markets, most of which could spread across the globe, thousands of miles from a country’s geographical boundaries. A threat to these assets would warrant speedy intervention, something that only air power could achieve. The case for further developing the IAF’s strategic air capability in the coming years cannot but be overemphasised in the light of India’s emergence as a potential economic superpower with global energy interests and markets. The need for swift, precise and decisive intervention in potential hotspots spread across continents can only be achieved by synergistic joint operations, with air power being used as a springboard or a launch pad for further intervention by land and naval forces.

UNDERSTANDING PARALYSIS, ASYMMETRY, AND PARALLEL WARFARE

The three main objectives of any military campaign have always been coercion or intimidation, incapacitation or dismemberment and, finally, annihilation or destruction. These military objectives have always been focussed in the direction of achievement of a nation’s geo-political objectives in any dispute or conflict. Warfare in the 21st century is slowly moving towards keeping destruction or annihilation as a last resort in legitimate war-fighting scenarios. With this in focus, two air power theorists from the USAF, Colonels Warden and Boyd propounded
path-breaking theories of paralysing the enemy by strategic application of air power. While Boyd talks about paralysing the enemy psychologically and weakening his will to fight, Warden emphasises the need to physically paralyse the adversary by attacking leadership, infrastructure, communication links and fielded forces as part of his now famous “Five Ring Theory” based on Clausewitz’s centres of gravity, which formed the heart of the air campaign in Operation Desert Storm. The cornerstone of this process is the high probability of pounding an enemy into submission without inflicting too many casualties and reducing the intensity of contact battles by driving his leadership “underground,” blinding him, rendering his senses (eyes and ears) ineffective and destroying reserves and follow-on forces by carrying out “deep precision strikes.” While the strategic air campaign that aims at paralysis is based on overwhelming asymmetry that US forces are likely to enjoy in any conflict scenario, it is important for policy and strategy planners in India too to understand the tremendous advantages of creating an asymmetry vis-à-vis potential adversaries by building up a potent strategic air capability that is built around technology, force multipliers and multi-theatre capability. At no stage is it considered that air power alone and that too the strategic air campaign alone can win a war by itself. What it certainly can do, by applying the principles of asymmetry and paralysis, is hasten the capitulation of an enemy by incapacitating him and reducing his military potential, as mentioned earlier, rather than destroying him. All this can be done by air power simultaneously while providing support to the surface campaign by exploiting air power’s ability to conduct parallel warfare at the tactical, operational and strategic levels. Building such an ability calls for acceptance of the need for asymmetry, change in mindset and significant alterations to asset allocation. In the Indian context, building up asymmetry cannot be restricted only to acquisition of technology, force multipliers and space-based sensors, as many would believe, in order to justify a “leaner” air force. All the above need to be supplemented with numbers

in terms of aircraft and platforms to be able to conduct parallel and asymmetric warfare on multiple fronts. This obviously calls for a strong case to 'beef up' up the number of squadrons in the IAF from a projected 29 in 2007 to at least 40-45 squadrons by 2015.

ROLE DEFINITION IN THE 21ST CENTURY

The emergence of invisible enemies like terrorists, and unconventional targets that revolve around material and human resources has meant that it will become increasingly difficult to classify the roles that strategic air assets would perform over the next few decades. If one were to identify the most critical characteristics of air power that would occupy centre-stage for the Indian Air Force in the years to come, they would be flexibility, reach, firepower with precision and interoperability, with other characteristics like surprise and shock effect being age-old and time-tested corollary benefits. What is it about these four USPs that makes them the focus of a study to define the roles of strategic air power for the IAF in the 21st century? The ability of a platform to effortlessly switch from a tactical to a strategic role is an inescapable imperative as is its reach in performing “interventionist” roles with appropriate combat support elements, thousands of kilometres away from its launch base. Having reached its target, the platform must be able to neutralise the target with precision attacks and minimum collateral damage.

The platforms and crew used for prosecuting the strategic air campaign must be able to operate in international air space with varied sensors, and possibly with aircraft/air crew of multinational task forces, especially in conflicts involving the UN/multinational forces. They also need to be well integrated with elements of the

surface forces involved in strategic interventions so as to synergistically apply the principles of asymmetry in conflict resolution. Having broadly spelt out the framework, what then are the broad strategic roles and missions that the IAF can take on with a force structure that would revolve around aircraft like the SU-30 MKI, MRCA, Mirage 2000, IL-78, IL-76 and the airborne warning and control system (AWACS)? While it would be very easy to ape the USAF and formulate a “strategic air campaign” and force that revolves around “centres of gravity,” nothing would be more divorced from the reality of the “Indian situation.” Two major questions would need to be asked:

- Do we have the resources to prosecute such a campaign?
- Are we likely to be faced with an Iraq-like situation of asymmetry?

The answer would obviously be NO! That brings us back to a strategic intervention capability revolving around economic progress, energy and people. Till now, the IAF has been seen as a predominantly tactical air force with limited deterrent capability. With the advent of platforms like the SU-30 MKI, weapon systems like the Brahmos and force multipliers that include aerial refuelling platforms, unmanned aerial vehicles (UAVs) and AWACS, there is a need to “think big” and “think far.” Conventional roles have to be replaced by roles that cater to the following scenarios:

- Power projection role.
- Strategic intervention.
- Proactive strikes and elimination of threats.
- Humanitarian intervention.
- Peace-keeping missions in a lead role.
- Protection of energy and economic resources and island territories of Andaman and Nicobar and Lakshadweep.
- Anti-terrorist and anti-hijacking operations.
- Protection and evacuation of human resources.
- Enforcement of “no fly zones.”

19 AIR POWER Journal Vol. 1 No. 2 WINTER 2006 (October-December)
Targeting philosophy too has changed significantly over the years, dictated mainly by the nature and duration of wars, capability of platforms, accuracy of munitions and quality of intelligence. In many of the scenarios and roles indicated above, while the navy and army would continue to form key components of a joint task force, it is air power that would be used to intervene at short notice. Even when it comes to humanitarian intervention, the recent tsunami highlighted the speed and responsiveness of air power as also the need for additional resources in terms of heavy lift helicopters and transport aircraft for disaster relief operations.

TARGETING FOR STRATEGIC AIR STRIKES
Targeting philosophy too has changed significantly over the years, dictated mainly by the nature and duration of wars, capability of platforms, accuracy of munitions and quality of intelligence. The slow and sequential effect of strategic bombing during World War II, and to some extent during Vietnam, did contribute significantly to the final outcome owing to repetitive attacks. This involved thousands of sorties against the same target sets without looking at civilian casualties and collateral damage, the main aim being to systematically undermine the industrial capability and psychologically numb an adversary into submission. Closer home, the surgical strike by the IAF MiG 21s on the governor-general’s residence in Dhaka in December 1971, did make a significant dent in the morale of the East Pakistani leadership that ultimately resulted in their capitulation only days later. Wars and conflicts in the 21st century will be short and swift, necessitating extremely quick and effective targeting without having to resort to repetitive attacks. Redundancy and recuperability of economic targets has also shifted focus on the types of targets that need to be neutralised to hasten the end of a conflict. Typical changes in target profiles over the years are indicated in Table 1.

As can be seen, the focus has shifted from people and economy to “leadership”
Table 1

<table>
<thead>
<tr>
<th>World War II</th>
<th>Gulf War of 1991 and Iraq War of 2003</th>
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<tr>
<td>Population centres</td>
<td>Enemy leadership</td>
</tr>
<tr>
<td>Industrial capability</td>
<td>Command, control, communications,</td>
</tr>
<tr>
<td></td>
<td>intelligence (C’I) systems and sensors</td>
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<tr>
<td>Manufacturing centres</td>
<td>Fielded forces and reserves</td>
</tr>
<tr>
<td>Hydroelectric and power generation</td>
<td>Nuclear and weapons of mass destruction</td>
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</table>

and military capability. Targeting for the strategic application of air power was also totally redefined during Operation Desert Shield, Desert Storm and in Kosovo, with significant refinements during Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom in 2003. As against a fairly rigid set of targets that were defined by perceived centres of gravity and folded into a largely individualistic and much publicised “shock and awe” strategic air campaign in 1991, the 2003 Iraq War saw a number of strategic targets being engaged simultaneously by platforms as varied as classical strategic platforms like the B-2 bomber to purely tactical platforms like the F-16 and Predator UAVs armed with PGMs and a wide variety of “smart weapons.” Of the 41,309 sorties flown during Operation Desert Storm, only 20 per cent were against strategic targets, primarily due to low availability of PGMs and absence of real-time target information, a figure that went up significantly in 2003. Another interesting change in the US strategy in 2003 that has lessons for the Indian Air Force is that the strategic air campaign during the 2003 Iraq War was not tied to any traditional timetable and was made to fit like a glove around simultaneous land and naval campaigns that gave more impetus to the importance of synergy and joint operations.

The focus has shifted from people and economy to “leadership” and military capability.

11. Grant, n 8.
The Honourable Raksha Mantri of India, Shri Pranab Mukherjee acknowledged the primacy of air power in future conflicts and linked the reorientation of the IAF to India’s rapid economic growth and the need to protect our security interests extending from the Persian Gulf to the Malacca Straits.

**ASSET ALLOCATION**

The present force structure of the IAF offers limited capability for "strategic intervention." Only aircraft like the SU-30 MKI and IL-76/78 meet the various criteria laid down for strategic intervention. Given India’s growing global aspirations, there is a need to address our force structure requirements for strategic force projection, intervention and even coercive diplomacy. While delivering the Air Chief Marshal P.C. Lal memorial lecture in March 2006, the Honourable Raksha Mantri of India, Shri Pranab Mukherjee acknowledged the primacy of air power in future conflicts and linked the reorientation of the IAF to India’s rapid economic growth and the need to protect our security interests extending from the Persian Gulf to the Malacca Straits. He went on to also highlight the need for emphasis on strategic thinking, joint operations and asymmetric warfare, all of which have been discussed in this article. Some of the essential ingredients to bolster our strategic air war-fighting capability are listed below. These include not only tangible assets like hardware resources and technology, but also intangibles like leadership and political will. The list includes:

- Platforms.
- Facilitators.
- Information providers.
- Responsible and knowledge based leadership.
- Political will and speedy decision-making appellate/organisation.

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Platforms
Amongst the numerous aerial platforms that are presently in use the world over as part of "strategic forces," the most important ones from an Indian perspective are fighter aircraft, heavy lift/medium lift transport aircraft, multi-role helicopters and force multipliers like AWACS, air-to-air refuelling (AAR) platforms and early warning (EW) aircraft. These platforms need to be backed up by real-time information providers like satellites with <1 m resolution and rapidly deployable UAVs with multiple sensors, adequate loiter time and even limited firepower. While the SU-30 MKI with its phenomenal reach, awesome firepower, multi-crew and multi-mission capability is an ideal platform to prosecute a "strategic air campaign," it is important that we clearly understand that essentially tactical platforms like the M-2000 and the MRCA, 126 of which are in the pipeline, can be employed effectively in neutralising "strategic targets." Even older platforms like the Jaguar can supplement the SU-30, M-2000 and MRCA. The only caveat being that greater coordination, support and precision would be required for using them in the strategic air campaigns. Strategic strike capability without strategic airlift capability leaves a gaping hole in a nation's ability to project, sustain, reinforce and, if required, even extricate, strategic forces over large distances. The IAF's only strategic airlift platform, the IL-76, is ageing and needs to be supplemented by a newer generation heavy lift aircraft in the same or larger category and a medium lift aircraft in the 15-20 ton payload category. As far as helicopters are concerned, destruction of C3I nodes, elimination of leadership, induction/extrication of special forces and interdiction of reserves and "follow-on forces" are all strategic tasks if one looks at effect-based operations. There is a yawning deficiency in this area and it needs to be addressed at the earliest.

Force Multipliers
With the induction of the IL-78 AAR platform and the impending induction of AWACS, the IAF would have taken the first step to becoming a truly self-reliant air force with global intervention capability. However, let us not be lulled into a false sense of bravado that the journey ends here. If one looks at the geographical extent of our country, one would realise that the number of
refuellers and AWACS would barely suffice to address tactical needs in multiple theatres, leaving very little for any meaningful strategic intervention. It is this limitation and void that needs to be filled with additional inductions to create an exclusive force that thinks, trains and fights "strategically" – more of which will be discussed in organisational and training imperatives later on in the article. The induction of UAVs and exploitation of civilian space technology has also added significant punch to our capability, and needs to be well integrated into our intelligence framework.

INTELLIGENCE GATHERING TO SUPPORT STRATEGIC AIR OPERATIONS

Presently, sharing of intelligence between the military and other agencies leaves much to be desired and turf battles have resulted in "below optimal" sharing of both hard and soft intelligence. Targets for strategic intervention are no longer static and range from elusive enemy leadership to highly mobile tactical weapon

![Diagram of Intelligence Gathering System](image-url)
systems whose destruction can break an enemy’s will to continue fighting. Classic examples of this were the continued US air attacks against mobile Al Qaeda leadership, with limited success, in conjunction with special forces, and the destruction of Serb SAGW sites during the Kosovo conflict by air power alone. There are presently too many agencies that receive, process, interpret and disseminate intelligence, and there is a pressing need for a lean intelligence structure to support strategic air operations. Without dissecting the structure too critically, a broad requirement is given in Fig. 1.

With the phasing out of the MiG-25 strategic reconnaissance aircraft, the onus of providing accurate intelligence for strategic targeting has shifted to space based sensors. Even in the absence of dedicated military satellites, capabilities of civilian remote sensing technologies like the Ikonos (USA) and the Indian technology experimental satellite (TES) permit resolutions as low as one metre. With possibilities of further reduction in resolution on the anvil, the dividing gap between civilian and military capability is reducing. Typical resolution of some possible strategic targets in metres is given in Table 2.

According to Prof U.R. Rao, one of the pioneers of India’s satellite programme,

<table>
<thead>
<tr>
<th>Target</th>
<th>Detection</th>
<th>General Identification</th>
<th>Precise Identification</th>
<th>Description</th>
<th>Technical Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>CI HQs</td>
<td>3</td>
<td>1.5</td>
<td>1.0</td>
<td>.15</td>
<td>.10</td>
</tr>
<tr>
<td>Nuclear Weapon Components</td>
<td>2.5</td>
<td>1.5</td>
<td>1.0</td>
<td>.15</td>
<td>.05</td>
</tr>
<tr>
<td>Missile Sites</td>
<td>3</td>
<td>1</td>
<td>1.0</td>
<td>.3</td>
<td>.05</td>
</tr>
<tr>
<td>Air fd Facilities</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>.3</td>
<td>.15</td>
</tr>
<tr>
<td>Bridge</td>
<td>6</td>
<td>4</td>
<td>1.5</td>
<td>1.0</td>
<td>.3</td>
</tr>
<tr>
<td>Radar</td>
<td>3</td>
<td>1</td>
<td>.3</td>
<td>.15</td>
<td>.02</td>
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<tr>
<td>Supply Dump</td>
<td>2</td>
<td>1</td>
<td>0.3</td>
<td>.03</td>
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14. Ibid.
the only way to exploit space for strategic intelligence is to foster greater synergy between the Indian Space Research Organisation (ISRO) and defence users like the three Services, Research and Analysis Wing (RAW) and Intelligence Bureau (IB). He further goes on to say that all requirements for strategic reconnaissance have to be met indigenously, with ISRO being capable of meeting reduced resolution requirements. Needless to say, the success of any strategic air campaign depends on the accuracy of intelligence and training in a realistic environment like the Coalition forces carried out in Operation Desert Shield prior to Operation Desert Storm. Common sensor and communications programmes in UAVs, manned aircraft and even satellites are vital for mission effectiveness along with a single processing, analysing and disseminating agency like the aerial common sensor programme being adopted by the US armed forces.

COMMUNICATION REQUIREMENTS
Transfer of real-time information between platforms and ground/airborne sensors is vital for the successful execution of any mission and assumes even greater relevance in the case of a strategic air operation wherein the flexibility to abort the operation or a new target location could be given minutes before the TOT (time over target), something that is imperative to ensure the success of the emerging concept of “just-in-time” targeting. Some of the ingredients of a secure, effective and flexible system are highlighted below:

- Satellite-based defence communication system with encryption and sufficient bandwidth.
- Link 16 type of data linking facilities that gives air crew and mission coordinators a clear picture or sitrep of both the tactical and strategic air situations. This would involve elaborate linking up of surveillance platforms, ground processing sensors, AWACS, airborne platforms and even special forces which could be assigned the role of terminal designators against mobile and elusive targets like enemy leadership in mountainous terrain.

15. Ibid.
POLITICAL WILL AND INTENT

Prosecution of the strategic air campaign requires strong political will, clarity of intent and ability to gather domestic public support/approval and absorb international flak and criticism. The only way to gather public support in a democracy like India is to encourage widespread strategic debates to make our strategic interests widely known and accepted, so that when these interests are threatened, the decision to use force can easily be taken. This is a weak area in our country and needs to be addressed at the earliest. The organisation for speedy decision-making exists. It only needs to be exercised in the direction of strategic interests and intervention more often.

CHANGES IN PHILOSOPHY/DOCTRINE

Probably the most difficult part of change is to alter a mindset. The last 30 years have shown that air power has the ability to decisively influence the course of any conflict by strategic application of aerial force, be it in the Arab-Israeli conflicts of 1967 or Bekaa Valley or Desert Storm, Kosovo or Enduring Freedom. It is time to embrace a doctrinal shift towards building up a Strategic Forces Command that recognises the need to develop intervention capability spearheaded by air power, with naval and land forces completing a synergistic troika without needlessly engaging in turf battles regarding command and control of theatre forces, something that has so often stunted the development of strategic doctrine within the Indian armed forces. There is a need to adopt the techniques of parallel warfare in which the payoffs of strategic application of air power, when applied simultaneously with tactical application, act as a decisive force. Lest the surface forces feel that the impact of strategic air strikes is not felt at the tactical or operational levels of war, one does not have to go very far back in history. The use of tactical platforms like the A-10s, AV-8Bs, and F/A-18s to destroy elements of the
two Iraqi armoured divisions that were seen to manoeuvre offensively to influence the abortive Iraqi offensive at Al-Khafji is a classic example of a tactical operation that ultimately had tremendous strategic significance in that it proved to be the proverbial “nail in the coffin” for Iraqi ground resistance in 1991.17 Contrary to early theorists like Douhet and Mitchell who believed that strategic air attacks alone can win a war, the concept of the strategic air campaign today focusses on attacking targets that can subsequently be attacked or exploited by surface forces, with reduced forces and reduced casualties. Current air force doctrines seek to serve the overall effort by leveraging the impact of strategic strikes and interdiction, and not waging independent wars.18 This in itself should be enough to assuage any apprehension amongst the surface forces that air power is trying to usurp the primacy of surface forces. Such a belief is a total non-issue and only undermines synergy and jointmanship. The key issue, however, is to foster an understanding of the capabilities of strategic strikes and interdiction. Despite the politico-strategic procrastination over using air power during the Kargil conflict,19 the IAF’s “never done before” high altitude interdiction air campaign did contribute significantly to the strategic objective of evicting Pakistani regulars and Mujahideen from the heights that they had stealthily and audaciously occupied. With that as a template, there is nothing that prevents the formulation of a cohesive interdiction campaign, provided the surface forces realise the tremendous payoffs of a well planned strategic interdiction campaign.

TRAINING
The next logical step, after displaying the political will and changing existing mindsets regarding the advantages of air power in the furtherance of India’s

18. Conversino, n.4.
strategic objectives is to train and think to fight strategically. The present training pattern in the IAF for air crew, controllers and support elements is heavily skewed towards tactical orientation and is rather defensive in nature, given our reactive doctrine since we have never wanted to be seen as an aggressive and expansionist country. Without drastically altering our training methodology, there is a need to train continuously in strategic roles. A strategic orientation can be introduced at the training stage itself after induction of the Hawk advanced joint trainer (AJT) in which trainee pilots could be introduced to AAR and long distance missions in the final phase of training.

Some areas that need immediate attention are enumerated below:

• Simulated target systems need to be created on the lines that exist in the Negev desert of Israel that cater to wide ranging scenarios, from evacuation of personnel to destruction of key installations and terrorist eliminations. These targets need to be engaged across the country in different seasons and terrains.

• A pool of specially trained air crew on varied platforms needs to be formed who are primarily tactically proficient but also undergo periodic specialist capsules and training in execution of strategic missions. This core group on different fleets needs to be exercised periodically.

• Regular yearly/half yearly exercises involving joint task forces at varied locations ranging from deserts to hilly terrain and island territories need to be conducted. Long distance missions involving AAR, change in control zones, height bands and time zones may be regularly planned. Sleep deprivation and fatigue orientation need to be introduced at regular intervals.

• Multiple aerial refuellings and engagements spread across theatres must be introduced at various levels of squadron training.

• Strategic airlift capability and helicopter operations along with special forces must be given impetus and exercised periodically.

• Exercises with a few foreign air forces must be continued with simulation of contingencies in mutually acceptable third countries.

20. Knight, n.1.
- Strategic task forces need to be created with centralised decision-making, independent component commanders, and decentralised execution.

INDIA-CENTRIC SUMMARY
With the phasing out of a number of squadrons of MiG-21s, 23s, and 27s, the IAF’s fighter fleet is in a period of transition. At a time when nations are increasingly reluctant to commit ground forces due to the “body bag” effect, the ability to engage strategic targets with minimum collateral damage and maximum effect has made air power a “most preferred option” in swift conflict resolution.

The transport and helicopter fleets in the IAF are also due for expansion and refurbishment, with emphasis on replacements for the AN-32 and IL-76 and the induction of a medium lift aircraft in the 15-20 ton category. No replacement has been identified for the Mi-8/ Cheetah/ Chetak though the advanced light helicopter (ALH) is waiting in the wings. The modernisation process is likely to take 10-15 years, by the end of which, the IAF will possess significant strategic capability in terms of platforms and force multipliers. These would not be an area of concern. The main areas of concern are related to infrastructure requirements to support such operations, communications, political will to prosecute strategic air operations and sister Service support and acknowledgement of the long-term strategic payoffs of such operations. The IAF’s mindset also has to shift from being a tactically oriented and proficient force to one that has the confidence to influence strategy and doctrinal changes.

At a time when nations are increasingly reluctant to commit ground forces due to the “body bag” effect, the ability to engage strategic targets with minimum collateral damage and maximum effect has made air power a “most preferred option” in swift conflict resolution. The main problems that have to be dealt with while prosecuting the strategic air campaign would relate to morality, legality and accuracy of intelligence. From the horrific aerial attacks

22. Thomas Keany, Air Power : What a Difference a Decade Makes (Foreign Policy Institute, John Hopkins University, February 9, 2005).
on London, Coventry, Dresden and Berlin to the precision with which targets were engaged in Afghanistan and Iraq in 2003, the strategic air campaign has come a long way and it is about time that the IAF puts together a blueprint for building a credible strategic aerial intervention capability over the next decade.

ELEVEN CARDINAL PRINCIPLES OF THE STRATEGIC AIR CAMPAIGN

- Aerospace power of any kind that directly influences or achieves the strategic objectives of a campaign would be classified as part of the strategic air campaign (SAC).
- Political will is the key to the effective implementation of the SAC.
- Centralised command of all forces involved in the SAC, coupled with decentralised execution and minimum political interference is a vital imperative for the success of the SAC.
- Target selection remains a predominantly politico-military process, while target engagement a purely military one.
- Flexibility, surprise and shock effect are the key ingredients of a successful and contemporary SAC.
- "Effect-based operations" and not platform-based ones are the cornerstone of such operations.
- The SAC cannot be an isolated and time-based campaign. It has to be intelligently dovetailed into the surface campaign, and best precedes it by surprising the enemy and blunting his will to fight.
- The SAC is best employed as part of the emerging concept of "parallel warfare" in which all forms of combat power are unleashed simultaneously.
- Accurate and "real-time intelligence" allows the SAC to transcend conventional barriers and adopt "just-in-time targeting" techniques, which until very recently was exclusively a tactical option.
- Use of PGMs ensures achievement of objectives with minimum effort, attrition and collateral damage.
- Creation of a credible and potent strategic force to prosecute the SAC can only come about if there are changes in mindsets at all levels that we have
entered a new era of warfare\textsuperscript{23} and that of air power being essentially a "tactical tool." Doctrinal changes will be slow, difficult and fraught with obstacles.

If a battle can be won without suffering loss, surely this is the most economical, if not the most traditional, way of gaining the strategical object.

—John Frederick Charles Fuller

The war between Hezbollah and Israel in Lebanon in the summer of 2006 has been called by different nomenclature, from being the "second" or the "sixth" Lebanon War, etc. Even as the war progressed, within weeks it was clear that while its military performed professionally, even Israel itself believed that it had lost the war — lost because it did not win — to Hezbollah, the non-state terrorist entity which controlled southern Lebanon (after Israel’s withdrawal six years earlier) and had expanded its political influence in the country, but did not control the Lebanese government or its policies.

Israel was “ill-prepared” for this war largely because this war was different from what it had experienced in the past, but not so different that it would provoke serious reexamination before or during the war.1 Hezbollah, perhaps itself not fully realising it, had set in motion what can only be called a semi-conventional war — a war that goes beyond mere terrorism by non-state groups and counter-terrorism or any classification like low-intensity conflict that could apply to forms of sub-conventional wars; nor was this a normal conventional war between organised militaries. Such guerrilla war with modern stand-off sophisticated weapons had been perfected during the past few years by Iran’s Islamic Revolutionary Guards Corps (IRGC). More important was the asymmetry, not only in capabilities, but also in strategic terms, where Hezbollah sought a politico-strategic objective through

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this semi-conventional war, while Israel looked for military-operational goals essentially through a conventional war to provide political outcomes.

For Hezbollah, victory was not to be measured by the military exchange ratios, territory captured and/or degradation/decimation of Israeli military capabilities. Obviously, given the very high professionalism of the Israeli Defence Force (IDF) and its high-technology weapons and equipment, this would have been a grossly unrealistic objective. What Hezbollah sought to do was to inflict maximum and sustained pain and damage which Israel would find difficult to bear, and ensure its own survival long enough to claim that it had won, because Israel had not been able to destroy it.

Israel, on the other hand, having repeatedly imposed dramatic military victories over the well-equipped and organised military forces of the Arab states, individually (as against Syria in 1982) and collectively (as in 1967 and 1973) had got used to dealing with ideological-nationalist terrorism waged through single and small group fighters for the past nearly a quarter century. Its military, especially the Israeli Air Force (IAF), had evolved ways and means of employing air power effectively in counter-terrorist roles, undertaking pin-point air strikes, and had performed well although civilian casualties and destruction of infrastructure remained a negative aspect. But
the way Hezbollah organised and fought a near conventional war with guerrilla characteristics with a force of highly trained 6,000 troops and modern weapons was different.

For the past five years or more of the intifada, the focus of thinking was almost entirely on low-intensity conflict operations (LICO), in responding with modern high-technology military conventional means to a sub-conventional war. After the Israeli withdrawal from south Lebanon in 2000, the focus of operations also shifted primarily to the occupied territories, and more recently, to stabilising them, and to withdrawal of settlements from these areas. These were the debates one heard in Tel Aviv and Jerusalem, even while delivering a lecture on the combination of conventional and sub-conventional war that Pakistan had waged against India in Kargil.

THE BACKGROUND

The territory that now constitutes Lebanon has had a tortured history, especially for the past five decades. From ancient times to now, it has been the battlefield for external powers ranging from the imperial to the regional ones, whether transiting to other regions or fighting for this land itself. Alexander’s armies marched through this territory, and so did Napoleon’s; and the US Marines landed here at least twice (the first time on beaches full of bikini clad sunbathers while the British paratroopers landed next door in Jordan to shore up the Hashemite king, and the second time in 1983, soon to withdraw after 241 Marines were blown up in a terrorist strike on their barracks in Beirut) during the Cold War. On the other hand, this had historically been a peaceful country till the wars and armed conflict of the past five decades tore apart its fabric of being the nearest thing to a heavenly territory on earth.

The wars that Lebanon has experienced since 1975 cover an amazing diversity that may give a false impression of only a warring society living in the country. History has been witness to a Lebanese-Palestine War, a Lebanese-Lebanese, a Palestine-Syrian, a Palestinian-Israeli, a Lebanon-Syrian, a Syrian-Israeli, and a Lebanese-Israeli War, with the US employing military force on occasion, and a total of perhaps 70 groups, entities and countries having been involved in these wars.
During this period, the country has been partially or fully occupied by Syria, Israel, and the Palestine Liberation Organisation (PLO) for prolonged periods, with fighting and violence becoming an endemic part. But for the purpose of our present examination, it may be useful to look at the 1982 War and the recent one. Both were fought by Israel, the former against the PLO, supported by Syria, and the latter by the Lebanese Hezbollah group, supported by Iran and Syria. In the former case, Israel achieved an astounding military victory neutralising a capable and well-equipped Syrian military within hours. Among other responses, Iran was reported to have sent a 650-strong expeditionary force of volunteer Pasdaran Revolutionary Guards to Lebanon, which established its headquarters in the city of Baalbek, in the Syrian controlled Beqa’a Valley in July 1982, ostensibly to fight the Israelis. But it was the subsequent occupation of southern Lebanon by Israel and frequent use of military power inside Lebanon for the next 18 years that created politico-strategic complications for Tel Aviv, which it had apparently not emerged from when the war started on July 12.

Israel’s efforts to create an alternate force to ensure control of southern Lebanon through a pro-Israel 2,500-strong militia called the South Lebanon Army, disintegrated and dissipated within hours of Israeli withdrawal from south Lebanon on May 22, 2000. Its place was taken over by Hezbollah, the Shia guerrilla group headed by Hassan Nasarallah, and 1,700 men of the South Lebanon Army surrendered to it. A massive cache of arms fell into the hands of Hezbollah which promptly started to consolidate its position. It built numerous tunnels, prepared positions and conducted sporadic firing across the Israeli border. It had earlier used Katyusha rockets to fire at Israeli territories in 1993 and 1996; and this became more frequent, though every time in small numbers. At the same time, Hezbollah built up its base in Lebanon as a credible national political party with social and welfare programmes which extended equally to non-Shia communities without distinction or discrimination; and it even had two Cabinet ministers in the government.

THE WAR
The 34-day war between Israel and Hezbollah ended with a UN-brokered ceasefire in which both sides claimed victory. The difference is that Israel went into public introspection and rigorous debate on whether it had fought the war the right way, on the strategy and tactics used, the issues of the success or otherwise of Israeli deterrence, and so on, while Hezbollah revelled in celebrations of victory, even as Lebanon bore the tragic costs of the war in the destruction of its population centres, infrastructure, and the death of over 1,100 civilian men, women and children. It is obviously too early to find definitive answers so close to the events, especially when authentic information is not easy to come by. We must, therefore, treat the following interpretation of events and actions as somewhat tentative at this stage.

It is not intended here to go into a chronological account of the war or its details, but to look at certain key aspects that defined the nature of the war and the way it was conducted by the two sides. While the root causes of the war go back decades, the immediate spark was the kidnapping of two Israeli soldiers by Hezbollah on July 12, 2006. Such kidnappings had been happening over the years where both sides employed punitive strikes against each other, Israel essentially by air power and discrete special operations, while Hezbollah employed artillery, guerrilla attacks and Katusha rocket strikes. But it needs to be remembered that Israel is extremely sensitive to casualties in general, and even far more sensitive to its citizens, especially military persons, being taken hostage.

What triggered a larger war was the massive — often described as “disproportionate” — military response by Israel within twenty-four hours. The IDF hit Beirut international airport, targets in the capital city of Beirut, infrastructure (including electric facilities, water sewage treatment plants, 25 fuelling stations, roads totalling nearly 650 km in length, 73 bridges, 900 commercial structures, up to 350 schools, etc.)5, especially to apply pressure on

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the Lebanese leadership, isolate Lebanon from supplies from Syria and Iran, neutralise missile launch sites and launchers, Hezbollah command, control and communications nodes, and tried hard to take out its leadership, albeit without success. The IAF flew an estimated 15,500 sorties (averaging 456 sorties per day) and attacked nearly 7,000 targets in the war. It did not lose any combat aircraft, though it lost four helicopters – one to a Hezbollah anti-tank missile, two to mid-air collision, and one to friendly fire. The IDF fired nearly 100,000 rounds from tanks and artillery guns, besides 2,500 shells fired by the navy, and it lost 119 soldiers (and suffered 41 civilian casualties). Lebanon (a country of 3.8 million people) reported 1,110 civilians killed and 3,700 wounded, and nearly 1,000,000 displaced during the Israeli bombing. It also estimated the total damage to buildings and infrastructure to be in the order of $3-6 billion with about 150,000 residences destroyed.6

Artillery rockets and missiles constituted the major weapons of stand-off range that Hezbollah used. At the beginning of the war, Hezbollah was estimated to possess around 13,000-20,000 such short range rockets and missiles of different types supplied by Syria, Iran, Russia and China which included a range of modern anti-tank and infantry weapons. It is not clear how many weapons of various categories Hezbollah launched, except that as many as 3,970 to 4,228 rockets were known to land on Israeli territory and targets. Nearly 92 per cent of these were 122 mm Katyusha type artillery rockets with a 30-kg warhead and with ranges of 20-odd km. An estimated 23 per cent of these rockets hit built-up areas, primarily civilian in nature. The scale and intensity of fighting on both sides can be gauged from the fact that as many as 160 Israeli cities (including Haifa, Hadera, Nazareth, Tiberias, Nahariya, Safed, Afula, Kiryat Shmona, Beit She’an, Karmiel, and Maalot), towns, villages, kibbutzim, and moshavim besides Druze and Arab villages were hit by Hezbollah missiles and rockets. And strikes on such an extensive scale for the first time in

6. This would imply that one in six families lost its residence as a consequence of the Israeli air strikes.
Israeli history have been a major cause of the angst and anguish in Israel, and the claims of “victory” by Hezbollah.

After the initial Israeli response, Hezbollah declared an all-out military alert. Hezbollah was considered in Israel to be a trained, skilled, well-organised, highly motivated force that was equipped with the cream of the crop of modern weaponry from the arsenals of Syria, Iran, Russia, and China. The Lebanese satellite TV station Al-Manar reported that the attacks had included a Fajr-3 and a Ra’ad 1, both liquid-fuel missiles developed by Iran. Hezbollah also engaged the IDF in guerrilla warfare from well fortified positions. The bulk of these IDF attacks comprised small, well-armed units often facing hundreds of sophisticated Russian-made anti-tank guided missiles (ATGMs).

While Hezbollah rockets and missiles caused only 41 civilian casualties, these were kept low possibly because hundreds and thousands of civilians (as much of a quarter of the total population) had vacated northern Israel, vulnerable to missiles, and/or used shelters to protect themselves. Hezbollah is believed to have lost around 30 per cent of its fighters in the 34-day air and ground war — an attrition it was likely to make up in a short time in view of the perceptions of its “victory.” Hezbollah shot down only one helicopter and that too with an anti-tank missile. Fixed wing aircraft of the IAF were delivering their weapons from medium altitudes and remained out of range of surface-to-air weapons that Hezbollah held and used. There were vague reports of a combat aircraft being shot down. It seems that what the IAF lost was one F-16 after it lost its tyre/wheel on take-off.

The most dramatic success of Hezbollah was the crippling of an Israeli Navy Sa’ar-5 corvette (INS Hanit) and the sinking of a Cambodian merchant ship on July 14 by two Chinese made Iranian modified C-802 anti-ship sea skimming missiles fired almost concurrently from the Lebanese coastline, achieving an SSKP (single shot kill probability) of one. The damage to the corvette might have been more severe if the missile’s warhead had actually

exploded; even then, it was rendered unfit for operations and had to be towed back to port for repairs. The successful over-the-horizon targeting of the two ships, apparently assisted by Lebanese coastal radars, is symptomatic of the nature of the war: sophisticated anti-ship missiles, characterising an aspect of this “semi-conventional war.”

On the other hand, amidst the “failure” of air power and the strategic “follies” of Israel, some key elements failed to receive adequate attention. There is no doubt that Israel did not succeed in stopping the rocket attacks on its population. But, on the second day of the war, the IAF, in a 34-minute air action, destroyed 59 medium range missile launchers inside Lebanon. By all accounts, this amounted to as much as 70-90 per cent of Hezbollah’s medium range ballistic missiles being knocked off before they could be used. This also must be seen in the context of the 1991 Gulf War when Iraq launched 91 Scuds on Israel and Saudi Arabia beginning with the first day of the war. The US-led coalition rapidly concentrated its full efforts in neutralising the launchers and missile capabilities of Iraq without success, as much as the Allied bombing had not succeeded in stopping German V1/V2 attacks in World War II. In fact, Scud-hunting (as the campaign came to be called), failed to hit even one mobile launcher, leave alone stop the attacks in spite of the US devoting over 18,000 sorties (representing the highest proportion of air effort devoted to any single target system) to this mission.

While doubts have been expressed about whether this completely neutralised Hezbollah medium range missile capability (which it probably did not given that Hezbollah had resorted to a great deal of deception, dispersal and camouflage) the fact is that none of these missiles was launched against Israel’s major cities like Tel Aviv and Jerusalem which would have caused Israel major distress. One can only speculate on the reasons for the non-use of medium range ballistic missiles since there is evidence that Hezbollah attempted to drop explosives on targets deeper inside Israel. The IAF successfully intercepted and shot down three Hezbollah unmanned aerial vehicles (UAVs), at least two of which were armed with high-explosive payload on an ostensible mission to drop them over Tel Aviv or other such major target.

9. Ibid.
Israel mounted some small scale commando raids in the beginning, and launched significant ground action with a three brigade-strong force across the border only on July 23, a good ten days after the beginning of the war. These troops encountered heavy fighting, ambushes and use of sophisticated anti-tank weapons (of seven different types), with great tactical acumen displayed by Hezbollah fighters. Some of the (Russian-made) anti-tank missiles are believed to be capable of penetrating some of the thickest steel armour protection used by modern armies.\(^{10}\) A total of 46 Merkava tanks was estimated to have been hit besides another 14 armoured vehicles. Four of these were damaged by large landmines, killing 12 crewmen due to lack of underbelly armour protection.

Israel finally launched a robust ground operation across the border just two days before the UN-brokered ceasefire was to come into force.

**ISRAEL’S STRATEGIC FAILURES?**
What we are trying to understand here are the main factors that led to the perceptions and/or reality of the failure of Israel. The main criticism revolves around the following issues:

- Israel pursued a flawed strategy largely because the top political leadership had no previous military experience.
- Israel relied on air power to defeat Hezbollah rather than sending in major ground forces into south Lebanon; and when the ground forces were sent in, it was a question of too little and too late.
- The above line of criticism is linked to the fact that the Chief of General Staff General Dan Halutz, an IAF officer appointed to the post almost inevitably held by an army officer in the past, was instrumental for this failure of military strategy.

However, we would like to pursue our enquiry from a somewhat different perspective.

\(^{10}\) Israeli analysts were cited as stating the missile could penetrate steel armour of 70-cm to 1,200-cm thickness; see Fulgham and Barrie, n.7, p.10.
WAR AIMS
The principles of war in all countries have held the principle of “selection and maintenance of aim” as one of the central and most important principles under which military power has to be employed. The essence of the war aims may be summarised broadly as follows:
1. Destroy Hezbollah.
2. Restore the credibility of Israeli deterrence after the unilateral withdrawals from Lebanon in 2000 and Gaza in 2005.
3. Force Lebanon to become and act as an accountable state, and end the status of Hezbollah as a state within a state.
4. Recover alive the two soldiers that Hezbollah had captured.

These aims are broadly borne out by other Israeli sources. It is obvious that such grandiose aims like destruction of Hezbollah through military means would pose serious challenges without a prolonged war and large scale casualties since Hezbollah was known to have modern weaponry and had prepared well, including in fortified positions. Hence, what could have been attempted was a limited punitive war; and limited wars produce limited results rather than absolutist effects like “destruction” of a highly trained, well-equipped dispersed guerrilla force of nearly 6,000 fighters deeply committed ideologically for martyrdom in the name of religion.

The military aims and objectives flowing from these politico-strategic aims (especially the first two) were, no doubt, as grossly unrealistic. What assumptions led to the formulation of the over-ambitious aims is not really clear beyond speculation in some quarters that this was linked to a potential strike by the US/Israel on Iranian nuclear facilities. However, little evidence to support such a theory has emerged so far. On the other hand, it is clear that a

11. For example, see Avi Kober, “The Second Lebanon War,” BESA Perspectives Paper, no. 22, September 28, 2006 p.5.
fundamental mismatch in military aims and employment of military power took place, with the consequence that expectations raised by public articulation (some have called the prime minister’s pronouncements in this regards “Churchillian”) of the politico-strategic goals have been a major factor in promoting the perception that Israel lost the war.

One of the factors that pushed Israel to launch an immediate air strike was also the belief that its deterrence had lost credibility. If this was the belief held for quite some time, as emanating from the Israeli withdrawal from Lebanon six years ago and more recently from Gaza, then adequate preparations to restore that credibility should have been a pre-condition of the military action. The decision to launch massive air strikes on Lebanon, with the land forces not prepared for the follow-up action on the ground becomes even more inexplicable. On the other hand, the previous Chief of General Staff, Lt. Gen. Moshe Ya’alon, who served as deputy and then chief for five years before Dan Halutz was appointed last year, with his characteristic bluntness says that the IDF (as long as he was heading the IDF) had been very clear that “there was no military action which could smash or pulverize Hezbollah.” 12 Ya’alon has gone on to say in relation to the military aims and objectives “Because the goals of the war were not defined and because no one clarified what the army is capable of doing and what it cannot do, the pursuit began of an impossible achievement.” This is not only a serious indictment of the IDF, but also has crucial lessons for the higher defence management. Did the component/force commanders provide their inputs or were their views overruled in an organisation (headed by the Chief of General Staff) akin to a Chief of Defence Staff (CDS) system? 13 This takes us to the second aspect.

But one last point needs mention. In the Indian case, where the army had been extensively involved in counter-terrorism for two decades (before Kargil) and hence, the dominant view was to treat even the military aggression in the Kargil sector in 1999 as “militant” jihadi “infiltration” (also as a significant component even by the Kargil Review Committee), the Indian Air Force was more concerned about


The last war Israel had been facing and fighting for nearly one generation was the war against terrorism. And Israel had come to rely almost exclusively on its air force for counter-terrorism. The risk of regular military operations by Pakistan. In Israel, it was the other way round. The Israeli Air Force has been the spearhead of counter-terrorism and the army has been increasingly limited to the role of special operations (performed exceedingly well). Hence, the question of an air force man at the top rather than an army man is less valid, and the issue of a wider and dominant belief system more the key factor in shaping Israeli responses and strategies. Hence, while the air force performed exceedingly well (as in the past) and the army special operations were conducted in the most professional manner, Israel was seen to lose since it was fighting the wrong war against a highly motivated enemy that fought above the level of terrorism but below the level of a regular conventional war.

FIGHTING THE LAST WAR
Military history is replete with examples of planners and commanders preparing to fight the “last war.” There are historically and intrinsically valid reasons for it (like the traditional conservativeness of militaries, the hesitancy of militaries to reform after victories, etc.) which we need not go into here for want of space. The last war Israel had been facing and fighting for nearly one generation was the war against terrorism. And Israel had come to rely almost exclusively on its air force for counter-terrorism by refining precision strike based on state-of-the-art intelligence and RSTA (reconnaissance, surveillance and target acquisition). Israeli leaders, like many before them, faced the problem of pervasive mindset, which had come to believe that terrorism was the primary threat and counter-terrorism the main military mission.

Israel had been militarily defeating its Arab adversaries convincingly and even dramatically in the wars since its inception. The last major conventional military-to-military war it had undertaken was in 1973 when, in spite of the strategic surprise that Egypt and Syria had achieved, it was able to recover ground and threaten Cairo before a ceasefire ended the war. This in turn led to the Camp David process. And
the last major military operation that had been undertaken by the IDF was in 1982 in its war against the PLO, ensconced in Lebanon, when the Syrian military tried moving forward to intervene. In a brilliantly dramatic air dominance campaign in June 1982, the IAF shot down 86 Syrian fighters over Beqa’a Valley in Lebanon in less than 48 hours and also stopped Syrian armoured forces moving before they could even engage Israeli ground troops. But that was 24 years ago.

For the past quarter century, Israeli security had not faced any serious conventional military threat. The PLO had been evicted from Lebanon, thus, eliminating any potential threat of being used as the spearhead for military action. Egypt was satisfied with the return of its territories, and heavily under US influence, armed with American weapons. Syrian capabilities kept eroding, especially after the collapse of the Soviet Union. Iraq was fully preoccupied with its war against Iran during the 1980s and after that with Kuwait and the following war with the US-led coalition in 1991. In any case, it would never have been easy for Iraq to pose a conventional military threat to Israel due to geographical factors physically separating it from Israel. After 1991, Iraq was under massive sanctions, watched and constrained by the no-fly-zones and hundreds and thousands of air strikes, followed by the war in 1993. Turkey was a friendly country. Saudi Arabia, with its relationship with the United States and various military limitations, was never in a position to directly threaten Israel.

Given this background, the focus progressively shifted to using military power for the immediate and pervasive threat: that of terrorism. Hence, the belief that it did not really face the threat of a matching conventional war; and consequently, that the main threat that the country had to deal with was what may be termed as a sub-conventional war, that is, the challenge of dealing with terrorism albeit with sophisticated weapons; 14 and Israel had perfected the ways and means of dealing with it over the decades.

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14 The Indian military-political leadership had also fallen victim to the same phenomenon when faced with the unique conventional war in Kargil in the summer of 1999 when New Delhi policy-makers agonised for nearly a month on the identity of the invaders. See Jasjit Singh, Kargil 1999: Pakistan’s Fourth War for Kashmir (New Delhi: Knowledge World, 1999); and then army chief General V.P. Malik, Kargil: From Surprise to Victory (New Delhi: Harper Collins, 2006). Not to mention the official Report of the Kargil Review Committee, From Surprise to Reckoning (New Delhi: Sage, 2000). Pakistan has also persisted with its deeply held belief systems that led one of the more perceptive observers (former information secretary to Ayub) to express this with some anguish soon after the 1999 Kargil War (see Altaf Gauhar, “Four Wars and One Assumption,” Nation (Karachi), September 5, 1999).
Hezbollah had decided to fight differently, which is best described as a "semi-conventional war" or a modern guerrilla war with stand-off precision strike weapons. The basic approach to the Hezbollah threat, therefore, was that of counter-terrorism. The counter-terrorism strategy was expansively focussed on the Gaza Strip and the West Bank. Hezbollah kept firing Katyusha rockets into Israel. Their inaccuracy and the limited numbers used till the recent war, kept them more at a nuisance level than a military challenge (more on this later). Israel kept pursing technological solutions; but as Ya'alon says, the economic costs of pursuing a more aggressive approach were seen as counter-productive in cost-benefit terms.

But it became rapidly clear that Hezbollah had decided to fight differently, which is best described as a "semi-conventional war" or a modern guerrilla war with stand-off precision strike weapons. The weapons used were all military ones; and it seems to have been much clearer on its war strategy than Tel Aviv. Of course, it had an intrinsic advantage: all it had to do was manage to survive and appear to remain undefeated. Its vulnerabilities were turned into its strength. For example, one of the major stated objectives of Israel was to pressurise the Lebanese government to force Hezbollah to give up terrorism and have the Lebanese military take over southern Lebanon. But the political, social and humanitarian activities of Hezbollah before and during the war had created an environment in Lebanon far more in favour of Hezbollah than against it. Extensive bombing of civilian targets by the IAF compounded the tragedy and misery of the people; in turn, proving greater (not less) support for Hezbollah. Incidents like the bombing of civilians at Qana only added to the process. As it is, large scale bombing of population centres has historically hardened the resolve to oppose the bombing rather than succumb to it.

The end result was that the two sides were fighting a war at different planes, with different strategies, seeking to exploit asymmetric vulnerabilities in targeting different centres of gravity (CoGs): Israel targeted Hezbollah's military assets and infrastructure, while Hezbollah targeted Israel's civilian community. The effect, for a variety of reasons, was that Israel ended up imposing large
numbers of civilian casualties and destruction of civilian infrastructure, while Hezbollah managed to impose some military casualties, but relied on Israel’s sensitivity to losses of life and property.

What we witnessed in reality from the Hezbollah side were the shades of Sun Tzu and Mao’s “People’s War” strategy where Hezbollah provoked Israel to react strongly, then fight its forces inside the territory Hezbollah controlled and had prepared with strong defences against armour, etc., counter-attacked with guerrilla tactics and forces with sophisticated weapons, while continuing to inflict damaging strikes on Israeli core vulnerability: its civilian population. Gen. Ya’alon asserts that Israel’s war strategy was faulty. One has to raise the inevitable question: since the centre of gravity of the terrorists as well as of counter-terrorism is the population, did Israel ignore this central factor? Or it was simply a case of faulty assessment of how the population would respond?

It is in this context that Israeli military force employment has come under severe criticism, especially inside the country, giving signs to observers outside of near trauma, with the recently retired head of the IDF saying that this was “no way to fight a war.” There has been a near global consensus for decades about the great professional force employment acumen of the Israeli military that has been the envy of many professional modern militaries. And this was seen as a major factor in providing deterrence against residual military threats. While many specific elements could be identified even at this early stage soon after the war, the only rational explanation at the broader level is that force employment was not consistent with the (unrealistic) aims of the war, that it was derived from the dominant experience of the past quarter century, but above all, that force employment was not tailored to a correct assessment of how the enemy would fight in spite of excellent intelligence about the specific capabilities of the enemy being known.

In fact, there have been strong arguments, based on empirical evidence, that historically, it was force employment and not the generally believed newer
Every time rockets and missiles (and for that matter, air power itself, not to talk of artillery) have been used, especially when in sufficient numbers, they have achieved disproportionate political-psychological impact. Military technology and/or sheer numbers and size of the forces that mattered.\textsuperscript{15} This is not to imply that technological advantage in weapons and equipment does not confer a distinct advantage on the possessor, or that sheer superiority in numbers is irrelevant in wars. Preponderance of technological superiority and/or numbers would always matter; and the specific area of technological/force size advantage matters even more where it is related to the enemy's vulnerabilities. What it implies is that force employment synergises these two in relation to that of the enemy. Hence, force employment has to be relevant to the enemy's forces and force employment doctrine and strategies/operational tactics. This is where Israel faltered, especially in relation to political-military aims and objectives in not assessing the enemy's force employment methodologies in spite of having almost all the information on what all Hezbollah held in terms of numbers and technological quality. It fought Hezbollah as a terrorist entity rather than a semi-military force fighting with shades of Mao's "People's War" doctrine and Iran's Islamic Revolutionary Guard Corps strategies, especially with missiles.

**THE CHALLENGE OF THE "UNKNOWN/IGNORED" WEAPON**

Military history and strategy have tended to either belittle or simply pay little attention to the role and effects of conventionally armed ballistic and cruise missiles and rocket attacks. In the absence of rigorous analysis/assessments, professional militaries, which focus heavily on high-technology systems, precision strikes and kinetic shock effect, have tended to dismiss them as of little or no military utility. On the other hand, every time rockets and missiles (and for that matter, air power itself, not to talk of artillery) have been used, especially

when in sufficient numbers, they have achieved disproportionate political-psychological impact. Military history and tactics are full of incidents of inaccuracies being compensated for by mass. Reflect for a moment on its politico-strategic impact if Saddam Hussein had been able/willing to fire the 91 Scuds that he fired over 42 days in a concentrated doze within, say, a 12-hour period during the 1991 Gulf War? Concentration of force (mass x firepower) has been part of the principles of war in most countries; but we often tend to forget the relationship between its capabilities in time and space. For example, the same quantity and quality of firepower delivered within different time spans would produce different military-psychological effects.

But looking back at the employment of missiles of various types in modern times, we need to recall the impact of German V-1 and V-2 bombs although rockets were first used apparently by the Mongols. Their effective use by Tipu Sultan against British troops during the siege of Seringapatam (India) in 1799 led to British attempts to develop a system for the Royal Artillery. But the dictum of Colonel William Congreve (who designed the British rocket system) of the “facility of firing a great number of rounds in a short time, or even instantaneously” as the key factor for success was not always followed till the Germans launched 10,492 240-km range V-1 rockets/cruise missiles on Britain’s cities (3,531 penetrated air defences), and 3,195 far more difficult to intercept 350-km range V-2 ballistic missiles in World War II. In spite of overwhelming bombing efforts with near total air superiority, air strikes against launch sites were ineffective. The missiles, as the Scuds in recent times, were inaccurate and less than 50 per cent reached the target area, with nearly one-third V-1s being shot down by air defences. The military impact was not effective. But the concentration of fire created a powerful political and psychological impact, forcing the Allies to alter the invasion (of Europe) plan to capture launch sites and factories.

Iran faced a serious political-psychological situation in the 1987-88 "war of the cities" when Iraqi modified Scuds kept falling in downtown Tehran, virtually leading to the Iranian decision to seek a ceasefire (when Iranian forces were still

"The IDF was leaning on air activity against Hezbollah, rather than activities on the ground, so as to reduce casualties." across the border) since life in Tehran had come to a grinding halt. This was probably the lesson that its Revolutionary Guard Corps used in equipping and training Hezbollah. Saddam Hussein again fired his Scuds in single shots, launching, on an average, less than three per day on targets as far apart as Israel and Saudi Arabia. Their military utility was highly questionable. But they created an enormous political-psychological impact, and the US-led coalition devoted an enormous amount of effort to neutralising the threat without being able to knock out a single mobile launcher. On the other hand, ballistics missiles and Katyusha rockets were fired in thousands in Afghanistan since 1980, both by the Mujahideen groups fighting the Soviets and Afghan government in Afghanistan, supplied by the Central Intelligence Agency (CIA) through Pakistan's Inter-Services Intelligence (ISI), as well as by the Kabul government against the Mujahideen, even across the border with Pakistan. Pakistan's next proxy spearhead, the Taliban, kept using them later on against the Mujahideen.

But the political-psychological impact in Afghanistan was much less than in the other cases, probably due to lower sensitivities to human casualties and urban destruction than in Western democracies. And Israel's extreme sensitivities to casualties were well known, especially after the Iraqi missile attacks in the 1991 Gulf War. The then Israeli Chief of Staff Shaul Mofaz had stated in 1999 that "the IDF was leaning on air activity against Hezbollah, rather than activities on the ground, so as to reduce casualties" (emphasis added).

It is, therefore, surprising that Israel apparently did not take into account the full import of such sustained attacks (as it turned out, nearly 150 rockets/misssiles per day during the 34-day war) with rockets and missiles (with a reserve of another 12,000-16,000) although Hezbollah had used these against it during the previous years.

17. Avi Kober, "Western Democracies in Low Intensity Conflict," in Efiram Inbar, ed., Democracies and Small Wars (London: Frank Cass, 2003), p. 12. Kober writes that this policy goes back to the late 1970s, and says that that then Chief of Staff Ehud Barak had asserted in 1993 that Israel preferred using massive fire instead of manoeuvring forces on the ground during the 1993 Operation Accountability against Hezbollah in southern Lebanon.
At one level, the problem is typical: it takes a lot of time (and money) before effective counter-measures are evolved/adopted against a new type of technological and/or operational threat. Israel was developing anti-missile systems for shorter range threats. Some of these plans, especially against short range missiles, had not received high priority since the costs were high and the level of protection low (at least with initial capabilities). Gen. Ya’alon, when asked about the Nautilus programme, expressed the real dilemma, that “it was extremely expensive and of limited results. It could only have protected a city here and a city there. If Israel invests a fortune to sew up a protective suit for each citizen and turns itself into a bunker state, it will not survive economically.”

There can be little doubt that Israel would, sooner rather than later, develop an anti-missile anti-rocket system that can handle a range of incoming missiles, from unguided Katyusha type rockets to long range ballistic missiles and various categories of cruise missiles. Israel had been developing its Arrow ATBM (anti-tactical ballistic missile) system to defend against medium and intermediate range ballistic missiles of the 300-km Scud and longer range weapons. Its air force rapidly destroyed over 90 per cent of Hezbollah’s fixed launchers for longer range missiles. The existence of rockets and missiles of ranges below these levels was known for decades. But the short time of flight, their very small size, very low trajectory and apogee, and the very minimum infrastructure and skills for launching them make their location and interception extremely problematic. And the challenge for a country extremely sensitive to casualties, which it had been emphasising publicly, was a natural invitation to the enemy to target this vulnerability by sustained concentration of force; and Hezbollah did exactly that, forcing Israel to pursue a war strategy that it had been perfecting and pursuing for more than two decades. This, incidentally, also made it more predictable and easier for the enemy to build and implement a counter-strategy targeting its vulnerabilities.

FAILURE OF INTELLIGENCE ASSESSMENTS
Israel is credited with one of the world’s best intelligence systems, in the IDF as well as in Mossad, in information collection, analyses/assessments, and covert

action. It is fairly clear that Israel had been acquiring and collating information and intelligence about Hezbollah activities, especially in south Lebanon, its building of strong points, fortified bunkers, tunnels, etc. Or, for that matter, the accumulation of massive quantities of sophisticated anti-tank weapons on one side, and nearly 15,000 rockets and missiles, ranging from the unguided Katyushas to the 220-km range ballistic missiles, on the other. And this too when skirmishes between the two continued to take place regularly, including firing of Katyusha rockets across the border into Israel, except that the density of firing was low prior to the war in 2006. This is exactly where the core problem may be identified: assessment of the enemy's strategy and tactics which would need to be factored into one's own if the enemy is to be defeated. This is particularly important in relation to one's own vulnerabilities that the enemy must be expected to exploit (if it has made its assessments correctly).

This is the central issue in asymmetric warfare where victory and defeat finally depend on one side's ability to generate favourable asymmetry in time and space related to the other side's vulnerability. Preponderance in size, superior technology, the strategy of indirect approach, turning the enemy's flanks, greater manoeuvre and mobility, interdiction of logistics, and so on, are methods and means which finally take one side or the other to victory or defeat. Intelligence assessments, however made, are the core of formulation of military strategy and tactics, and, hence, of force employment. And this, surprisingly, turned out to be Israel's Achilles' heel.

Here there is greater uncertainty and ambiguity in understanding why Israel failed to make the right assessments about the way Hezbollah would fight, in spite of having sufficient information, and its own analytical capabilities. From what little is known, Israel had maintained an internal, but separate, institutional mechanism to question the intelligence assessments - something few intelligence systems are known to do. Then why the failure?

The main factors which probably led to this situation have been spelt out above: that of pervasive belief creating a mindset across the board, in and outside the IDF. For example, Efraim Inbar, a leading strategist and head of the BESA Centre for Strategic Studies in Tel Aviv, while making India an exception (which
the Indian Army leadership was loath to do itself, at least till Kargil) concluded a few years ago, “The main security challenges of contemporary Western democracies are small wars, often called low-intensity conflicts.” This was, no doubt, correct, particularly in Israel’s case.

But the issue of how it gets fought remains a major challenge since it should be expected to be implemented differently by different people and by the same people in different contexts. We were witness to Gen. Pervez Musharraf, faced with the prospects of even a limited conventional war in 2002 by India in response to escalation of Pakistani sponsored terrorist attacks (especially on the Parliament in December 2001) threatening to unleash a massive “unconventional” war. This was interpreted by most as a threat of use of nuclear weapons (in which the end result would have been the annihilation of his country). But what he, no doubt, meant was swarming by as many as 150,000 trained and well-equipped fighters with very high levels of religious motivation. Nawaz Sharif, even as the chief minister of Punjab state of Pakistan at that time had made a similar threat twice in February 1990, of launching 10,000 “civilians” across the border into India; and others actually organised such a force in 1994 which he as the elected prime minister of Pakistan was forced to curb by force before a crossing could be effected.

Innovation is central to achieving favourable asymmetry in war; and innovation must be expected at all times, since whether it succeeds or not depends not only on the innovator but equally on the counter-innovator. This is where military-related assessments have become even more crucial in modern warfare. This is, no doubt, why many in the Chinese military have been advocated unrestricted warfare, but within the basic formulation of a “local-border war” fought with high technology weapons and systems. This is also what makes the traditional debate of air power versus “boots on the ground” irrelevant to the real issues. It is in this context that signs of a semi-conventional way of fighting wars were visible for some time before the Lebanon War.

Terrorist/guerrilla groups had been increasingly acquiring weapons and tactics of military specifications at least since the war in Afghanistan during the 1980s. Call it a change in the nature of terrorism or a change in the nature of conventional wars, the shift from conventional to sub-conventional wars was clear since at least the Vietnam War. But in the Iraq War we witnessed the shift to what can only be referred to as a semi-conventional war, with Iraq’s special forces providing resistance to US troops, delaying their advance. The war showed that the superior American military made short shrift of Iraq’s elite Republican Guards even in a massive dust storm that would have normally hidden their relocation. But dealing with the Saddam Force was a harder task since it was targeting an American vulnerability — casualties. The fighting line between the two fighting forces became diffused, with 30 American Army helicopters being hit by small arms before they could deliver their weapon load and had to abort an important mission. The failure to destroy the Taliban/Al Qaeda in Afghanistan and their reemergence has taken place due to their conducting a semi-conventional war. And we are likely to experience more of this in the future, especially where a state sponsors such wars through “non-state actors”, equips them and trains/directs them as Pakistan has been doing through the ISI with the Mujahideen/Taliban to its west and jihadi groups to its east, or Iran did to Hezbollah through its IRGC.

SOME INTERPRETATIONS
We are still too close to the events leading up to the Lebanon War and its conduct to make a definitive prognosis of its implications for the future. But it is possible to conclude at this stage that the Hezbollah-Israeli War would have profound implications for the future of armed conflict and war in general, and the security of the Western Asia/Persian Gulf region in specific which has been in turmoil since the Mujahideen War in Afghanistan which accelerated after the Iran-Iraq War. This, in turn, has enormous implications for international peace and security and Indian core interests, not to talk of the other great powers of the world. It would, thus, be puerile to look at the war in terms of the “air power versus boots on the ground” debate, although the changing nature of capabilities
in the air and ground must be studied closely.

Information at this early stage is limited; but even a great deal of what comes out in the future is likely to be biased, doctored and sketchy. But there are enough empirical indicators in respect of the war to arrive at likely consequences and conclusions for the future. Some of these are embedded in the examination of the issues in this paper. Others are briefly outlined below:

- Perhaps the most important and clearest implication of the war would be to trigger a "ripple effect", setting in motion multiple trends into the future. The most crucial of these is the high probability of the Hezbollah strategy of semi-conventional war being adopted by other countries and their sub-state institutions to undertake war through proxy(s). Iran and/or Syria may be tempted to employ this in the future in other scenarios.
- Pakistan already has extensive experience in its ISI (an extension of its army), with enormous resources drawn from the narcotics trade, and procurement of sophisticated weapons, including rockets and missiles of a large variety, with a vastly expanded and sophisticated capability banking on its official and non-official arms manufacturing capabilities. The ISI in particular has extensive expertise and experience in equipping, training, managing, and directing proxy wars (through the Mujahideen in Afghanistan against the Kabul government and the Soviets during the 1980s; through the Khalistanis in Punjab from 1983-1994; through jihadi entities and groups like Lashkar-e Tayyeba, Harkat al-Ansar, Harkat ul-Mujahideen, etc. in Jammu & Kashmir since 1988; through the Taliban against its own creation, the Mujahideen, in Afghanistan after 1993; and support to Osama bin-Laden and Al Qaeda). The question must be squarely

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20. The recent attempt at a coup by military people against Gen. Musharraf was reportedly based on an attempt at "targeted killing" of Musharraf by rockets to be fired at his residence.
addressed: are we likely to face a Hezbollah-model of semi-conventional war in the coming years? If so, how are we going to fight and win it?

- One of the most significant after-shocks of the Mujahideen War in Afghanistan in the 1980s and Soviet military withdrawal by 1989 was the rapid spread of a belief that the Mujahideen had defeated a superpower! This was particularly conspicuous among elites in Muslim countries; and “jihadi” terrorism titled differently in different places, erupted from the Balkans to the Philippines. It is useful to recall that the first terrorist attack on the World Trade Centre (New York) took place in 1993. With the sole superpower, the United States in a quagmire in Iraq, and Israel seen to be defeated by Hezbollah trained and equipped by the Iranian Revolutionary Guard Corps, seen as Tehran’s “Western Command,” there is every possibility that this would trigger broader support for, if not actual growth of, armed violence in the name of jihadi terrorism across the globe, to usher in a “new world order.”

- The war has enormously strengthened Iran’s self-confidence and its leverages in the international and regional arenas. If it can engineer Hezbollah fighting Israel to a (ceasefire) standstill, it can certainly defend itself against a powerful military power. Any US and/or Israeli strikes against its nuclear facilities, leave alone a war, if it was feasible option at all (which I have maintained, it was not), now stands ruled without catastrophic consequences all round.21 We must be careful not to rush to a conclusion that this implies that Iran would pursue nuclear weapons acquisition. It has used its nuclear programme for political purposes so far, and is likely to keep doing so with greater confidence and high pressure diplomacy.

- The influence of the United States on the world stage has been on the decline for a large number of factors. Its overwhelmingly superior military power has been a major factor in sustaining the reality and perceptions of its super power. The terrorist attacks by Al Qaeda on 9/11 had laid bare its vulnerabilities. Now, after its inability to overcome armed resistance in Iraq,22 and the Israeli stalemate in

21. It is quite likely that North Korean decision to test and nuclear weapon at this time was influenced by the Lebanon War and its outcome, increasing P'yongyang's leverages.

22. The United States has experienced the highest level of casualties of its troops in Iraq during the three months following the Lebanon War.
Lebanon, perceptions are bound to grow about superior military power not being as invincible as generally believed.

- In specific military terms, serious rethinking will be required on the issue of mere reliance on high-technology “RMA” (revolution in military affairs) and force-multipliers. Israel possessed all these, and produces a great deal of the systems that are needed for them, but found that it faced shortages of combat aircraft as well as helicopters (so much so that C-130 Hercules transport aircraft had to be brought in to supply troops in the battlefield across the border\(^2\)). Precision strike once again highlighted the criticality of target acquisition and, hence, accurate time-sensitive intelligence related to the enemy’s actions and capabilities within the time required to acquire and hit the target.\(^3\) It would be more appropriate to revert to the two-decade old terminology of RSTA (reconnaissance, surveillance and target acquisition) as compared to the more current ISR (intelligence, surveillance, reconnaissance) which places target acquisition outside this mission.

- It is sobering to reflect on the reality that Hezbollah’s network-centricity and exploitation of intelligence were of a very high order and its command and control system survived directed air strikes throughout the 34-day war. Israel had developed systems to reduce the sensor-to-shooter time to 90 seconds; but Hezbollah had evolved its rocket force employment to remain within 80 seconds from positioning, launch and camouflage. This was an added advantage of using simple, small size Katyusha rockets, with numbers making up for inaccuracies.

- The strategy for the use of weapons and tactics in war must obviously take into account the centre of gravity (CoG) of the enemy. Identifying the vulnerabilities of the enemy is part of identifying and focussing on CoG. But

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\(^{2}\) There is an obvious necessity for a comparative cost-effectiveness analysis of fixed wing aircraft versus helicopters for airlift and battlefield support.

\(^{3}\) A simple OODA loop would be an insufficient formulation to seek. The better framework is a “Comparative IDA Cycle” as propounded by Ajay Singh, “Time, the Fourth Dimension of War,” Joint Force Quarterly (USA) 1995.

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Semi-conventional war is best defined as an organised military-type force which is not the legal instrument of any state, though probably supported by a state (mostly through its intelligence agencies or its sub-state forces like IRGC, ISI, etc.) and equipped with sophisticated weapons and equipment for fighting a conventional war with guerrilla characteristics.

Specific focus on the enemy’s as well as own centre of vulnerability (CoV) is critical in modern warfare. For example, Katyusha rockets and Scuds ballistic missiles were used extensively in the Afghanistan War in the 1980s and even after that. But the sensitivities to such attacks in the country and the forces deployed was far less than those of Israel.

**EMERGENCE OF “SEMI-CONVENTIONAL” WAR**

The war has produced a variation of the wars we have been used to, by interposing a new type of war between traditional military-to-military conventional war and sub-conventional war (through religious-ideology driven terrorism, insurgencies, and so on). This can only be termed as semi-conventional war which is best defined as an organised military-type force which is not the legal instrument of any state, though probably supported by a state (mostly through its intelligence agencies or its sub-state forces like the IRGC, ISI, etc.) and equipped with sophisticated weapons and equipment for fighting a conventional war with guerrilla characteristics.

This type of war has been evolving since the 1980s Afghanistan War (if not the earlier Vietnam War). What is important for national defence and international peace and security are the challenges this would throw up in the future; hence, the need to study it in deeper detail. Much greater political-military-diplomatic synergy would be needed to defeat such a war by a competent enemy. There is need to undertake objective studies and analyses of the strategies, tactics, technologies, etc. likely to be involved in this type of war.

The war in Lebanon makes it amply clear that challenges to national defence
are becoming even more complex than normally accepted. It is also clear from
the Israeli experience that once a semi-conventional war starts, there will be little
time and opportunity to innovate force employment and weapons and
equipment. It is instructive that Israel had to seek urgent supply of weapons
from the United States within ten days after the war started since it had started
to run out of ammunition and weapons (while Hezbollah had rockets and other
wherewithal to carry on for months). Such wars are much more likely to last
longer than what most modern militaries are planning for; and the sheer
extension of the duration of the conflict could force an adverse decision, leading
to a ceasefire or even defeat.

The obvious agency to undertake this task in India is our Defence Intelligence
Agency. But it would require a substantive upgradation if it is to undertake such
tasks. Relying on short tenure career officers is not the best way to approach the
study and analyses/assessments of complex defence issues for the 21st century.
At the very minimum, the Defence Intelligence Agency would need at least 200
analysts working on such studies.

ROLE OF AIR POWER
The war, for the first time, raised questions about the Israel Air Force concepts
and capabilities to provide the requisite deterrent and to achieve the military
objectives it set out to achieve. The picture has been muddied a great deal by
directing the criticism along the lines that the “failure” of the IDF to win was
caused by the fact that the IDF chief was an air force person (which had
happened for the first time). Historical evidence in general and the recent wars
in particular had demonstrated an increasing role for air power that had led
some people to claim that air power alone can achieve the military effect
necessary for a “victory.” The war in Kosovo in 1999 has been the favourite
example cited to support this view. The most vocal conclusion derived now is
that victory in war cannot be achieved without “boots on the ground” and,
hence, this was Israel’s main failure. The air versus ground forces debate, that
seemed to have tilted in favour of air power after Afghanistan and Iraq, is once
again ready to swing to the other side.
The short range rockets and missiles of the Katyusha and other varieties were the ones that Israel found almost impossible to defeat. What is often forgotten is that much of the projection of air power as the supreme instrument of military power after the Cold War was in sections of the Western politico-strategic literature. And it has been difficult to escape the conclusion that this was related to the tremendous asymmetric advantage that the Western developed countries enjoyed in the air and the aerospace technological superiority that it entailed, and this advantage was rationalised, reinforced and even exaggerated to derive political, psychological, hegemonic capabilities. A spin-off for casualty-sensitive countries was also the surgical application of military power that dramatically reduced, if not virtually eliminated, own casualties. In all such cases in the recent history of the performance of air power, the adversary had no air power or it was eliminated early on, providing a crucial asymmetry in an important area of military capabilities, which provided expanded options.

If one was to judge on the basis of casualty exchange ratios, the IAF did extremely well. It undertook 15,500 sorties, striking at something like 7,000 targets in the 34-day war. It did not lose a single combat aircraft. It lost four helicopters: one to Hezbollah (anti-tank missile fire), two to a mid-air collision, and one to friendly fire. Israel lost 119 soldiers to combat on the ground. The Israeli air strikes resulted in enormous damage to Lebanon’s infrastructure. But the fulcrum of the war were the Katyusha and other short and medium range missiles that Hezbollah launched into Israel.

The Israeli Air Force knocked out nearly 90 per cent of the medium range missile launchers in a 34-minutes air strike blitz. This was a crucial Hezbollah capability that could have had a enormous negative impact on Israel, and its neutralisation was a tremendous gain for Israel early on in the war. And the fact that this could have been achieved only by the air force needs to be noted. But the short range rockets and missiles of the Katyusha and other varieties were the ones that Israel found almost impossible to defeat. Their small size, short pre-launch preparation time (reportedly reduced to 60 second from the time the
launcher moved to launch position to launch and then withdrawal of the launcher) made their location, target acquisition and strike extremely problematic. And since these were being launched at an average rate of around 150 rockets a day, their political-psychological impact is what created the impression of Israeli failure.

For those who may be surprised by Hezbollah’s rocket and missile firing into Israel would do well to remember that they were used fairly extensively during the Afghanistan War in the 1980s and even after that. Kabul city was frequently hit by rocket attacks fired by the Mujahideen (and later the Taliban). However, for a number of reasons, they had not created the type of concerns that we witness in Israel where the angst was more due to a sense of helplessness to stop them rather than only the damage caused. Israel had been victim of Katyusha rockets by Hezbollah earlier also, though they had been used in the past in ones and twos. Israel was working on developing a technological solution to counter such attacks. But this was proving to be prohibitively expensive and incapable of providing a viable defence.

This reality may yet prove to be the major problem for defence against such short-to-medium rocket and missile attacks in the future, especially by non-state actors. Politico-diplomatic arms control and non-proliferation measures had simply ignored this type of threat and the INF (Intermediate Nuclear Forces) Treaty focussed only on eliminating land-based ballistic missiles above the range of 500 km in Europe, while the MTCR (Missile Technology Control Regime) of 1987 covered missiles above the range of 300 km. Typical of the lessons of history, it is this window of below 300-km range rocket/missile that has been exploited by Hezbollah for its offensive war. We in India would have to pay special attention to the ways and means of effectively dealing with such a threat which is more than likely to face us in the future.

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LEVERAGING SPACE CAPABILITIES FOR INDIA'S DEFENCE

D.C. KUMARIA

Space capabilities are becoming absolutely essential for national development, economic well-being, commerce, and everyday life, besides becoming a crucial component of successful military operations. It is generally well-known and accepted that space has emerged as an essential component in furthering a nation’s comprehensive national power. India has a robust civil space programme which is essentially geared towards scientific and development goals. As we move towards greater development, utilisation of space for economic and developmental purposes is likely to increase, and as dependence on space assets and systems increases, the concurrent vulnerability of our country to hostile action seeking to deny, degrade or destroy our space capabilities would increase. India’s dependence on space for vital economic purposes has been growing rapidly and, hence, any serious disruption or degradation would have a major negative impact for the nation’s economy.

The lessons of history, on the other hand, are clear: wherever serious threats to national economic interests arise, military force would be necessary to protect them. Military organisations are responsible as instruments of national power to

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The use of space has expanded with every passing conflict as emerging technologies afford greater exploitability of the environment for pursuance of military activities. This generates the rationale for military involvement in space apart from the fact that space enabled capabilities are fundamental to the core of the revolution in military affairs (RMA) aimed at enhancing military capabilities. The effectiveness of modern precision warfare witnessed during the Gulf War is largely a by-product of the RMA which is aimed at combining the cumulative potential of air and space forces in terms of intelligence, surveillance, reconnaissance (ISR), communications, navigation, etc for providing information dominance, essential for application of force, which, in turn enables decisive war-winning effects. Hence, as part of the Indian Air Force’s (IAF’s) modernisation drive as also to attend to the compulsions of national security, it would be essential to utilise the space-based options available for national defence. Before a comprehensive assessment of the options available, it would be essential to broadly examine the utility of space for the armed forces.

MILITARY USES OF SPACE
The use of space has expanded with every passing conflict as emerging technologies afford greater exploitability of the environment for pursuance of military activities. Until the last decade, however, the uses were largely of a “non-weapon” nature. Space-based assets were mainly aimed at “force-enhancement” missions like observation, communications, navigation, meteorology, etc which allowed terrestrial military forces to conduct military affairs more efficiently. Thus, most military space missions were auxiliary to other more direct military activities. In fact, the capacity to deliberately cause damage to another asset in space is not the main criterion for attributing a military character to satellites. Most present-day satellites (excluding anti-satellites—ASATs) affording military capabilities or performing military functions are incapable of directly destroying or damaging another country’s
property. Apart from “early warning” satellites, which have a clear military role, most of the other military activities can also be performed by civilian satellites and vice-versa. For example, civilian earth-observation satellites can be used for military surveillance, civilian (even commercial) communication satellites have been known to carry military transponders, military navigation satellites have overwhelming civilian users—there is, hence, no clear demarcation between civil and military users.

However, as military as well as commercial reliance on satellites grows, so too has the awareness that space-based assets are centres of gravity which are likely to be targeted in war. This in turn has fuelled the quest for development of techniques for protecting one’s assets in space as well as denying an adversary the use of space. Thus, space-based systems earlier focussed on force-enhancement missions, and the new focus has shifted to controlling the realm of space for one’s own benefit while denying it to the adversary. The accent on military utilisation of space is gradually shifting beyond enhancement of military force capabilities to control of the environment and actual application of military force “in, from and through space.” The above trend is evidenced in the quest of space superpowers like the US embarking on programmes aimed at space control and space force projection. Some of these include programmes like the experimental satellite series (XSS) which seeks to use small satellites to manoeuvre around other satellites in order to inspect, service or attack. They also include kinetic energy anti-satellite (KEASAT) systems, directed energy programmes as well as “counter-space” initiatives like the counter-communications system (CCS)\(^1\) aimed at disrupting satellite-based communication used by an enemy for military purposes. The first of such CCS systems was delivered to the US 76th Space Control Squadron in the year 2004.

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A space-based interceptor test-bed programme is also underway to develop and test space-based miniature missile defence interceptors. The Pentagon’s Missile Defence Agency has already provisioned budgetary allocations for the same. The concept broadly envisages a constellation of space-based interceptors of 50 to 100 interceptor satellites offering a thin boost/ascent defence against intercontinental ballistic missiles (ICBMs) and a multi-shot mid-course defence against medium to intercontinental range missiles.

The agency’s plans call for the first contract to be let out in 2008, the first intercept tests by 2012 and “a constellation production decision” by 2014. From the foregoing, it is evident that space-based systems are presently in the process of transition from an era of militarisation to weaponisation.

Military Applicability for Nascent Space Powers

However, it needs to be borne in mind that the above transition is applicable only to nations like the US. The next rung of “space powers,” the Russians and the Chinese are yet to embark on any serious weaponisation programme. This is mainly on account of the prohibitive costs and technological challenges involved. The Russians inherited the entire range of capabilities for force enhancement missions from the erstwhile Soviet Union. However, since the 1990s, Russia’s capabilities have been severely degraded due to funding problems. With regard to the Chinese, though they are the undisputed leaders in Asia, in relative terms vis-à-vis the US, their capabilities are nascent. However, the Chinese seem to be pursuing the ASAT programme as a priority area. Other countries with known space-based force enhancement assets in operation include France (Helios imagery intelligence satellite and Telecomm-2 communications satellite), Italy (Sical communications satellite), Spain (Hispasat communications satellite), Britain (Skynet-4 communications satellite), Israel (Eros and Ofeq imagery intelligence satellites), India (TES photo-reconnaissance satellite); Japan (commercial Superbird communications satellite system and information gathering satellites); and South Korea (Kompsat-1 remote sensing satellite).

Thus, it is apparent that besides the US, most nations are yet to progress beyond rudimentary military space capabilities aimed at force enhancement missions.
USE OF SPACE FOR FORCE ENHANCEMENT
A brief description of the capabilities afforded by space systems for force enhancement are as follows:

(a) Intelligence, Surveillance and Reconnaissance (ISR)
Their primary contribution is to enable situational awareness by providing high resolution images of the area of interest, monitoring changes, strength and location of forces. ISR satellites could be of the following types:
(i) Imaging Satellites. These are low earth orbit (LEO) satellites that orbit the earth at a height of approximately 300-450 km. Their payload comprises optical as well as radar sensors to provide day/night coverage. To identify troops, a resolution of less than 25 cm would be required. However, for larger sized target identification, a one metre resolution would suffice. Presently, this capability is provided by the technology experimental satellite (TES), which was launched in October 2001. In the future, the CARTOSAT-2 would provide an enhanced capability with the space-based surveillance (SBS) programme.

(ii) Early Warning (EW) Satellites. These are used to monitor the launch of ballistic missiles, rockets for launching satellites as well as nuclear detonations. Space-based sensors are capable of giving warning almost immediately after launch or when the missile breaks through the cloud cover. Hence, they provide maximum warning time for counter-action. Geostationery satellites are suitable for the EW role. Sensors include scanning infra-red telescopes having a resolution of 3 m or less to pick up the hot plumes of missiles.

(b) Communication Satellites
These are typically geo-stationery satellites at altitudes around 36,000 km. These enable military commanders to exercise command and control over their forces and to receive real-time information about the progress of the campaign. Space and terrestrial sensors involved in ISR, navigation, etc generate an enormous amount of data. The transmission of this data requires reliable and secure
communication which is provided by communication satellites. Satcom is particularly useful for connecting geographically separated units. Networks could also be established at remote locations in a short period using these.

The Indian communication satellites are as follows:

(i) INSAT-2 E
(ii) INSAT-3 A, B, C & E
(iii) GSAT-2* (ADGES back-up & IMMOLS)
(iv) GSAT-3* (Tele medicine)
(v) INSAT-4A

* Presently used by the Indian Air Force (IAF)

In the future, GSAT-4 will provide Ka band transponders on an Indian satellite for the first time, and GSAT-7, a dedicated navy satellite, would provide an enhanced coverage in the Indian Ocean region.

(c) Navigation Satellites
Navigation satellites such as the Navstar GPS, and GLONASS have helped military forces to precisely manoeuvre, synchronise actions, locate and attack targets as well as locate and recover stranded personnel. They have profoundly improved the accuracy of weapon delivery. With a hand-held global positioning system (GPS) receiver, a ground soldier can precisely locate his position. Using a laser range finder, he can obtain the range and bearing of the target. This could be relayed to an airborne platform to attack the target site. We currently use the American GPS array of satellites in a 20,000 km orbit. Of the entire constellation, at any time, at least four satellites are simultaneously in view to provide precise time, position and velocity data. In the future, the projects GAGAN and Indian Regional Navigation System (IRNS) would provide an indigenous wide area augmentation system (WAAS) and navigational platform.

(d) Meteorological Satellites
These satellites provide information about atmospheric water vapour, temperature and other weather phenomena. They could be used to determine the most appropriate time for attack. They monitor meteorological conditions.
over the target area, and provide data about cloud cover so that satellite reconnaissance missions can be planned effectively. The satellites maintain altitudes around 800 km, inclined at 98 degrees, and are sun synchronous. The geometry of this orbit is such that each satellite views the whole surface of the earth twice a day. These can also be geo-stationery satellites, typically giving cloud cover every hour. Kalpana-1 and Oceansat-1 are satellites dedicated for meteorological purposes. In the future, the Oceansat-2 is envisaged for providing continuity to Oceansat-1.

(e) Geodetic Satellites

These are used to produce maps of the earth by using photographic and radar techniques. They also provide data about the earth’s gravitational and magnetic fields which enable trajectories of ballistic missiles to be predicted accurately. These are essential for the guidance system of cruise missiles.

IMPERATIVES FOR OUR DEFENCE NEEDS

It is apparent that space-based systems provide vital capabilities to successfully execute national military strategy, and have the potential to be used across the full range of military operations at the strategic, operational and tactical levels of war in order to accomplish national security objectives.

Secondly, information derived from air space platforms would be vital for success in conflicts. Hence, it would be imperative to attain a certain medium of “information dominance” in order to complement our conventional capabilities.

Thirdly, targeting would assume increasing importance and would be aimed at the heart of the enemy through effect-based operations (EBO), which would, through a few, carefully selected and executed time critical operations (TCO),
significantly affect the course of the campaign. Such a winning combination of information dominance, real-time command and control and judicious force application would be possible only through the aerospace medium. Aerospace operations, extending from the ground up to space will render obsolete the traditional dividing line between strategic and tactical operations, and enable hitherto distinct levels of war to be merged into simultaneous, precise and carefully orchestrated operations which would aim for the nerve centres of leadership as well as command and control at the very outset of hostilities.

Many emerging realities of IAF air power like the integrated air command and control system (IACCS), airborne warning and control system (AWACS), operational data link, etc are different aspects of an emerging network-centric environment in which the space medium would be a vital, though largely invisible component. However, there exists an emergent need for examining the options afforded by space in order to address the following aspects:

(a) Securing of our space and terrestrial assets and, thereby, ensuring uninterrupted national development.

(b) Coordination of military requirements and development of military space capabilities.

(c) Integration of space and conventional military capabilities.

From the foregoing, it is clear that there is a need to amalgamate space assets with conventional capabilities to bolster prevailing capabilities, resulting in the conduct of traditional tasks more efficiently. Existing space assets would need to be exploited and future projects should take into account national security requirements along with economic, scientific, social and other requirements. The military uses of space have evolved from early, tentative attempts at enhancing conventional military force capabilities to actually enabling the decisive outcome of battle in the present times. The reliance, rather over-reliance on space-based systems like in the

There is a need to amalgamate space assets with conventional capabilities to bolster prevailing capabilities, resulting in the conduct of traditional tasks more efficiently.
US basically stems from the fact that space-based systems can accomplish or enable accomplishment of military missions more efficiently, more economically and in a technologically superior manner than could be achieved by any other means. No surprise then that acquisition of space-based military capabilities globally has become the norm rather than the exception.

At the same time, it also needs to be understood that space is not a substitute for conventional military capabilities, or a panacea for information voids or military inadequacies. Uses of space-based systems are constrained by exorbitant costs because of the high levels of technology involved. Satellites themselves are constrained by technological factors like predictable over-pass timings and orbital patterns, width of coverage, attenuation due to inclement weather, etc. Their utility and limitations in the information loop, applicability at the strategic, operational, tactical levels, etc must be understood in the correct perspective for optimal exploitation. It also needs to be borne in mind that arriving at present levels of military space utilisation has taken even an advanced nation like the US the better of over four and a half decades. Hence, we would need to be cautious in emulating the capabilities of such advanced nations, and in superimposing their advanced doctrines and strategies on our relatively nascent needs and capabilities. Defence strategy on space should be dictated by rational security needs and not the outer limits of what appears to be technically possible as in the case of superpowers like the US.

DEVELOPING SPACE CAPABILITIES FOR DEFENCE

Nonetheless, it is crucial that we incorporate existing space capabilities, resources and operations in our security policies and strategy. Our unique circumstances and practical considerations would demand a deeply cooperative and integrated approach to capacity building and resource utilisation by various departments of the government. It would be counter-productive to duplicate assets or to reinvent the wheel; affordability and optimisation would demand a cooperative evolutionary

It is crucial that we incorporate existing space capabilities, resources and operations in our security policies and strategy.
approach. India already has fairly advanced programmes for economic and social development purposes. These programmes could be modified to include space capabilities needed for security purposes. In other niche areas, space capabilities for defence could be built upon as an extension of these programmes, thereby, enabling affordability and optimal utilisation of resources.

Space capabilities for defence would primarily need to be built upon two considerations. One, a balanced assessment of the military requirements vis-à-vis capabilities afforded by space; and, second, the coordination and integration of space into our conventional security apparatus. Prioritisation of requirements, technologies and capabilities would need to be objectively charted and pursued for development and deployment of capabilities. This would be essential for evolving a robust, credible and affordable programme which would be mutually beneficial, cohesive and cost-effective. It could fulfil national defence needs, and at the same time, not drain or compete with the civilian developmental programmes. The structure could be designed to ensure that the civil and military aspects of the national space programme complement and draw strength from each other rather than compete with each other.

EXTRACTING MILITARY APPLICATIONS FROM CIVIL CAPABILITIES

We have significant experience and expertise in space and space-related technologies. Many of them would have dual-use applications while some of them would have to be further developed to support defence forces. Civil, and military space activities are complementary and no “budget-intensive” effort is envisaged for technology transfer from civil to military space endeavours. For example, launch vehicles are the same for civil and military payloads. Similarly communications, navigation, imagery, meteorology and geodesic satellites have both military and civil applications. In fact, space-based imagery, communications and permission guidance are available off-the-shelf as commercial products. It is accepted that economic (and perhaps political) considerations may limit some civil-to-military spin-offs. However, it is a matter of national interest that capabilities for defence should benefit from
economic and commercial uses of space. These are challenges to be overcome jointly in the larger national security interests, while developing our military space capabilities. While certain dual-use capabilities could be harnessed right away, other capabilities would demand dedicated efforts. Certain defence-specific technologies would need to be developed and progressed. Defence research and development (R&D) would have to concentrate on defence-specific technologies that cannot be developed by civilian R&D agencies. Joint efforts by a central defence coordinating agency, space agencies and defence technological agencies like the Defence Research and Development Organisation (DRDO) could undertake development, planning and execution of such programmes.

Thus, keeping in mind the “availability and affordability” criteria, presently available space technologies would need to be dovetailed to meet present national security and defence requirements. Future requirements should be projected with due attention to costs, legalities and treaties in vogue, technical feasibility, etc. For future applications, doctrine, requirement, technology and capability could be evolved synergistically, keeping pace with each other for optimal military exploitation and utility of space-based systems.

Challenges to Civil-Military Modifications
In the near term, the main differences perceived for modification of our prevailing (civilian) space programme to meet security requirements relate to:
(a) Greater robustness and manoeuvrability, essential to secure space assets against degradation, disruption and destruction by enemy counter-measures like jamming, ASAT weaponry, etc.
(b) Increased resolution capabilities coupled with more frequent revisit capabilities to meet intelligence, targeting and other requirements.
(c) Independent, secure, dedicated and redundant communication and navigation links to ensure uninterrupted access even during times of crisis,
LEVERAGING SPACE CAPABILITIES FOR INDIA'S DEFENCE

Wars, etc. Reliance cannot be placed on systems like the American Navstar GPS, whose use may be denied, restricted or degraded by the service provider itself.

(d) Sharing of technological, operational and related knowhow for building up aerospace surveillance capabilities.

AGENCY FOR COORDINATING SPACE-BASED MILITARY AFFAIRS

Space offers a number of war-winning capabilities like near instantaneous communications, continuous surveillance and highly accurate positioning. These capabilities provide a decisive advantage to the military. India has considerable civilian space capabilities, but dismal military space capabilities. We have, over the years, built up adequate capability in space technology and our space assets are being exploited efficiently by the civil sector for a number of applications but the military use of space by India has been minimal. Indian military use of space is limited to procuring imagery from a single military satellite, the TES. India is yet to integrate its civilian capabilities into its war-fighting machinery or at least take steps to protect its assets in space. This lack of coherent direction in military space application has resulted in the significant gains being underutilised in a military context. India ranks at fourth position in the world with regards to both national air power and space capabilities; however, the absence of foresight and coordination has led to a situation wherein joint exploitation of the media of air and space is among the lowest in the world, as highlighted by Table 1.

As part of a focused, integrated approach, the Integrated Space Cell (ISC) at Headquarters Integrated Defence Staff (HQ IDS) has been designated as a nodal agency to coordinate all space related issues for the three Services. Some of the tasks that the ISC would fulfil are as follows:
Table 1: Composite Aerospace Exploitation Across The Globe

<table>
<thead>
<tr>
<th>Country</th>
<th>Air Power (No of Aircraft) - year 2003</th>
<th>No of Military Satellites - year 2003</th>
<th>Degree of Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>16,038</td>
<td>105</td>
<td>Highest</td>
</tr>
<tr>
<td>Russia</td>
<td>9,211</td>
<td>144</td>
<td>High</td>
</tr>
<tr>
<td>China</td>
<td>9,812</td>
<td>09 Dedicated, dual-use 42-use not known</td>
<td>Medium</td>
</tr>
<tr>
<td>India</td>
<td>1,813</td>
<td>01</td>
<td>Nil</td>
</tr>
<tr>
<td>Japan</td>
<td>1,754</td>
<td>02 launched (in orbit) 02 failed</td>
<td>Medium</td>
</tr>
<tr>
<td>Israel</td>
<td>1,038</td>
<td>02 in orbit 01 dual-use 02 failed</td>
<td>High</td>
</tr>
</tbody>
</table>

(a) It would serve as a single point of contact for all space applications and support, responsive to all security agencies.
(b) It would serve as a nodal agency for space system/capability demand, acquisition, procurement, etc from external agencies (both civil and commercial).
(c) It could be entrusted with the responsibility of coordinating the requirements of various users, consolidating all existing and proposed space support applications, recommending compatibilities and feasibilities of such applications and scrutinising support requirements, etc.
(d) It could be tasked to examine and recommend suitable defence oriented systems/sub-systems, deployment of such systems, and, subject to approval, pursue implementation of such projects.

2. The number of aircraft has been sourced from "World Military Aircraft Inventory," Aviation Week and Space Technology, January 13, 2003, pp. 257-76 and generally corresponds to equal figures in SIPRI’s and Military Balance. However, military satellite estimates with respect to the US and Russia differ in publications ranging from SIPRI’s, the Teal Group, etc to the US Air Force Association’s Space Almanac, etc. Nevertheless, most publications are in common agreement regarding the estimates of Asian military spacecraft.
From Theory to Practice
The present choice of military space applications, hence, could be a subtle mix of applications which need not be exclusive to military needs, but would be a natural adjunct of civilian applications, with a greater degree of autonomy, redundancy and security. Thus, while present military requirements may be included into the Indian Space Research Organisation’s (ISRO’s) decade plan (1997-2007), future military requirements, after due consideration, could be projected well in advance to allow their inclusion and integration into the subsequent decade plans. The above would enable synergistic evolution of national military space capabilities without disturbing the pace of our civilian space capabilities. Towards this, the Defence Space Vision (DSV)-2020 has been produced by HQ IDS with the participation of the representatives of the three Services and the Department of Space (DoS). The document is presently being converted into two technical reports pertaining to ISR and communications. The reports will contain the roadmap of the specific space-based capabilities required by the three Services and the commitment, with time-frames by the DoS to achieve the same.

Roadmap for Military Utilisation
The assets and capabilities required for a credible space programme aimed at national security in addition to civilian development would need to be carefully built up taking both the operational needs as well as the critical issues of affordability, political correctness, cost, etc into account. A significant amount of capability and assets would need to be built up, with many of them created on a priority basis and/or strengthened even after they have already been initiated. The needs and developments would have to be kept under constant review and monitoring.

Roadmap Ahead
The list of technological advances and applications afforded by our extant civilian capabilities is long and impressive and there is an equally long list of the potential paths and options for exploiting these capabilities.
Fundamentally, the roadmap in the near term would focus on force enhancement missions and protecting our assets in space. The first aspect could be addressed by inducting space systems in areas such as communications, navigation, observation which would be within the scope of technologies available to us and affordable to the exchequer. The emphasis would be on utilising the enormous scope provided by space systems to conduct military affairs more efficiently. This would demand significant participation and cross-exchange of ideas and information between the military and civilian space agencies. The cross-flow of information would primarily be in terms of technological inputs and feasibilities from the civilian space agencies corresponding to operational requirements put forth by the armed forces. The second aspect would be of protection and security of our space-based assets built so painstakingly over the decades which would also demand cross-exchange of inputs and participation by both civilian and security agencies.

DESIRABLE CAPABILITIES

Reliable Communication Capabilities
In view of factors ranging from immediate responsive communicability required for the defence forces deployed across the length and breadth of the subcontinent, the variety of terrain, and the inherent limitations of ground-based communication systems, there is a need for the armed forces to be provided connectivity by space-based systems. The inherent virtues and efficiency of space-based communications would overcome prevailing problems of line-of-sight links, attenuation losses, low reliability, etc. Secondly, apart from enhancing command control, communication, computers, intelligence (C3I), it would also serve to efficiently transfer the enormous amount of data and information provided by space-based observation, navigation and other systems to the users in real-time or near real-time.
A military communication system in our Indian context would basically indicate military-unique system(s) owned, leased or dedicated to military purposes. These would encompass operations, control and employment of system(s) by the military. The system(s) could include the requisite number of transponders, frequency bands or even leased capabilities on civil or commercial satellites rather than dedicated military communication satellites. Dedicated efforts would be prohibitively expensive and may amount to underutilisation in an era of multi-tasking. The essential factor distinguishing civil and military systems is that civil applications are aimed at reliable connectivity at most economical rates whereas defence applications would demand reliable connectivity even in the face of deliberate degradation, interference, etc which are characteristic to combat operations. It is desirable to have the required bandwidth on more than one satellite to obviate disruption of services and in case of failure/sabotage of a particular satellite, requisite modification could be undertaken to balance and meet both the requirements.

Space-Based Capabilities
The term space-based observation has been used to broadly include missions of imagery intelligence (IMINT), electronic intelligence (ELINT), signals intelligence (SIGINT), etc which primarily deal with space-based observation aimed at providing significant ISR capabilities. ISR requirements would entail integration and exploitation of prevailing and forthcoming advances in space-based sensors inclusive of capabilities on civilian application satellites like the IRS series, dedicated military assets like the TES, and even commercial satellites like IKONOS. The integration would not be limited to just space-based ISR systems but also to corresponding air and surface-based systems because pursuing independent ISR capabilities would amount to defeating the purpose of such potent capabilities. Overall integration of capabilities would be essential.
to obtain a synergistic strategic, operational and tactical observation capability. The broad requirements to be fulfilled for ISR capabilities would be as follows:

(a) IMINT

(i) Systems providing one metre resolution are presently available and would suffice for the near term, though repetivity and revisit factors need to be improved. In specific areas, sub-metric imagery would have to be obtained for effective targeting.

(ii) Area of coverage contiguously needs to be extended to include locations where known threats exist.

(iii) Availability of a judicious mix of sensor payloads like hyper spectral imaging (HSI) and synthetic aperture radar (SAR), etc.

(iv) Availability of better data processing and transmission capabilities.

(b) ELINT/SIGINT

(i) While dedicated efforts for the above capabilities would be most suitable, in the interim, requisite payloads could be placed as “piggyback options” on satellites to cover areas of interest.

(ii) Opportunities afforded by micro and nano satellites in fulfilling the requirements also need to be explored.

(iii) Integrate space-based effort with conventional capabilities.

(c) Ocean Reconnaissance

(i) This would be an investment in the near term, which would be dedicated to purely military affairs; however, this is considered inescapable on account of our expanding area of interests and reach of the navy.

(ii) In view of the enormity of the investment involved, the project may have to be undertaken phase-wise.

Space-Based Positioning and Navigational Capabilities

Financial propriety in investing in expensive indigenous navigational capabilities would prima-facie appear questionable. However, it needs to be borne
in mind that apart from our own satellite-based augmentation system GAGAN (GPS and geo-augmented navigation), which is devoted to civilian uses, India has already invested in every existing navigational system ranging from the American NAVSTAR GPS, Russian GLONASS to the European GALILEO with no reciprocal guarantee of assured access. The requirements and costs of an indigenous navigational capability need to be assessed vis-à-vis our strategic relationship with parent countries i.e. the US, Russia and the European Union (EU). In addition, the following measures could be undertaken:

(a) Acquire navigation receiver systems compatible with multiple transmitters since receivers would need to be compatible with American, Russian and European systems.

(b) Take advantage of the existing GPS, using differential GPS for greater accuracy.

(c) Develop a system analogous to the wide area augmentation system (WAAS) of the USA for military uses. The system is a network of precisely surveyed ground reference stations which receive GPS signals and determine errors and compute corrections. These corrections are then transmitted from a geostationary communications satellite on the same frequency as GPS. This would enable continuous use of GPS even in the eventuality of the service provider attempting to deny or degrade GPS facilities. Incidentally, until the maturing of their indigenous space-based navigational system “Beidou”, the Chinese were known to be following this option.

(d) Install GPS integrity monitors at air traffic control centres or air defence direction centres to monitor GPS, and enable corrective action in case of systems degradation or denial.

**Early Warning**

The requirement of early warning (EW) against ballistic missile (BM) launches would require an enormous investment since neither would the satellites be dual-use nor would the requirement be sufficed by a single satellite, two satellites or a part constellation. An enormous effort and investment into a constellation covering the entire subcontinent, including the island territories,
would be required. Such an enormous investment in the near term is not considered prudent and it would be wiser at present to invest in capabilities like communications, navigation, observation, etc which are of a more emergent nature in the near term and the foreseeable future. Dispensing with an elaborate ballistic missile early warning (BMEW) system in the near term is being suggested primarily on the following grounds:

(a) BMEW systems are largely a sub-set of ballistic missile defence (BMD) which itself is a controversial endeavour. The technology is yet to mature, the operational utility and concepts are unproven, and the cost intensive. Once the experimentation stage ends, depending on the failure or success of the endeavour, efforts could be initiated.

(b) Unlike in the case of Cold War where BM rivals, the US and USSR, were separated by intercontinental distances and, hence, needed an elaborate investment in BMEW systems, our threat is characterised by proximate, contiguous neighbours. The prevailing conventional radars are capable of detecting and tracking missile trajectories within the atmosphere (to a certain extent). Therefore, whether an enormous investment needs to be undertaken for tracking and detection beyond the atmosphere is a moot issue. Particularly, in view of the fact that even after detection and identification, the more important issues of interception and destruction are yet to be addressed.

(c) Lastly, other delivery options are available to both the BM and nuclear powers in our neighbourhood, hence, concentrating on BMEWs is not recommended.

Protecting and Securing Assets in Space
As of now, no known protection measures have been undertaken to secure our assets in space. Assuming that some of these would have joint civil-military applications, a hard kill (e.g. ASAT attack) or soft kill (jamming, interference) by a hostile entity would cause a significant dent in our military capabilities and an enormous dent in our economic capability. Increased
use and exploitation of space capabilities for economic and other development would call for enhanced protection of space assets and capabilities; hence, steps to protect and secure assets in space need to be undertaken in the near term.

**Threats Envisaged**

Presently, the threats to space-based systems are perceived from the following:

(a) Ground, airborne and space-based energy weapons like directed energy weaponry (DEW), electro magnetic pulse (EMP), high power microwave (HPM), etc.

(b) Kinetic kill by (non-nuclear) ASATs and other interceptors.

(c) Degradation by jamming and other forms of interference.

Effective threat levels of the above three would, however, vary. Technology in the first case is yet to mature completely and is extremely costly. The other two are more problematic due to the prevalence of established technologies, which are capable of jamming or degrading space systems by targeting signals, uplink/downlink, etc or actually destroying satellites. It also needs to be borne in mind that latent ASAT capabilities already exist with many space powers. Conflicts and disputes are already on-going as also is interference with signals, etc. The situation is already alarming and is only likely to worsen further.

**Protection and Security of Space Assets**

The above would demand parallel defensive measures, which comprise a studied, deliberate, institutionalised effort rather than knee-jerk responses to adverse situations. Our space systems would need to be equipped with proper shielding, frequency agility, manoeuvrability and encryption to be invulnerable and more importantly, survivable even with degraded capability in a worst-case scenario.

Protection of space systems would largely revolve around the following:

(a) Orbital monitoring and protection.

(b) Link (uplink/downlink) control and protection.

(c) Allied receiver system (terrestrial) protection.
Protection Measures

Broadly, the following measures would need to be undertaken to ensure protection of space assets:

(a) Monitoring of space for continuous information on the location of satellites, space debris, asteroids and other harmful matter. This would necessitate the formation of aerospace surveillance centre(s), which would monitor the entire vertical expanse inclusive of the atmosphere, near earth orbit and even beyond. This task may require collaboration with other space powers.

(b) Incorporation of survivability measures for both satellites and their payloads like hardening, shielding, etc to shield against soft-kill energy weaponry like (DEW), lasers, HPM, etc. Electronic counter-measures (ECM) like frequency hopping, antenna nulling, etc would need to be incorporated. The ability to pin-point and enable counter-response against jamming, interference, etc would also need to be factored in.

(c) Incorporation of additional energy (fuel) to provide manoeuvrability to defeat physical attack (hard-kill). Payload penalties would have to be designed within acceptable limits so as to compensate for hardening, manoeuvrability, etc.

(d) Encryption of satellite links (uplink/downlink/crosslink) to protect and prevent intelligence leaks from transponders, transmitters, receivers, etc.

(e) Multi-sensor data fusion to provide for redundancy and integration of satellite imagery and other data derived from airborne sensors like aircraft, unmanned aerial vehicles (UAVs), etc to defeat camouflage, concealment, deception and also compensate for degradation.

(f) While a wide variety of survivability and protection options is available, a judicious mix of efforts in response to the nature and probability of threat as well as the value of satellites would need to be undertaken for balancing...
While a wide variety of survivability and protection options is available, a judicious mix of efforts in response to the nature and probability of threat as well as the value of satellites would need to be undertaken for balancing conflicting requirements of security and cost. But fundamentally, the roadmap to be followed could be grouped into the following three categories:

(a) **Near-Term (2007-2017)**
   (i) Application of available space capabilities for military force enhancement, i.e. using space for enabling more efficient use of conventional military capability.
   (ii) Institutionalising protection measures for securing space-based assets by measures like hardening, manoeuvrability, etc.
   (iii) Establishing organisational and infrastructural facilities to fulfil the above requirements.

(b) **Mid-Term (2017-2027)**
   (i) Integrate space and conventional military capabilities to possess a comprehensive instrument of national power capable of delivering the collective might of military and space power for furtherance of national objectives.
   (ii) Institutionalise measures for defending national territory and assets against military force application from space.

(c) **Long-Term (2027-2037)**
   (i) Synergise operations and technology to go beyond incremental capability
Fundamentally, the roadmap in the near-term would focus on force enhancement missions and protecting our assets in space.

**Near-Term (2007-2017)**

The list of technological advances and applications afforded by our extant civilian capabilities is long and impressive and there is an equally long list of the potential paths and options for exploiting these capabilities. Fundamentally, the roadmap in the near-term would focus on force enhancement missions and protecting our assets in space. The first aspect could be addressed by inducting space systems in areas such as communications, navigation, observation which would be within the scope of technologies available to us and affordable to the exchequer. The emphasis would be on utilising the enormous scope provided by space systems to conduct military affairs more efficiently. This would demand significant participation and cross-exchange of ideas and information between the military and civilian space agencies. The cross-flow of information would primarily be in terms of technological inputs and feasibilities from the civilian space agencies corresponding to operational requirements put forth by the armed forces. The second aspect would be of protection and security of our space-based assets built so painstakingly over the decades which would also demand cross-exchange of inputs and participation by both civilian and security agencies.

**Middle-Term (2017-2027)**

It would be too ambitious to expect total fulfilment of all near-term goals, therefore, it would be prudent to expect spillover of incomplete programmes onto the subsequent phase. The pace of technological and geo-political change would dictate intense inherent dynamism and adaptability in our plans and capabilities. Nevertheless, by mid-term, it would be reasonable to expect a certain level of mission fulfilment in the roles of communication, navigation, ocean reconnaissance, etc. A certain level of maturity in the technology,
By mid-term, the emphasis should shift to completion of pending projects and better integration of space into conventional military capabilities. This would dictate a review of changed capabilities and focus on doctrine, strategies and procedures for optimal exercise of military power in pursuit of national objectives.

Long-Term (2027-2037)
Long-term predictions and visions are fraught with difficulties on account of the pace of change. Extended long-term visions generally dissipate into mirages and, hence, for the present it would suffice to have a broad long-term concept which would deal largely with going beyond incremental capabilities and developing new strategies based upon capabilities foreseen in the future. Such an endeavour could be undertaken towards the end of the middle term and, hence, is dispensed with at present.

CONCLUSION
The security demands of the future on any nation are no longer restricted to physical security. The future security starts with physical security in one’s own territory, and extends to security of its population worldwide, to economic security, to energy security, not only its own, but also of friendly states. In the future, armed forces would increasingly be involved, more so in peace-time activities like disaster management and out-of-area contingencies, etc.

Use of air power in various parts of the world during the last decade has shown that air power is the most effective instrument of power projection for a nation. Air power is also the most effective instrument for providing for any
commitment of the nation to its population. In recognition of this, to keep pace with the growing needs of the nation, the IAF’s strategies and its operational concepts have been reviewed constantly to meet all kinds of contingencies and the need for unremitting vigilance. Professional training and development of air warrior qualities have been strengthened to meet all future challenges.

It is keeping in mind such a futuristic scenario that the IAF is planning to integrate space-based applications extensively into its conventional strategies and operations. The IAF vision is linked with the vision of the country, and the IAF’s capabilities would grow as the country grows. The new dimension of warfare is moving into space, the ultimate high ground, and this is where the IAF would also move to. We are already using space for telecommunications, reconnaissance, navigation targeting and many other operations. The IAF is adopting a focussed and fast tracked approach to harness space effectively to provide synergy with all the facets of its operational roles.

Air power is also the most effective instrument for providing for any commitment of the nation to its population.
DEFENCE MANPOWER IN INDIA: SOME SALIENT ISSUES

GURMEET KANWAL

POST-COLD WAR UNCERTAINTY
The 20th century was perhaps the bloodiest century in history. Two world wars, the spectre of nuclear weapons, numerous small wars and insurgencies and, in the last few decades, many ethnic conflicts, ensured that the last century of the 2nd millennium remained mired in violence. The peace dividend that was expected to accrue after the Cold War ended in 1991 failed to materialise. Instead, numerous small wars and insurgencies broke out all over the world, such as those in Bosnia-Herzegovina, Kosovo, Somalia, Rwanda, Kampuchea, Chechnya and East Timor. In a world that continues to be in a state of transition after the collapse of bipolarity, new challenges and threats to national security are constantly emerging. While conventional war is becoming increasingly unviable as an instrument of foreign policy, sub-conventional conflict and armed violence have become more prevalent. The Al Qaeda-planned September 11, 2001, terrorist attacks that employed civilian passenger aircraft to bring down the twin towers of the World Trade Centre in New York and damaged a wing of the Pentagon in Washington, DC, struck at the heart of Western civilisation and made international fundamentalist terrorism the leading threat of the 21st century.

The end of the Cold War led to what could be characterised as an era of strategic uncertainty. Defence planning has become more difficult in several ways. The sources and types of conflicts for which planning must be carried out have become more diverse and less predictable even as the number of potential adversaries...

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If there is but one trend that is discernible in the restructuring efforts that are currently underway in most modern armed forces, it is that of qualitative upgradation of forces to revolution in military affairs (RMA) technologies, doctrine and organisations and their quantitative downsizing. The range of missions that armed forces need to undertake is expanding to include those likely to be assigned in sub-conventional conflict, including low intensity border wars and insurgency fuelled by foreign powers. And, the global security agenda has expanded in functional terms. Yesterday’s peripheral challenges such as the security of energy sources and the threat from mass migrations now compete with conventional threats for a share in the defence pie. Systemic changes in the structure of the global economy, communications and military technologies are likely to alter the strategic stakes. These changes in the security paradigm are changing the strategic terms in which policy-makers, military leaders and defence analysts must address long-term defence planning so as to evolve defence capabilities that will be relevant to the emerging threats.

The asymmetric character of contemporary conflict challenges conventional thinking and demands fresh responses. General Rupert Smith has identified six key trends that define modern warfare: the growing role of non-state actors as well as multinational forces as combatants; looking for creative new uses for old weapons; emphasis on force protection rather than using force at any cost; the prolonged nature of modern wars; a new focus on winning the hearts and minds of people; and, a shift from absolute objectives to more flexible ones. He writes that in the Clausewitzian trinity (army, state and people), the balance among the three has changed. “There was a time when armies dominated—as they still do in the country of warlords; later, states were able to command the complete obedience of their people. Now it is the people who are in charge and the strategic objective is their hearts and minds.”

If there is but one trend that is discernible in the restructuring efforts that are currently underway in most modern armed forces, it is that of qualitative upgradation of forces to revolution in military affairs (RMA) technologies, doctrine and organisations and their quantitative downsizing. As military manpower becomes more and more expensive to recruit, train and retain, planners are increasingly opting for technological solutions at least in low risk areas and relying more on ‘mean and lean’ conventional forces for deterrence. However, at the same time, conventional forces are increasingly proving to be inadequate for facing up to the challenges of sub-conventional conflict. “In particular, Iraq, Afghanistan and Chechnya demonstrate the limitations of modern conventional forces in complex environments that depend more on them than traditional warfighting.”

The aim of this paper is to examine the salient issues affecting the recruitment, training and retention of suitable personnel in the Indian armed forces, understanding the linkage between manpower and technology, and recommending measures to reduce the cost of manpower.

EMERGING TRENDS IN INTERNATIONAL FORCE LEVELS
With economic power gradually edging out military power as the key determinant of national strength and geo-political status, international force levels have witnessed a downturn since the end of the Cold War. In planning future force levels and equipping these forces, most modern armed forces have taken their bearings from the transformation process that is underway in the United States (US) as well as the lessons of the 1991 Gulf War and 2003 Iraq War and the intervening campaigns like the ones in Kosovo in 1999 and Afghanistan in 2001. A number of emerging trends, some clear and certain, others nascent or incipient and some others that are still hazy, are discernible in international force levels.

Due to the decreasing emphasis on gaining and holding territory, capabilities-based restructuring of conventional forces, as opposed to the old threat-based organisations, is leading to downsizing, particularly of army fighting formations.

Due to the decreasing emphasis on gaining and holding territory, capabilities-based restructuring of conventional forces, as opposed to the old threat-based organisations, is leading to downsizing, particularly of army fighting formations and units. Emerging threats like international fundamentalist terrorism, especially from non-state actors, are also guiding this trend. Simultaneously, the strength of reserve troops has gone up almost across the board. The transformation of conventional forces is in progress to bring them in conformity with RMA concepts and technologies. Special efforts are being made to upgrade intelligence, surveillance, reconnaissance (ISR) capabilities, particularly those of space-based platforms, and to attain the ability to wage network-centric warfare (NCW). At the higher end of the technology trajectory, the trend is towards introducing weapons platforms and ISR systems that are either completely unmanned or require minimum manpower for prolonged employment and usage.

Dr. Stephen P. Cohen, senior fellow, Brookings Institution, Washington DC, has mentioned two drivers that are relevant to acquiring RMA capabilities:

"First, the continuing and expanding use of technology to miniaturise weapons and to make them more accurate and, hence, more destructive as well as precise. Second, this costs a huge amount of money, and even the wealthiest countries cannot buy in quantities that their militaries were accustomed to, and also forces greater cooperation in weapons development. It is no longer taboo to work on vital systems in partnership with other countries. This is now catching up with India, and the craze for autarky is pretty much irrelevant."

Modern armed forces are carefully integrating individual Services to prepare them for joint warfare for greater synergy in orchestrating operations. This is invariably undertaken in the face of heavy opposition as individual Services resent and stubbornly resist change. The reduction in conventional force levels is leading to greater reliance on coalition warfare as nations pool in their
capabilities to make up for deficiencies and shortfalls and to gain diplomatic strength. However, this is not always the best solution, as coalitions tend to have disparate objectives and often lack cohesiveness.

The increasing proclivity to seek to achieve military aims and objectives by domination from the air through fighter-ground attack (FGA) aircraft and missiles is leading to enhancement of these capabilities. For example, the US and coalition forces enforced an exclusion zone over Iraq for over a decade exclusively from the air. Rapid deployment and rapid reaction forces are being added to the inventories of almost all the modern armies. China, for example, is in the process of upgrading one division each to the status of a rapid deployment division in all military districts. Similarly, the European Union has constituted a rapid deployment force.

There is noticeable accretion in the force levels of special forces the world over as greater reliance is being placed on the low-visibility employment of military force, especially against terrorist cells and fundamentalist insurgents. Some of the armed forces are gravitating towards raising specialised internal security and counter-insurgency forces as a new branch that is being added on to the existing armed forces in the country. This is being seen as a means to separate a 'lean and mean' conventional force for deterrence from fluctuating force levels for sub-conventional conflict. However, this is not yet widespread.

In some countries, in real democracies as well as those that hold sham elections or have never held an election, the trend is towards a huge expansion of paramilitary forces for internal security duties. In Asia, India leads in this reliance on second tier forces. Almost all the central police and paramilitary forces (CPMFs) like the BSF, CRPF, ITBP, CISF and SSB, have added a large number of battalions to augment their fighting strength since the mid-1990s when realisation had first dawned on the military and civilian bureaucracy that insurgency and terrorism are here to stay.

The increasing proclivity to seek to achieve military aims and objectives by domination from the air through fighter-ground attack (FGA) aircraft and missiles is leading to enhancement of these capabilities.
The US, Japan, France, the UK and India have formulated plans to enhance strategic sealift and airlift capabilities for power projection as well as for disaster relief. Additional capabilities are being gradually created for littoral warfare and assault from the sea as the seas and oceans become more important for trade and commerce.

Special efforts are being made to reduce the logistics footprint of armed forces by outsourcing the supply and maintenance chain to civilian trade wherever it can be done without compromising operational readiness. After the American experiment in Iraq, armed forces the world over are considering outsourcing the perimeter security of airfields, logistics bases and other similar nodes and convoy protection duties, when deployed out-of-area for peace-keeping, peace-support and stabilisation operations, to private companies so as to reduce the need for the large-scale employment of regular troops on rear area security duties that are not optimally suited to their skills and training.

In view of the sophisticated hi-tech weapon systems that are now in service with almost all modern armed forces, the technological threshold of the men and women in uniform needs to be much higher than was the case even a decade ago. Hence, it is becoming increasingly more important to recruit and train well-educated youth to serve in the armed forces. Among the Services, the navy and the air force need more educated personnel than the army because of the greater complexity of their weapon systems. In fact, these Services are looking to raise entry level educational qualifications to graduation (B.A./B.Sc.) in most trades while the army could perhaps manage with 12th standard pass soldiers in arms like the infantry till about 2015 or so with better training. As such, since personnel are likely to be found predominantly in urban areas, the recruitment base is likely to shift to such areas for army personnel as well. In case some of the CPMFs also seek to upgrade their entry-level manpower, this will lead to a new set of socio-economic problems as
the armed forces and the CPMFs provide fairly extensive employment opportunities to the rural youth at present.

ADDRESSING SHORTAGE OF OFFICERS

As India’s economy is booming and lucrative career options are available to the youth in the private sector, the Indian armed forces are being increasingly faced by an acute shortage of officers. The worst affected is the Indian Army that has a staggering shortage of approximately 13,000 officers out of an authorised cadre strength of about 40,000 officers. In August 2004, the central government had announced a proposal to select aspiring Indian Administrative Service (IAS) and allied services candidates after the 12th standard with a view to catching them young for a career in the bureaucracy. Presumably, a new academy is proposed to be established for this purpose because the Mussoorie academy has a different charter. The best option and one that is readily available is to train the young recruits at the National Defence Academy (NDA), Khadakvasla, Pune, which provides the finest all round education at the under-graduate level in India. In fact, it would do the budding central services officers a world of good to do some national service in the armed forces for about five years during which they would be exposed to a disciplined way of life, gain hands-on experience of man-management and good leadership, imbibe values and ethics and learn to be officers and gentlemen. They would also contribute handsomely to national security and help to reduce the officers’ shortage in the armed forces.

The endemic shortage of officers in the armed forces continues to have a deleterious effect on their war-fighting capability, particularly on the army’s performance in counter-insurgency operations in Jammu and Kashmir (J&K) and the northeastern states. As the shortage of officers is primarily in the ranks of


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captain and major, the solution apparently lies in a revamped short service entry scheme which offers lateral induction into civilian jobs after five to eight years of service in the army. Such a scheme would confer the twin benefits of filling all the vacant positions and reducing the pension bill.

The most pragmatic option is for the central government to absorb all the officers scheduled for early release from the three Services. The best method with multifarious benefits to the nation would be to make “military service” compulsory for all aspirants for the central services, including the Indian Foreign Service (IFS), the IAS, the Indian Police Service (IPS), other allied services, the CPMFs and other similar organisations.

Recruitment to the IAS, IFS and the allied services should be channelled only through the armed forces, for men as well as women. Entry into the army, the navy and the air force should be through the Combined Defence Services examination for the NDA conducted by the Union Public Service Commission (UPSC). On graduating from the NDA, the cadets should receive further training at the respective academies of the three Services and then join these as commissioned officers. After five years of service, all volunteer officers should be given three chances each to appear for the UPSC examinations and interviews for lateral transfer into the IAS, IFS and the allied services. Those who do not wish to leave or do not qualify, would continue to soldier on in their respective Service.

Assuming that the bait of eventual transfer to the central services would be a lucrative enough inducement for talented young men and women to join the armed forces, such a step would not only completely eliminate the shortage of officers over a few years, but also considerably enhance the quality of the junior leadership of the three Services and, later, of the central services. However, such a move is bound to meet stiff resistance and would require supreme political will to implement. Since the prime minister is himself eager to improve the quality of intake and the training standards of the central services, he must provide the leadership to ensure that this pragmatic measure can be pushed through politically.

Graduates of the NDA receive B. Sc. degrees, as the armed forces require a fairly high threshold of the knowledge of science. The NDA syllabus can be suitably modified to accommodate the special managerial requirements of the
central services. Particularly at the Indian Military Academy (IMA), Dehradun, and the corresponding academies of the navy and the air force, a recognised management diploma can be included in the syllabus and, if considered necessary, the duration of training can be increased to two years to enable the gentlemen cadets to acquire an MBA degree.

At present, officers from the NDA get commissioned at the age 21 to 22. Those selected for the central services, after five to seven years of active service in the armed forces, would be absorbed into the IAS at about 27 to 29 years of age. This would be only marginally higher than the present average age of IAS officers on joining. Services officers joining the central services will be trained leaders of men, some of them baptised under fire, and would have had the unique privilege of commanding men — perhaps the greatest honour that any man can strive for.

Above all, they will have the opportunity to serve the national cause in many strife-torn corners of the country and will gain first-hand experience of the problems of the local people. Their acquaintance with, and insights into, the unique diversity of India’s culture and traditions, reflected in the armed forces, would surely stand them in good stead in the remaining 30 to 32 years of their service.

It has been accepted by all perceptive observers of the national scene that in these times of a failing national character, with rampant corruption, political expediency and widespread nepotism ruling the roost, the three Services have played a stellar role in holding the nation together as a viable political entity. A disciplined way of life, highly advanced and pragmatic man-management techniques, a no-nonsense approach to problem solving, and active secularism, have helped the Services to avoid falling prey to the maladies afflicting the other organs of the state. The officers transferring to the central services from the armed forces will carry with them these impeccable attributes and will undoubtedly succeed in transforming the manner in which the bureaucracy conducts the business of administration. Compulsory military service for entry into the central services will also give civilian bureaucrats a better understanding of India’s defence and security interests and will create a permanent bond of camaraderie between the civilians and the Servicemen. It is a win-win situation and an idea whose time has come.
REMOVING MANPOWER COSTS

Qualitative Upgradation versus Quantitative Resizing

It is now well recognised that a million-strong army is unlikely to be affordable around the 2020-25 time-frame unless modernisation is given the go by, because the costs of manpower are going up and the defence budget is continuing to decrease in constant rupees year after year even as the cost of defence equipment is rising worldwide at the rate of 10 to 15 per cent annually. Modernisation is capital intensive and it is difficult to foresee the annual defence budget touching even three per cent of India’s gross domestic product (GDP) in real terms, leave aside crossing this figure. Therefore, it must now be accepted that qualitative upgradation of the whole army is possible only if quantitative resizing precedes it. ("Downsizing" has become an unacceptable word that arouses passions and leads to incoherent thinking!)

Modern technology may enable factory managers to reduce manpower through automation, but similar benefits have not yet become available to commanders directing operations in the field. State-of-the-art technology enables Reliance Industries to run a world-class multi-million tonne refinery with a mere few hundred workers but, as the US Army learnt in Iraq at great cost during the Iraq War, "boots on the ground" continue to be a critical factor even when a low-tech army is pitched against a modern, hi-tech one. So far, the benefits of technology have accrued mainly in terms of creating assets that are force multipliers, enabling commanders to optimise their combat potential. Weapons technology has not yet reached a stage where it will enable gadgetry, for example robots, to replace trained personnel. Former Chief of Army Staff (COAS) General Shankar Roychowdhury is sharply critical of those who disparage manpower:

The Indian Army has traditionally been manpower intensive, which many modern intellects disparage as a hangover from the Second or even the First World War era. But it must be understood that these apparent anachronisms linger on even at present due to certain economic as well as operational compulsions. At one level, the inability of the Indian Army to shed manpower is due to the lack of resources to replace it with high-end technologies, primarily because of the generally low priority accorded to defence planning and inadequate resource allotment...

The unsatisfactory hybridisation, which created the current Reorganised Army Plains Division (RAPID), is a good example of this. In this case, the divisional structure was reduced by a brigade on the assumption that the manpower thus reduced would be replaced by force multipliers and surveillance. Needless to say, the resources for the technological makeover were simply never allotted.

At another level, mountain and jungle terrain in the northern and eastern regions combined with extensive deployments on counter-insurgency, established operational imperatives for organisations with adequate manpower... in New Age organisations, manpower versus technology will have to be implemented carefully and judiciously.

**Manpower-Intensive Internal Security Duties**

Superiority in numbers has never been instrumental in winning battles. Victory on the battlefield goes to the side that can synergistically orchestrate its full combat potential at the point of decision. However, India's internal security and counter-insurgency (CI) operations are manpower intensive and, as reduction in the army's present levels of involvement in these operations does not appear to be in sight despite the raising of many new battalions of central police forces, military planners cannot be expected to effect major reductions in manpower. Therefore, no military analyst can recommend a reduction in force levels unless the external and internal security environments are seen to improve substantially. Answering a question regarding reduction in the
strength of the standing army in an interview, Defence Minister Pranab Mukherjee said, “In view of the current commitments, I do not think it is possible to reduce the strength of the army.”

Catch 22!

Hence, it is a Catch 22 situation. The army cannot reduce manpower because of its commitments in low intensity conflict (LIC) and it cannot modernise and improve the quality of its forces unless it reduces its manpower strength because its huge numbers are a drain on the defence budget. Perhaps the answer lies in reducing the costs of manpower even if the number of personnel cannot be reduced as yet. The fundamental challenge is to find ways and means to maintain a force structure capable of dealing with today’s realities and still generate sufficient resources to invest in modernisation and military technologies that are crucial to tomorrow’s battlefield. As expenditure on manpower accounts for over 50 percent of the army’s budget, all possible avenues need to be explored to save manpower costs without compromising operational preparedness.

Realising that additional funds for modernisation were becoming increasingly difficult to come by, as COAS in 1998, General V. P. Malik had unilaterally ordered the “suppression” of 50,000 personnel (approximately 5 per cent) of the field force. This was effected against opposition within the army by asking all units to accept being under-posted by 3 to 7 per cent of their authorised strength. Over a period of about two years, new recruitment was curtailed to reduce the strength. The aim was to utilise the saved funds (Rs 500 crore @ Rs 1,00,000 per soldier) for modernisation. However, the Kargil conflict forced General Malik’s successor to reverse this decision. Similarly, in 1996-97, a committee headed by Lt Gen S.

Chandrashekhar, GOC-in-C, Central Command, had recommended the reduction of about 20,000 to 30,000 personnel from the non-field force so that these personnel could be redeployed to raise new force multiplier units as it has consistently been the government policy to tell the army to find personnel for new raisings from within its own resources, without asking for the manpower ceiling to be raised. Because of the need felt during the Kargil conflict, some of these, like certain units of the Pioneer Corps, too had to be reinstated.

Large-Scale TA-isation
Several viable options can be considered to reduce the strength of the standing army without compromising on operational preparedness though each one of these would need to be thought through logically to eliminate its disadvantages. Large-scale “TA-isation” of the army offers a lucrative opportunity to save on manpower costs by reducing the number of regular army personnel in service and increasing the number of territorial army (TA) personnel. TA battalions have performed creditably in the post-independence conflicts and are continuing to do so in CI operations in J&K and the northeastern states. An infantry battalion TA requires approximately 50 to 60 regular personnel to form the nucleus; the rest are TA personnel. It should be possible to employ TA battalions in defensive operations to hold ground in depth in the second and third tiers of defences and, eventually, where permitted by the tactical situation, even in less threatened areas in the front line. It does not need to be emphasised that the present fighting capabilities and the equipment profile of TA units will need to be substantially upgraded. The TA units will have to be embodied for much longer than the present 45 days annually to enable them to be better trained. They will also need to participate in operational alerts and manoeuvres with troops. The time has come to recognise and exploit the true war-fighting potential of TA units.

Regular Units into TA
The other aspect of TA-isation is to convert some regular Indian Army units to TA units. Besides infantry battalions, field and corps of
army air defence TA units have existed in the past in India. Even today, the British Army, that has been downsized and has only two deployable active service divisions, places immense reliance on TA units for almost all arms and services. In the initial stages, the concept could be tried out with infantry battalions. It may be more prudent to convert one or two rifle companies to TA companies rather than convert a whole battalion. When the concept has been found to be successful after the teething problems have been ironed out, it could be extended to other arms like the armoured corps, artillery, corps of army air defence, engineers, signals and mechanised infantry. Since all of these arms have equipment-intensive holdings, innovative methods will have to be devised to keep the TA soldiers well drilled in handling their equipment and to ensure that the equipment is well maintained. There will be heavy resistance within the army to the implementation of such a concept. Commanders with deeply entrenched mindsets will warn against the dangers of such a venture and will question the operational preparedness of such units even after a three to six month warning period for training. However, it is a concept whose time has come and it will be better for the army to begin planning its implementation in-house rather than have it imposed from without. It will not be an easy concept to implement and many challenges will have to be overcome, but then nothing new is ever easy.

Reliance on the TA-isation concept to effect savings in manpower costs will require the enactment of a new Indian Territorial Forces Act with stringent provisions for ensuring that the presence of TA personnel can be guaranteed whenever they are called up for service. Employers’ accountability for sparing their TA employees will have to be ensured by making employers liable for prosecution. Perhaps the most important statutory change required to make the revamped TA combat-worthy at all times would be to make TA service compulsory for all central government employees. This would require a bold political initiative, but one from which no nationalistic political party concerned with the nation’s security should shy away.

**Placing Formations in Suspended Animation**

Another concept, which is resisted tooth and nail but merits serious
GURMEET KANWAL

consideration, is that of placing whole formations in suspended animation. The logic behind this concept is simple. Not all formations and units are required to be in a state of immediate operational readiness at all times to ensure the territorial integrity of the nation since wars are now unlikely to break out virtually overnight. There would normally be a long gestation period during which an endeavour would be made to resolve contentious issues through bilateral as well as multilateral or United Nations (UN)-sponsored diplomatic negotiations. If this line of argument finds acceptance, it should be possible to downgrade the readiness standards of certain formations earmarked for offensive operations. These would have to be carefully selected. The modus operandi would be that while the command and control elements and a core group of essential personnel are retained to maintain equipment (most of which would be mothballed) and warlike stores and to ensure the upkeep of barracks, the remaining personnel would be reservists who would be called up only when war clouds appear over the strategic horizon. However, they would be periodically trained to hone their skills and to keep them in touch with their planned war-time trades.

Reduction in Colour Service

However, an obvious question is this: how can such an arrangement be practically worked out? The solution is as simple as it is attractive. Colour service in the army could be reduced to seven years, as it used to be in the bygone years. On release from the army, the other ranks (OR) could be absorbed in toto by the central police organisations (CPOs — BSF, CRPF, CISF, ITBP et al). They should continue to serve in the CPOs till superannuation, as per the prevailing terms and conditions of service. On transfer to the CPOs, the army should have a lien on their service as reservists for a period of 8 to 10 years. During this period, the reservists would be put through refresher cadres, annual training camps and occasional courses. During national emergencies, they could be called up whenever required to fill all the vacancies in Colour service in the army could be reduced to seven years, as it used to be in the bygone years.
their old units. Depending on the arm and the type of equipment held, they could be licked into shape as a top-grade fighting unit in three to six months.

**Younger Profile**

No matter how closely one analyses this proposal, it appears to be a win-win situation. The army would have a much younger profile; the other ranks would continue to have gainful employment till the standard age of superannuation; the CPOs would be able to induct trained army manpower and would, in due course, develop the army ethos and work ethic, and the exchequer would save millions of rupees of the taxpayers' money by being able to cut down on pension bills. Doubtlessly, there would be stubborn resistance to the implementation of this proposal from various vested interests. They will have to be convinced, cajoled, prodded and, if necessary, browbeaten into submission!

**IMPROVING “TEETH-TO-TAIL” RATIO**

The logistics chain of the field force is an area where some reduction in manpower numbers is still possible, combined with corresponding reductions in stocking levels of fuel, oil and lubricants (FOL), rations and spares with arrangements to push forward the required stores quickly when necessary. The inventory of some equipment like 'B' vehicles could also be reduced to some extent as these are now being mainly procured indigenously directly from the manufacturers. As these companies also sell similar models in the market, it should be possible for them to commit stepped up production at short notice to meet rising demands of the armed forces during national emergencies. Similarly, various other aspects of logistics support must be critically examined so as to cut the flab and streamline the supply chain.

It is encouraging to note that Army Headquarters (HQ) has taken several initiatives to improve the archaic logistics system that goes back to World War II. In response to a question regarding the steps that the army proposes to take to enhance logistics support and reduce costs, Lt Gen S. Patabhiraman, VCOAS, stated: 8

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8. Interview with the author.

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There is always an effort to improve the teeth-to-tail ratio of the army by reducing the logistics tail. Dependence on dedicated logistics units needs to be reduced gradually by deploying logistics nodes and centralised repair and maintenance facilities on a grid basis. Further, due to induction of more and more COTS technology equipment, infrastructure and facilities ex-trade have to be made use of to cut down the size of logistics units. The fruits of development are reaching the fringes of our border states, resulting in availability of better infrastructure, which the army too can harness for its logistics needs. The availability of medical facilities in border areas could help in reducing the size of integral field medical units. Similarly, today the trade is even prepared to maintain and repair equipment well forward under most difficult conditions; this could help in reducing the size of integral engineering support workshops. Better rail and road communication infrastructure in forward areas will also help in reducing the logistics tail.

**Ex-Servicemen’s Transport Corporation**

With the development of better roads and other infrastructure in the border areas, massive investments in “third line” and in some cases even “second line” transport are no longer necessary. The army can easily requisition thousands of trucks in a short period of time and can save on manpower as well as vehicle holding costs. Obviously, as far as second line transport is concerned, a certain number of 4x4 vehicles capable of cross-country movement will still be required. For these, the government can float an ex-Servicemen’s transport corporation that should be a public sector undertaking (PSU) on the lines of the Container Corporation of India so that the vehicles can be used for commercial purposes during peace-time and provided to the army during war and for internal security duties and counter-insurgency operations. Such a corporation will provide post-retirement employment to a large number of drivers.

**Out-Sourcing of Logistics Support**

There are various other methods of reducing the cost of manpower. Establishments like advance base workshops can be easily wound up as civilian companies can perform the same tasks at perhaps half the cost. However, it
Manpower costs are increasingly becoming unmanageable and are driving national security planners towards thinking creatively about what used to be called “affordable defence”. Similarly, the cost of holding large inventories in ordnance depots needs to be drastically pruned by outsourcing the procurement and delivery of low-cost, fast-moving ordnance items to the private sector. A comprehensive study should be ordered by Army HQ to examine these issues holistically to make rational, practicable recommendations. Of course, there is a point up to which some calculated risks can be taken while planning for operations and logistics support; beyond that, such moves become counterproductive. Decision-making for reducing the cost of logistics support requires detailed cost-benefit analyses through a comprehensive study of the logistics requirements in each theatre of operations. The days of doing things on a Mughal scale are over.

The logistics services must shape up to reduce the cost of providing logistics support. Despite the Non-Field Force Study done in 1997-98 and the consequent manpower cuts, there is still plenty of flab in the logistics services. It is time the army graduated to just-in-time logistics. The war and peace establishments of various HQ also have plenty of surplus staff authorised to them. Army HQ tops this list and could easily be pruned to the extent of almost 30 to 40 per cent without material reduction in efficiency. These issues are as relevant as those that have been discussed and merit detailed scrutiny for restructuring.

CONCLUSION
Manpower costs are increasingly becoming unmanageable and are driving national security planners towards thinking creatively about what used to be called “affordable defence”. Despite leap-frogging from third to fourth generation weapons technologies in the short span of about two decades, modern armed forces are still far from being able to effect substantive reductions in manpower by substituting fighting personnel with innovative technologies.
while ensuring operational effectiveness. In fact, more often than not, technological solutions are proving to be costlier than the present arrangements for security. It may be quite a long wait to see which way the technology cookie crumbles.

In India's case, because of the army's extensive commitments in border management and manpower-intensive internal security duties, it is unable to undertake major reduction in its manpower. Direct personnel costs amount to almost 50 per cent of the army's revenue budget and indirect costs add further to the burden. As the defence budget is unlikely to increase beyond 2.5 per cent of the GDP, the army's modernisation plans have fallen way behind the required qualitative levels. There is a need to seek innovative and creative solutions to reduce the costs of manpower even if the manpower itself cannot be reduced in large numbers at present. The navy and the air force are already finding it difficult to retain trained manpower as opportunities are opening up in the private sector. Air force pilots, in particular, are getting lucrative offers from the new airlines that are mushrooming by the day. The personnel challenges being faced by the Indian armed forces are extremely complex but certainly not insurmountable. With modern human resources development (HRD) techniques and wholehearted government support these can be systematically overcome.
APPENDIX 1

The International Nuclear Event Scale
For prompt communication of safety significance

<table>
<thead>
<tr>
<th>Level Descr</th>
<th>Off-Site Impact</th>
<th>On-Site Impact</th>
<th>Defence-in-Depth Degradation</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Major Accident</td>
<td><em>Major Release</em>: Widespread health and environmental effects</td>
<td></td>
<td></td>
<td>Chernobyl, Ukraine, 1986</td>
</tr>
<tr>
<td>4 Accident Mainly in Installation</td>
<td><em>Minor Release</em>: Public exposure of the order of prescribed limits</td>
<td>Partial core damage. Acute health effects to workers</td>
<td></td>
<td>Vandellos, Spain, 1989 (turbine fire, no radioactive contamination). Davis-Besse, USA, 2002 (severe corrosion)</td>
</tr>
<tr>
<td>2 Incident</td>
<td>nil</td>
<td>nil</td>
<td>Incidents with potential safety consequences</td>
<td></td>
</tr>
<tr>
<td>1 Anomaly</td>
<td>nil</td>
<td>nil</td>
<td>Deviations from authorised functional domains</td>
<td></td>
</tr>
<tr>
<td>0 Below Scale</td>
<td>nil</td>
<td>nil</td>
<td>No safety significance</td>
<td></td>
</tr>
</tbody>
</table>

Source: International Atomic Energy Agency.
### APPENDIX 2

#### Some Energy-Related Accidents 1977 - 2002

<table>
<thead>
<tr>
<th>Place</th>
<th>Year</th>
<th>Number Killed</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machhu II, India</td>
<td>1979</td>
<td>2,500</td>
<td>hydro-electric dam failure</td>
</tr>
<tr>
<td>Hirakud, India</td>
<td>1980</td>
<td>1,000</td>
<td>hydro-electric dam failure</td>
</tr>
<tr>
<td>Ortuella, Spain</td>
<td>1980</td>
<td>70</td>
<td>gas explosion</td>
</tr>
<tr>
<td>Donbass, Ukraine</td>
<td>1980</td>
<td>68</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Israel</td>
<td>1982</td>
<td>89</td>
<td>gas explosion</td>
</tr>
<tr>
<td>Guavio, Colombia</td>
<td>1983</td>
<td>160</td>
<td>hydro-electric dam failure</td>
</tr>
<tr>
<td>Nile R, Egypt</td>
<td>1983</td>
<td>317</td>
<td>LPG explosion</td>
</tr>
<tr>
<td>Cubatao, Brazil</td>
<td>1984</td>
<td>508</td>
<td>oil fire</td>
</tr>
<tr>
<td>Mexico City</td>
<td>1984</td>
<td>498</td>
<td>LPG explosion</td>
</tr>
<tr>
<td>Tbilisi, Russia</td>
<td>1984</td>
<td>100</td>
<td>gas explosion</td>
</tr>
<tr>
<td>northern Taiwan</td>
<td>1984</td>
<td>314</td>
<td>3 coal mine accidents</td>
</tr>
<tr>
<td>Chernobyl, Ukraine</td>
<td>1986</td>
<td>31+</td>
<td>nuclear reactor accident</td>
</tr>
<tr>
<td>Piper Alpha, North Sea</td>
<td>1988</td>
<td>167</td>
<td>explosion of offshore oil platform</td>
</tr>
<tr>
<td>Asha-ufa, Siberia</td>
<td>1989</td>
<td>600</td>
<td>LPG pipeline leak and fire</td>
</tr>
<tr>
<td>Dobrni, Yugoslavia</td>
<td>1990</td>
<td>178</td>
<td>coal mine</td>
</tr>
<tr>
<td>Hongton, Shanxi, China</td>
<td>1991</td>
<td>147</td>
<td>coal mine</td>
</tr>
<tr>
<td>Belci, Romania</td>
<td>1991</td>
<td>116</td>
<td>hydro-electric dam failure</td>
</tr>
<tr>
<td>Kozlu, Turkey</td>
<td>1992</td>
<td>272</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Cuenca, Equador</td>
<td>1993</td>
<td>200</td>
<td>coal mine</td>
</tr>
<tr>
<td>Durunkha, Egypt</td>
<td>1994</td>
<td>580</td>
<td>fuel depot hit by lightning</td>
</tr>
<tr>
<td>Seoul, S.Korea</td>
<td>1994</td>
<td>500</td>
<td>oil fire</td>
</tr>
<tr>
<td>Minanao, Philippines</td>
<td>1994</td>
<td>90</td>
<td>coal mine</td>
</tr>
<tr>
<td>Dhanbad, India</td>
<td>1995</td>
<td>70</td>
<td>coal mine</td>
</tr>
<tr>
<td>Taegu, S.Korea</td>
<td>1995</td>
<td>100</td>
<td>oil &amp; gas explosion</td>
</tr>
<tr>
<td>Spitsbergen, Russia</td>
<td>1996</td>
<td>141</td>
<td>coal mine</td>
</tr>
<tr>
<td>Henan, China</td>
<td>1996</td>
<td>84</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Datong, China</td>
<td>1996</td>
<td>114</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Henan, China</td>
<td>1997</td>
<td>89</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Fushun, China</td>
<td>1997</td>
<td>68</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Kuzbass, Siberia</td>
<td>1997</td>
<td>67</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Huainan, China</td>
<td>1997</td>
<td>89</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Huainan, China</td>
<td>1997</td>
<td>45</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Guizhou, China</td>
<td>1997</td>
<td>43</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Donbass, Ukraine</td>
<td>1998</td>
<td>63</td>
<td>coal mine methane explosion</td>
</tr>
</tbody>
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NUCLEAR SAFETY CRITICAL FOR FUTURE NUCLEAR EXPANSION

<table>
<thead>
<tr>
<th>Location</th>
<th>Year</th>
<th>Number</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liaoning, China</td>
<td>1998</td>
<td>71</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Warri, Nigeria</td>
<td>1998</td>
<td>500+</td>
<td>oil pipeline leak and fire</td>
</tr>
<tr>
<td>Donbass, Ukraine</td>
<td>1999</td>
<td>50+</td>
<td>coal mine methane explosion</td>
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<tr>
<td>Donbass, Ukraine</td>
<td>2000</td>
<td>80</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Shanxi, China</td>
<td>2000</td>
<td>40</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Guizhou, China</td>
<td>2000</td>
<td>150</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Shanxi, China</td>
<td>2001</td>
<td>38</td>
<td>coal mine methane explosion</td>
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<tr>
<td>Sichuan, China</td>
<td>2002</td>
<td>23</td>
<td>coal mine methane explosion</td>
</tr>
<tr>
<td>Jixi, China</td>
<td>2002</td>
<td>115</td>
<td>coal mine methane explosion</td>
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</table>

Safety is an important aspect of any activity or industry. But it is most critical for the nuclear industry that deals with materials that are radioactive and, hence, potentially dangerous, and with systems and technologies that are extremely complex. Moreover, nuclear accidents have widespread implications, not only in terms of the geographical expanse that may be affected, but more in terms of shaking public confidence worldwide in this source of energy. In no other industry does an accident in one plant have comparable impact on the international industry as a whole. The last major nuclear accident, Chernobyl in 1986, may have occurred two decades ago, but it still casts its shadow on the nuclear industry, and in the US, no new plant has been ordered since the Three Mile Island incident of 1979. Indeed, the future of the nuclear industry is greatly dependent on the assurance that such accidents will not recur.

Therefore, the safety performance of operating nuclear power plants (NPPs) and its periodic and stringent rule-based evaluation are of vital importance in order to minimise and possibly obviate any danger to plant workers or the public. In fact, for every nuclear plant that is built and operated, the society needs assurance that the facility will be safe mainly on four accounts:

(a) It would not suffer an accident leading to release of large amounts of radioactivity.
(b) It would not cause pollution to the environment during the conduct of its routine operations.

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(c) It would account for the long-term storage and safe disposal of its radioactive waste.

(d) And, more importantly in the context of today’s threat perceptions, it would be safe against a possible strike by terrorists.

The guarantee of these assurances requires the establishment and maintenance of effective mechanisms and the deployment of requisite measures in the design, site selection, operation and decommissioning of a nuclear plant. At the same time, relevant regulatory bodies need to be instituted to oversee and assess the implementation of safety measures against a range of parameters so that the individual, the society and the environment can be protected against radiological hazards.

Generally speaking, three dimensions of nuclear safety preoccupy the public mind and future expansion of the nuclear power programme is dependent on perceptions of these safety issues. These relate to the personnel involved in the nuclear fuel cycle; reactor operations; and the environment. Given the Indian ambition of considerably augmenting the country’s electricity generation with new nuclear plants, safety considerations related to all three aspects need to be taken into account.

With this in view, this paper examines the safety philosophy of the Indian nuclear power programme. It also analyses the role of the regulatory bodies in this exercise; besides briefly highlighting the increasing focus on security of nuclear plants post-September 11. The paper argues that despite a good Indian record of nuclear safety over the last five decades or more, there can be no room for complacency. Rather, as more power plants are built along with the concomitant other fuel cycle activities, the safety concerns must be viewed with greater seriousness and urgency. Even a single untoward incident would be unacceptable since it would
leave an indelible adverse impact on public opinion and mar the chances of widespread public acceptance for a long, long time.

**NATURAL RADIATION**

Any comprehension of the wider issues of nuclear safety must begin with the basic understanding that radiation is a natural phenomenon that man has cohabited with for centuries. It is over-dosage of radiation that is harmful to the human body and must be guarded against and, hence, the emphasis on nuclear safety. Nuclear power programmes and operations of atomic reactors are premised on this basic knowledge and need to take special care or safety measures to ensure no there is undue exposure of personnel and public to radiation in the course of the entire nuclear fuel cycle, from uranium mining to electricity generation and waste disposal.

Natural radiation exists in three forms — in the form of cosmic radiation from the sun and space; from naturally occurring radioactive materials such as uranium and thorium; and from radioactive elements present in our bodies such as potassium 40, carbon 14 or tritium. Estimated annual exposure of man to natural radiation sources in areas of normal background is 2.5 millisievert (mSv) of which two-third is from radioisotopes inside the human body. In some areas such as the Gangetic plains and the coastal areas of Kerala and Tamil Nadu, natural radiation levels are nearly 2-5 times higher than in others. It has been estimated that hundreds of thousands of people in countries like India, Brazil and Sudan receive up to 40 mSv/yr and some in Iran receive many times more, all without apparent ill effects. The cosmic radiation dose varies with altitude and latitude. Air crew can receive up to about 5 mSv/yr from their hours in the air, and frequent flyers may score a similar increment, but people subjected to such exposure have shown no adverse effects.

Apart from the radiation from natural sources, certain man-made sources such as X-ray machines, nuclear reactors and radioisotopes also provide radiation. This radiation is usefully employed in fields such as medicine, industry, hydrology, power generation and agriculture. However, the operative clause in all these uses is the avoidance of excessive exposure to radiation to the
workers employed in the activity, and to the general public.

Accordingly, radiation protection is based on the understanding that small increases over natural levels of exposure are not likely to be harmful but that they should be kept to a minimum. To put this into practice, the International Commission for Radiological Protection (ICRP) has established recommended standards of protection based on three basic principles:

- **Justification.** No practice involving exposure to radiation should be adopted unless it produces a net benefit to those exposed or to society generally.

- **Optimisation.** Radiation doses and risks should be kept as low as reasonably achievable (ALARA), economic and social factors being taken into account.

- **Limitation.** The exposure of individuals should be subject to dose or risk limits above which the radiation risk would be deemed unacceptable.

These principles apply not only to routine operations but also to the potential for accidental exposures. The ICRP recommends that the additional dose above natural background and excluding medical exposure should be limited to prescribed levels which are established as: one mSv per year for members of the public, and 20 mSv per year averaged over five years for radiation workers who are also to remain under closely-monitored conditions. However, the weight of scientific evidence does not indicate any cancer risk or immediate effects at doses below 50 mSv in a short time or about 100 mSv per year.¹

**PERSONNEL SAFETY**

The data mentioned in the above paragraphs forms the premise for the formulation of rules and regulations of personnel safety. Radiation protection or health physics is concerned with the protection of individuals employed in the nuclear industry at every and any stage of the fuel cycle. The guiding principle of this safety is to ensure that radiation doses to the occupational workers do not exceed prescribed limits as laid down by the ICRP at ALARA levels. The Atomic Energy Regulation Board (AERB) in the case of India has made these stipulations even more stringent. The Bhabha Atomic Research Centre (BARC), as also other laboratories accredited by it,

1. These figures are derived from studies about incidences of high radiation doses to populations such as from the Japanese bomb survivors. For more on this, see World Nuclear Association website at http://www.wna.org.
conduct countrywide personnel monitoring in nearly 3,000 industrial, medical, and research and development organisations that are involved in any way with the nuclear programme.

Importantly, the nuclear industry is the only one where every single employee is subjected to periodic monitoring. This is because the harm caused by radiation can be both somatic and genetic, and, hence, is completely unacceptable. The effects of over-exposure may show up in the individual himself in his lifetime, or perhaps only later in his children. Accordingly, the workers wear monitoring ‘badges’ while at work, and their exposure is carefully monitored. However, health records of these occupationally exposed groups have shown that they have lower rates of mortality from cancer, the disease most associated with radiation exposure, than the general public and, in some cases, significantly lower rates than other workers who do similar work without being exposed to radiation. At the low levels of exposure and dose rates involved in the nuclear industry, the effects are, in fact, probabilistic rather than measurable.

Health risks to occupational workers in the nuclear industry need to be considered at mainly three stages of the nuclear fuel cycle: front end, reactor operations and back end or waste disposal. In uranium mining or in other activities related to the front end of the nuclear fuel cycle, the risks are largely internal and, hence, more dangerous. Past exposure of miners to radon gas, with

2. Cancer is normally the disease associated with radiation over-exposure. Also, since cancer is a common disease in older people there have been, and will continue to be, cancer cases among radiation workers. This does not, however, automatically imply that they are radiation-induced. However, this question has been studied closely in a number of areas and work is continuing. So far, no conclusive evidence has emerged to indicate that cancers is more frequent in radiation workers than in other people of similar ages in Western countries, where cancer accounts for a quarter of all deaths.

3. About sixty years ago, it was discovered that ionising radiation such as that which continually forms part of our environment could induce genetic mutations in fruit flies. Intensive study since then has shown that radiation can similarly induce mutations in plants and test animals. However, evidence of genetic damage to humans from radiation, even as a result of the large doses received by atomic bomb survivors in Japan has not shown any such effects. Some 75,000 children born of parents who survived high radiation doses at Hiroshima and Nagasaki in 1945 have been the subject of intensive examination. This study confirms that no increase in genetic abnormalities in human populations is likely as a result of even quite high doses of radiation. For more on this, see World Nuclear Association website at http://www.wna.org.
Health risks to occupational workers in the nuclear industry need to be considered at mainly three stages of the nuclear fuel cycle: front end, reactor operations and back end or waste disposal. a consequent higher incidence of lung cancer, is historically the most palpable evidence of this. However, with greater knowledge and understanding of this, safety precautions have since been in use and exposure to high levels of radon in uranium mines has not been an issue of concern for over thirty years now. Nevertheless, the presence of some radon around a uranium mine in operation and some dust bearing radioactive decay products must be recognised.

However, when compared with the hazards of inhaled coal dust in a coalmine, the health hazards to uranium miners are considered to be small and less than the risks of industrial accidents. In fact, the contrast between air quality effects from coal burning for electricity and increased radiation from nuclear power is very marked: a person living next to a nuclear power plant receives less radiation from it than from a few hours flying each year. On the other hand, anyone living in an area that receives wind blowing from over a coal-fired power plant can expect it to have an effect on the air quality, possibly even to the extent of affecting health. In some areas, coal contains enough radium and thorium to cause coal-fired power stations to release far more radioactivity to the environment than a nuclear power station, though today this is mostly retained in fly ash!4

In the case of routine operations, the dangers of radiation to reactor operators are comparatively much lower than in the case of the front end workers since in a plant, operators are handling sealed sources. Of course, in the event of an accident in the plant, the risk rises manifold, but as is discussed in the following section, several inherent and engineered plant features guard against this risk. Certainly, nuclear power generation is not completely free of hazards in the occupational sense, but it does appear to be

no more dangerous than other forms of energy conversion. This is well illustrated in Table 1.

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Immediate fatalities 1970-92</th>
<th>Who?</th>
<th>Deaths per TWy electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>6,400 workers</td>
<td>342</td>
<td></td>
</tr>
<tr>
<td>Natural gas</td>
<td>1,200 workers &amp; public</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Hydro</td>
<td>4,000 public</td>
<td>883</td>
<td></td>
</tr>
<tr>
<td>Nuclear</td>
<td>31 workers</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>


Workers employed in the back-end of the nuclear fuel cycle deal with the most dangerous open sources, particularly plutonium that is separated from spent fuel by reprocessing and has been called the most toxic element known to man. However, it would be instructive to compare its toxicity with that of some other materials. For instance, if swallowed, plutonium is much less toxic than cyanide or lead arsenate and about twice as toxic as the concentrate of caffeine from coffee! It is, however, the most dangerous if inhaled as fine dust and absorbed through the lungs since this increases the likelihood of cancer 15 or more years afterwards, and there has been one documented fatality from plutonium-induced cancer.

In conclusion, it may be said that since the health effects of exposure to radiation are well known, this knowledge allows the personnel to arm themselves with requisite safety measures too. For instance, the personnel are provided with proper radiation shielding. The plants follow a zoning system with regular contamination checks of personnel and equipment. The ventilation systems are so designed as to minimise airborne radioactivity. Plant personnel use protective clothing and respirators while entering hazardous areas and radiation levels in various plant areas are also continuously monitored. Given

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5. Ibid.
The dangers in the nuclear fuel cycle are not any more than in other industries. The essential task for those in government and in the nuclear industry is to prevent excessive amounts of such toxins harming people, now or in the future. ALARA must remain the guiding principle of radiation safety.

PLANT SAFETY
The Three Mile Island (TMI) incident in the USA in 1979 and the Chernobyl accident in 1986 are the only two major nuclear mishaps that have occurred ever since nuclear power came to be used for commercial electricity generation. The situation to date is that in over 10,500 reactor-years of civil operation, these are the only accidents in commercial reactors that could not be substantially contained within the design and structure of the reactor. And only the latter one, exemplifying the "worst case" disaster scenario, resulted in the loss of life of 31 staff and firefighters, 28 of them from acute radiation exposure. There have been also 800 cases of thyroid cancer in children, most of which were curable, though about ten have been fatal. About 130,000 people received significant radiation doses (i.e. above ICRP limits), and are still being closely monitored by the World Health Organisation. Radioactive pollution drifted across a wide area of Europe and Scandinavia, causing disruption to agricultural production and some exposure (small doses) to a large population. But, in the case of TMI, the total radioactivity release from the accident was small, and the maximum dose to individuals living near the power plant was well below internationally accepted limits. Nevertheless, both these accidents had a pronounced psychological effect and proved to be a severe blow to the nuclear industry in the two countries and beyond.

The Chernobyl accident resulted from a combination of design deficiencies, the violation of operating procedures and the absence of a safety culture. In fact,

MANPREET SETHI

the post-accident analysis served as a sort of a wake-up call, and since then, plant operators and governments worldwide have become acutely conscious of the dangers involved and of the need to religiously follow safety precautions. Over the last two decades, the international safety record of NPPs has been remarkable given that the complex nuclear technology is today employed in about 40 countries, with some forty-year-old reactors still in operation. Yet, there have been no major safety lapses.

While it should be emphasised that a commercial reactor cannot under any circumstances explode like a nuclear bomb, reactor safety, however, needs to be premised on the assumption that the problems are complex not only because of the inherent characteristics of the nuclear materials involved, but also because the process of fission could be affected by such extraneous factors as high temperature creep, irradiation induced creep, high temperature gradient, transient thermal stresses, propensity to fatigue damage, flow induced vibration, shock loading, earthquakes, etc. Therefore, in the case of nuclear plants, special precautions need to be taken at every stage — design, siting, operation and decommissioning.

The safety philosophy and principles being followed in India are examined in the following paragraphs. In the case of the Indian reactors that are mostly pressurised heavy water reactors (PHWRs), the safety principles begin to be applied from the time of selection of site to its designing and stringent quality control during construction itself in order to obviate chances of malfunction. The Indian NPPs are based on the principle of defence-in-depth, physical and functional separation between processes and safety systems, redundancy to meet single failure criteria, and accident analysis based on postulation of design basis events. In fact, in addition to the deterministic safety analysis, probabilistic safety assessment (PSA) techniques are also being used as are now being encouraged by the International Atomic Energy Agency (IAEA).

The Chernobyl accident resulted from a combination of design deficiencies, the violation of operating procedures and the absence of a safety culture.
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worldwide. PSA allows the operators to model the design and operation aspects of the plant having a bearing on safety in a systematic and integrated framework of event trees in such a way that the contribution of any basic event such as component failure or human error to the overall plant safety can be determined. The results of such assessment can put the safety issue in perspective and can be used in risk-informed decision-making in design and in operation.

Site Selection and Construction
Correct choice of site for NPPs is critical. Detailed investigations are required to ensure that the location of the plant will not pose undue radiological hazard to the public and the environment during normal operation and following an accident. This involves the assessment of the seismic history and geological characteristics of the region, possibility of natural events such as floods based on the precipitation patterns, high tides, wind effects, etc. At the same time, and more so after the September 11 attacks, there is a need to assess the possibility of man-induced external events such as aircraft crash, chemical explosion blasting operation, etc. in the vicinity of the plant.

For minimising radiological impact on the surrounding areas and for facilitating effective emergency measures for the population in the event of an accident, certain zoning requirements are established. These include:
(a.) An exclusion area of minimum 1.5 km from the reactor centre to be established around the reactor with entry here restricted only to personnel.
(b.) A sterilised area of upto 5 km around the plant where growth of population is restricted for emergency measures.
(c.) A radial distance of 16 km from the plant is established for emergency planning wherein availability of transportation networks and means of communication are checked for adequacy.

Safety during construction is also critical. This is achieved through stringent quality assurance during material selection, testing, component fabrication, civil construction, site erection, assembly and commissioning. Special care is particularly necessary to ensure the leak-tightness of the containment structure.
Defence-in-Depth
As became evident in 1986, not all Soviet-designed reactors followed the “defence-in-depth” protection. The accident drew public attention to the lack of an adequate containment structure. An important safety feature that today guides NPPs worldwide is that of defence-in-depth. This implies a safety philosophy wherein several lines of defence are created, one after another. The chief aim of reactor safety is to ensure that the radioactive fission products generated in the reactor are contained under all circumstances. Therefore, several barriers are created so that the failure of one barrier or level of defence does not lead to a catastrophe.

There are four primary barriers to contain the release of radioactive fission products. As the first level, the fuel itself being of high density retains most fission products within itself. Secondly, the fuel is sealed inside a clad. Then, the fuel with the clad is placed inside a high-pressure heat transport system. And, fourthly, a massive double walled containment building surrounds the entire reactor.

The double containment in PHWRs is the critical barrier between the plant and the environment. While certain inherent safety features in PHWRs and engineered systems for reactivity control reduce the chance of an accident, the containment building surrounding the reactor provides an added level of safety. The inner containment of the PHWR is made of pre-stressed concrete and is designed to withstand design basis accidents (DBA) such as LOCA (loss of coolant accident) or main steam line break, etc. The outer wall is made of reinforced concrete and the annulus between the two containment walls is maintained under negative pressure with a provision for continuous monitoring of radioactivity. The double containment ensures almost zero release to the

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environment and it can even withstand external and internal missile or aircraft impact load effectively.

Amongst the most common disaster scenarios is one involving a loss of coolant. This may lead to overheating of the fuel in the reactor core and the release of fission products. Hence, emergency core cooling systems need to be constantly maintained on standby. In case these should fail, a further protective barrier comes into play: the reactor core is normally enclosed in structures designed to prevent radioactive releases to the environment.

Besides, the physical barriers that layer the defence-in-depth, it is also possible to establish certain action-based levels of defence and the means adopted to enhance reactor safety. These include:

- Prevention of deviation from normal operations or failures through emphasis on conservative design and high quality construction.
- Quick detection and interception of failures through control, limiting and protective systems and use of surveillance techniques.
- Control of consequences in the rare event of an accident through engineered safety features and accident procedures.

Maintaining Structural Integrity of Components and Processes

Reactor safety hinges on the structural integrity of its components and systems, and the safety of the power plant can be assessed by considering the safety of individual systems that constitute the whole. Therefore, the ultimate goal for safe reactor operations is to ensure that the structural integrity of reactor components is maintained not only under normal operating conditions but also in case of a nuclear accident. This is done through adoption of the latest software tools for analysis and design, stringent specifications of used materials, comprehensive quality assurance during fabrication, installation and operation, regular in-service
inspections and simulated component failure to see how the process and other components withstand.

The first step towards ensuring structural integrity is at the design stage. While designing nuclear components, three main tasks are undertaken:
(a) Identification of various failure modes of each material and component used. For instance, a pressure tube undergoes corrosion and hydrogen/deuterium concentration from the primary coolant from the inside and carbon dioxide (CO₂) from the outside. This can lower the fracture toughness of the tube. Moreover, the hydrogen migration towards stress concentration, particularly the tip of growing cracks, can lead to severe degradation of mechanical properties.
(b) Identification of parameters such as stress, hydrogen concentration on materials, etc., that might cause failure.
(c) Incorporation of relevant safety features based on the above.

One of the most important objectives of safety to nuclear plants is to ensure that the radioactive fission products stay contained within the fuel. This requires that the integrity of the fuel and fuel claddings be maintained by ensuring that the fuel does not get overheated beyond certain limits. Safety assessment, therefore, requires an analysis of possible system or component failures that could lead to such overheating. However, by following the principle of physical and functional separation between processes and safety systems, it is ensured that a single local event such as fire, or a pipe failure, does not result in multiple component or system failure.

**Accident Analysis**

Accident analysis of nuclear reactors is an important safety mechanism. The first category of accidents, called the DBA are those which have a low, yet significant probability of occurrence (rated at one on one million) and design provisions are made to mitigate their consequences. An example of such accident is the LOCA. The emergency core cooling system is provided as an engineered safety feature to mitigate the consequences of LOCA.

The second category of accidents is known as the beyond design basis accidents or severe accidents. These have an extremely low probability of
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occurrence of one in a hundred or in a thousand million and could be the consequence of a combination of failures where a postulated DBA is accompanied by simultaneous failure of engineered safety systems, leading to spillover of consequences to the public domain.

G. R. Srinivasan, vice chairman of the AERB has listed ten rules of nuclear reactor safety:

1. Operate conservatively
2. Do not relax rules in times of crisis.
4. Verify actions affecting reactor safety.
5. If in doubt, stop, think and ask.
6. Ensure all actions stand up to critical scrutiny.
7. Understand the implication of a change.
8. Do not live with problems.
9. Determine and correct underlying reasons for problems.
10. Keep it simple.

As is evident, seriously following certain basic rules of safety is most essential for the safe running of an NPP. This has been proven in the retrospective analysis of every accident. For instance, an accident at a plant in Tokaimura in Japan, in 1999, was caused by workers trying to save time by mixing excessive amounts of uranium in buckets. This killed two people and injured hundreds, and led to the temporary suspension of all 17 plants of the Tokyo Electric Power Co (Tepco) plants in April 2003 after it admitted to falsifying safety records. This naturally prompted considerable alarm amongst the Japanese public, already very sensitive to nuclear issues, given their historical experience, and was reflected in the views of the Citizens' Nuclear Information Centre (CNIC) in Tokyo, which was created in 1975 to monitor nuclear safety. CNIC concluded that the roots of the problems were two-fold: inadequacy in government regulations and a culture within the industry's management of covering up mistakes. It said the Japanese safety appraisal process, which takes place before a power plant is even built, was extremely lax, while inspections carried out afterwards were "very

haphazard." Such an approach is unacceptable for nuclear plants and the contemporary emphasis on nuclear safety must obviate this.

ENVIRONMENTAL SAFETY

The environmental safety aspects of nuclear energy are formulated on the basis of well-established international radiation protection standards. Acts and rules have been formulated to achieve effective control of release of radionuclides into the environment. The Department of Atomic Energy (DAE) itself has laid down an Environmental Protection Policy as the first step to regulate environmental releases from nuclear facilities. This establishes that:

(a) The operation of the nuclear installation shall not interfere in any manner with proper utilisation of environmental resources in the area outside its control.

(b) No deleterious effects shall accrue from the nuclear operations and disturb the ecological balance of life.

(c) Radioactive and non-radioactive pollutants released into the environment shall be at such concentration levels and quantities that the resultant accumulation of radioactivity and other toxins in any component of the environment will not cause detriment to the ecosystem.

The basic concepts for discharge control are based on current radiation protection principles of the International Commission on Radiological Protection (ICRP) and are expected to be consistently maintained at all NPPs. While safe radioactive waste disposal and safe decommissioning of plants are also critical for maintaining the sanctity of the environment, these issues will be dealt with separately in another paper. This one, meanwhile, retains focus on the safety of the environment during the operation of the plant.
Environmental radiological surveillance and protection was initiated in India at the very inception of the nuclear programme. Presently, under the Global Environmental Radiation Monitoring Network (GERMON), 25 stations spread all over India continuously measure levels of radioactivity in the environment. Also, an aerial surveillance facility for quick assessment of large area contamination and locating lost/misplaced radiation sources has been in operation for the last eight years. This Compact Aerial Monitoring System (CARMS) is used for estimation of large area contamination using unmanned aerial vehicles.

Environmental monitoring at various NPP sites is initiated by setting up environmental survey laboratories (ESL) at least two-three years prior to commissioning of the plant for conducting pre-operational monitoring that would provide a base line for natural and fallout radioactivity in the environment. The ESL operates as an independent monitoring agency set up by BARC and estimates radiation exposure to the general public through detailed sampling and analysis of environmental matrices like water, milk, air, vegetation, soil, etc.

The monitoring programme continues throughout the operational phase of the installation. The State Pollution Control Boards ensure compliance of pollution prevention measures. NPPs take the consent from these boards to discharge their water and air effluents. It is worth mentioning that the environment around nuclear sites in India is well conserved. In fact, nearly all NPPs and heavy water plants have the Environmental Management System Certification under the ISO 14001 and have bagged the AERB Green Site Award.

**REGULATORY STRATEGY**

Well-established regulations are critical for nuclear safety. It is the responsibility of the regulatory bodies to stipulate the safety levels while simultaneously achieving a balance between a conservative approach that calls for frequent shutdowns and one that shows greater propensity for high production at low cost. In India, the AERB, the Ministry of Forests and Environment and the State Pollution Control Boards lay down
the requirements with respect to environmental protection, pollution control, radiological safety, industrial safety and emergency preparedness.

The AERB is the main regulatory body governing nuclear operations in India. Given the importance of the tasks it is expected to perform, it is important for the AERB to have the requisite mechanism and methodology to obtain an integrated safety performance evaluation of each unit throughout the life cycle of the plant, from its siting to its decommissioning. Its regulatory strategy is based on the principle that the responsibility of the safe operation of the plant lies with the licensee. Calculating that its regulatory burden is inversely proportional to the safety efforts put in by the licensee\(^9\), it promotes an effective safety management system by ensuring self-assessment and self-regulation. This is quite in contrast to the US Nuclear Regulatory Commission (NRC) regime that is based on prescriptive regulation, accompanied by inspection and enforcement of rules.

But in the case of India, the AERB maintains that induced safety cannot be more effective than inherent safety. It encourages the NPPs to evolve a good safety culture so that safety is ingrained in every aspect of the plant, its people, procedures and systems. There are strong internal review processes within the operating organisations and multi-tier review committees. The AERB uses several tools and processes for continuous safety evaluation such as inspections, study of reports, periodic safety reviews and licence renewal, etc.

In India, licences are issued by the AERB after the successful commissioning of an NPP. These are given for the design life of the plant, which is generally estimated at 30-40 years for PHWRs. During the process of this licensing, all aspects related to safety at various stages such as siting, design, construction, commissioning and operation and even management of waste and decommissioning are reviewed. Within the operating licence, the AERB grants initial authorisation for a specified period and renewal of authorisation for further specified periods after assessment of the safety performance of the plant.

One of the important responsibilities of the AERB is to prepare concise and comprehensive safety standards, codes, guides and manuals to address the following requirements:

\(^9\) Ibid., p. 60.
(a) To simplify, accelerate and standardise the complex licensing process.
(b) To ensure that siting, design, construction, operation and decommissioning of the nuclear facilities happen on a uniformly high safety level and in accordance with the latest technological advances made in the industry.
(c) To take into account public concern and improve public acceptance.
(d) To protect the site personnel, public and environment from undue radiological hazards.

Towards this end, safety codes and guides are prepared on the basis of international recommendations as made by the International Atomic Energy Agency (IAEA), the International Nuclear Safety Group (INSAG) and the Nuclear Safety Group (NUSAG). Formulated as a result of multi-tier reviews along with expert opinions, the codes and guides reflect a consensus on safety principles and are also subject to periodic reviews and updates to take into account natural and technological evolutions and to implement enhanced safety requirements.

AERB aims to ensure the safety of the public, environment, plant operators and plants. However, it must not only do so but also must be seen to be doing so. Therefore, the regulatory strategy must also envelop transparency, openness and public information. In fact, it would aid the future expansion of the nuclear power programme if the government would, as part of its near-term R&D programme, develop more fully the capabilities to analyse life cycle health and safety impacts of fuel cycle facilities and focus reactor development on options that can achieve enhanced safety standards. The MIT study conducted in the US on the “Future of Nuclear Power” proposes nothing less than a whopping $50 million per year for this purpose.10 India must take a cue from this and realise the import of nuclear safety.

COST IMPLICATIONS OF SAFETY

Often, it has been argued that the high cost of nuclear power plants is because of the criticality of having advanced safety features in place. About one-third of the capital cost of reactors is normally due to engineering designed to enhance the safety of people—both operators and the public. However, given the nature of the material and processes that the nuclear industry deals with, there can be no cost high enough to ensure safety. Rather, as has been proven, safety and production are not mutually exclusive — where safety performance is high, production too has been high. Delays, even if for reasons of construction accidents as occurred in the case of the Kaiga unit 1 dome delamination, or due to some other aspect of industrial safety as in the case of the electrical fire in the NAPS unit 1 that led to the disruption of normal operations, inevitably result in financial losses. Therefore, safety and production are inseparable.

Nevertheless, a contemporary debate on nuclear safety focusses on whether nuclear reactor safety goals would be compromised with a transition to competitive electricity markets. Some observers suggest that private nuclear electricity generators, whenever they are allowed to participate in this activity, will be more concerned with maximising plant output and less willing to close plants for safety inspections and corrective actions where necessary. On the other hand, owners groups have long stated that nuclear plant operation conducted to ensure a high level of safety is also economically beneficial.

In any case, the public's views on safety and costs are critical to their judgment about the future deployment of this technology. Technological improvements that lower cost while improving safety can increase public support for this energy source.

SECURITY OF NUCLEAR INSTALLATIONS AGAINST TERRORIST ATTACK

After the September 11 attacks in New York, there is greater understanding worldwide that terrorists have the ability to inflict catastrophic damage. Nuclear facilities as potential targets (of terrorist attacks) have not escaped notice. However, nuclear experts contend that civil works and security provisions make nuclear plants hard targets.
Nuclear facilities as potential targets (of terrorist attacks) have not escaped notice. However, nuclear experts contend that civil works and security provisions make nuclear plants hard targets.

In fact, nuclear plant safety itself is a good starting point for the evaluation of security risks. As a matter of routine, nuclear plant safety has considered natural external events, such as earthquakes, tornadoes, floods, and hurricanes. Terrorist attacks by fire or explosion are analogous to external natural events in the implication for damage and release of radioactivity. The strength of containment buildings and structures presents a major obstacle and the power plant is actually a hardened target for attack. However, a broad survey and evaluation of hazards and protective actions is in order to make decisions on adequate protection. Such an analysis must begin by identifying possible modes of attack and vulnerabilities associated with designs and locations. It must also identify the cost-effectiveness of a range of security options for new designs, old plants near decommissioning, and plants in mid-life. There is also a need for sharing information with governments of other countries and supporting institutions that will undertake nuclear power programmes in order to provide effective intelligence and security.

CONCLUSION
Adequate supply of energy is essential for continued industrial and socio-economic development, especially for a developing country like India with increasing population and urbanisation. Nuclear power is an important source suited for meeting energy demands and it will be increasingly necessary to expand this source of energy in the national energy mix. Although nuclear power involves handling and generation of radioactive materials, it is a technology whose hazardous effects are well understood and controlled. Moreover, it is a technology that has developed with strict regulatory control and realises that it is always under public scrutiny. Hence, the industry itself realises the need for emphasis on safety at every stage.
While there can be no nuclear activity or nuclear plant design that is totally risk-free, with the benefit of experience and improvements in reactor designs and adoption of enhanced safety features, plant performance has improved over time to unit capacity factors of 90 per cent and higher, even as the incidence of major mishaps in nuclear power generating units has drastically reduced. Indeed, over five decades of experience have taught the nuclear community a number of lessons, including the introduction of inherent safety features, defence-in-depth, and better emergency planning, conduct of independent peer reviews and feedback of operating experience at reactors worldwide, so that operators share information and there is the evolution among plant owners and managements of a safety culture. Actions and initiatives in training and qualification of reactor operators that have been implemented by organisations are major factors in the performance improvements and are manifest in the fact that a number of events at reactors that could have been headed for an accident were stopped short. Above all, there is a tacit understanding worldwide that safe operations require effective regulation, a management committed to safety and a skilled workforce.

Evidently then, if used safely, the benefits of the use of radiation and radioactive materials under controlled conditions greatly outweigh the risks. Hence, it would be foolish to give up the use of fission because of fear of radioactivity contamination. As has been said earlier, the chances of this are less than one in a million. In fact, risk is an inevitable part of life and its many activities, even such banal ones as walking or driving down the street. Table 2 is demonstrative in this regard.
Table 2

<table>
<thead>
<tr>
<th>Activity</th>
<th>Chance of Death per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking 20 cigarettes a day</td>
<td>1 in 200</td>
</tr>
<tr>
<td>Deep sea fishing accidents</td>
<td>1 in 400</td>
</tr>
<tr>
<td>Death due to natural causes 40 years old</td>
<td>1 in 500</td>
</tr>
<tr>
<td>Road accidents</td>
<td>1 in 5,000</td>
</tr>
<tr>
<td>Accidents at home</td>
<td>1 in 10,000</td>
</tr>
<tr>
<td>Accidents at work</td>
<td>1 in 20,000</td>
</tr>
<tr>
<td>Radiation work (2 mSv an year)</td>
<td>1 in 20,000</td>
</tr>
</tbody>
</table>

Source: Indian Association for Radiation Protection (IARP), “Natural and Man-Made Radiations Around Us”, pamphlet issued as part of Public Awareness Programme, IARP, Mumbai.

Therefore, what is important is that the dangers of dealing with nuclear power are adequately understood and safety measures stringently employed to minimise, if not obviate the chance of accidents. Highest priority needs to be assigned to undertake reactor safety related research and development not only in areas of existing PHWR systems, but also for new concepts of reactors like the advanced heavy water reactors (AHWRs), prototype fast breeder reactors (PFBR), etc. which will soon be inducted into the Indian nuclear power programme. The goal of such R&D work should be to develop progressively improved mathematical models to represent components/sub-systems closer to reality. In the case of PFBRs, standard safety principles have been followed in the design, choice of materials, concepts and feedback from the operating experience of 300 reactor years of fast reactors. Increased nuclear power will mean more safety concerns and a greater need for training and qualification of people competent to manage and operate NPPs safely, including the supporting infrastructure necessary for the maintenance, repair, refuelling and spent fuel management.

Achieving unimpeachable safety standards should be treated as a continuous journey and not as a destination. While the safety performance of India’s

operating units is more than satisfactory, there is no room for complacency. Given the widespread impact that safety can have on the fate of nuclear power worldwide, the relevant procedures and their regular improvement need to be imbibed as an organisational culture so that safety that results is not induced but inherent. Improvements, or a constant update of safety procedures, is particularly important based on advanced R&D, worldwide operational experience, assessment of incidents and accidents, and changes in public opinion. At the same time, intangible parameters for safety excellence such as dedication, safety thinking, a questioning attitude, good communication, discipline and a methodical approach also need to be periodically stressed and rewarded. For nuclear safety there can be no goal less than AHARA or As High As Reasonably Achievable.

While the safety performance of India's operating units is more than satisfactory, there is no room for complacency.
The 9/11 terror attacks on the World Trade Tower, New York, have been a watershed in the conduct of wars. The global war on terror essentially is a form of asymmetric conflict of state versus non-state warfare which has seen a wholly new paradigm of war-fighting peculiar to the 21st century. The challenges for conventional armed forces have increased manifold. A key test is of force projection in areas which have not formed a part of traditional military planning, whether it is for preemptive operations or peace-keeping. The current dilemma of an international peace-keeping force in Lebanon is perhaps a significant example of the emerging dynamics of expeditionary engagements. The harsh reality of the logistics of mustering and movement of forces overrules other considerations like the need for rapid deployment.

A similar predicament was faced by the forces of the Western world immediately after 9/11, as the need to check the spread of influence of Al Qaeda,
safely ensconced in the shelter provided by the Taliban in Afghanistan, entailed rapid deployment of force in a hostile, underdeveloped country devoid of resources. The challenge, therefore, was primarily of logistics, of mobilisation, movement, readiness and sustainment of force thousands of kilometres away from the home base. This was followed by Operation Iraqi Freedom approximately a year and a half later where a different set of logistics challenges faced the planners. Without indulging in the diplomatic, political or operational nuances of these actions, a review of the logistics best practices during OEF and OIF is, thus, considered immensely valuable.

AIM
The aim of this paper is to analyse logistics management during Operation Enduring Freedom and Operation Iraqi Freedom with a view to cull the best practices.

SCOPE
The scope of the paper is restricted to the opening phase of the operations in Afghanistan and Iraq, the stage of conduct of conventional military operations. The stabilisation operations conducted later and which are still going on have not been included as the logistics problems during this phase are felt to be easily manageable. However, some of the relevant common issues have been included in the paper. The focus is more on best practices and, thus, only those details which relate to this issue have been covered in the following parts:

(a) Part I – General Aspects.
(b) Part II – Mobilisation and Movement of Forces.
(c) Part III – Supporting the Forces.
(d) Part IV – Conceptual Issues.

PART I – GENERAL ASPECTS

MILITARY LOGISTICS
“Military logistics” includes a large number of activities which are involved in movement, maintenance and provisioning of forces, which include the
deployment of forces, the acquisition of material, and the sustainment of forces. Logistics had a major impact on the planning of operations as is evident from the change in plan for OIF where the Northern option had to be foreclosed once Turkey denied bases for operations in Iraq. The other important issue of modern logistics is the acquisition process, particularly to meet emergent equipment requirements during ongoing operations. For example, at present, the US armed forces are looking for high quality ear drum plugs in Iraq. It is a logistician's task to look for such an item off the shelf and supply it to troops in real-time, not just to enhance their operational efficiency but also to enhance soldier safety and survival.

CONSIDERATIONS: POWER PROJECTION
Apart from political and diplomatic considerations, power projection capabilities are primarily based on logistics capabilities. Some essential logistics considerations which will limit power projection are as follows:

(a) The overall strategic response is based on an ability to move sufficient combat power executing a wide spectrum of abilities over a wide area of responsibility.

(b) Logistics limitations could dictate the level of forces employed.

(c) Reducing deployment timings is a key parameter. Nothing could highlight this better in our context than Operation Parakram. Some norms established by the US armed forces for deployment indicate readiness levels of 96 hours for a brigade combat team (BCT), 120 hours for a division, and 30 days for five divisions along with the requisite support elements.

(d) Economy is a key parameter of logistics while maintaining war-fighting capability. But it should not become an end in itself.
OPERATION ENDURING FREEDOM

The combat operations in Afghanistan commenced on October 7, 2001, with a massive bombardment on selected targets by the US Air Force and Navy carrier-based bombers, deftly supported by special operations forces of the army based in Uzbekistan and other areas of northern Afghanistan. Kabul was occupied on November 16, 2001, and stabilisation operations were in progress thereafter. Principally, the Allied forces had limited ground engagements but provided massive air and combat support as well as logistics support in the southward drive of the Northern Alliance.

The logistics challenges during Operation Enduring Freedom were enormous. As the secretary of the air force brought out on April 11, 2002, "For the first time in the history of war, this country has fought in a landlocked area where every single thing going in and coming out has gone by air. Food, water, ammunition, troops were all transported by air, and that's really incredible." The issues generally relate to the geography and the state of underdevelopment in Afghanistan and are summarised as logistics and management challenges as follows:

- **The Logistics Challenges**
  - Landlocked geography.
  - "Compelling" distances.
  - Extended lines of communication.
  - Poor infrastructure. No railway and poor road network.

- **The Management Challenges**
  - Diplomatic clearances – overflight, sea and airport access.
  - Lack of preliminary operational plans.
  - No aerial threat – the biggest boon for logistics planners and executors.
  - Limited threat from ground disruption – sneak attacks.
  - Total dependence on the air force for support and supply of the forces.

The logistics dimension of OEF is evident by the following facts:

(a) Distance – 7,000 plus miles (11, 200 km).
(b) Missions – 11,000 plus.

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(c) Passengers – 158,000.
(d) Short Tons – 222,460.
(e) Aircraft used – C-5, C-17, and civil airlines.
(f) Staging Areas – Staging areas were located in many countries across Europe, Japan and the Indian Ocean to include Moron AB, Spain, Ramstein AB, Germany, Incirlik AB, Turkey, Sigonella NAS, Italy, Andersen, AFB, Kadena Okinawa and Diego Garcia.
(g) Theatre Air Bases – Kandahar and Bagram.

OPERATION IRAQI FREEDOM
The combat operations for Iraqi Freedom commenced on March 20, 2003, and the rapid advance by a corps sized plus force saw Baghdad falling to Allied control by April 8, and Mosul in the north by April 24. Thus, in a brief period of over a month, all of Iraq was brought under control. The advance took place on a narrow front from Kuwait, northwestwards to the capital Baghdad and on through Kurdish territory to the border with Turkey. An initial plan of a two-pronged thrust was negated with Turkey opting out of provision of a base for operations. While increasing the likelihood of operational difficulties, it considerably eased the problems of supporting ground operations. Political and diplomatic considerations precluded a long air campaign before the ground offensive which reduced the length of support required by the air force, though considerably enhancing the problems of maintaining daily readiness levels. The logistics experience curve which had commenced with the opening of OEF, peaked during OIF, thereby, facilitating support. However, the scale of operations was much larger and, hence, a number of significant logistics lessons were to emerge.

OIF is said to be the largest support effort that the US military has ever undertaken in modern times. Of the $28.1 billion that the Department of Defence (DoD) allotted for OIF, the Services and the Defence Logistics Agency (DLA) reported that $14.2 billion was for operating support costs and $4.9 billion for transportation costs, thus, impinging upon two-thirds of the allotment.² The

dimensions of logistics during OIF is indicated by the US per capita logistics demand, expressed in the weight of support and its transportation, for an operation like Iraqi Freedom being three times what it was in World War II and nearly 15 times what it was in World War I.

PRINCIPLES OF LOGISTICS
The key principles of logistics which emerged in application during OEF and OIF were as follows:

(a) Foresight.
(b) Advance preparation, planning and placement through anticipation.
(c) Flexibility.
(d) Economy of effort.
(e) Military–Civil Interface. This is an emerging principle of logistics which perhaps is relevant for developed nations with a large private sector which has understood the art of doing business with the forces, thereby creating an effective military–civil interface. As Jeff Jones, the DLA administrator indicated, “DLA’s primary value is military-civil integration, ‘anyone’ can buy or sell stuff.”

(f) Dedicated ICT Interface. This is also an emerging principle of logistics which greatly contributed to the support of the operational forces.
(g) Integrated Organisation. American logistics is based on a fully integrated logistics organisation which starts from the DLA and has an effective blending of joint as well as Service specific components down to the lowest level.

OIF is said to be the largest support effort that the US military has ever undertaken in modern times.
PART II - MOBILISATION AND MOVEMENT OF TROOPS AND STORES

STRATEGIC AIRLIFT
OIF, especially the initial phase, was a nightmare for strategic airlift as no contingency planning had been carried out. This apart, the lack of infrastructure, the hostile fire and lack of diplomatic clearances were major problems which had to be overcome. The theatre level issues included lack of bases, overloading at the few existing bases, and poor mission reliability of older versions of transport aircraft and overdependence on airlift without attempting to exploit other means of transportation. Deployment timings were considerably improved by expanding the lift capacity of new as well as old platforms, enhancing the infrastructure at base locations as well as intermediate bases and also adopting efficient processes.

EARLY WARNING TO THE DLA
For OIF, the DLA was informed well in advance, in July 2002, and given that the operations were launched in March 2003, there were approximately eight months to move forward the logistics requirements. However the scale of needs was very vast. A large number of items had to be procured such as chemical protection suits, since there was threat of a chemical strike, meals ready-to-eat (MREs), construction material, and so on. The DLA has a budget of $24 billion and manages the same with 22,000 civilian employees and just about 500 military staff. There are 4.6 million items to be managed, including all requirements of the Services' fuel, food, and so on, less 10 per cent of the repair parts. It processes an average 30,000 requisitions for material each day and awards 4,000 contracts per day. Thus, it is a massive enterprise. This model of centralised logistics under a nodal agency needs greater examination for implementation if deemed appropriate in our Services.

4. Lippert, n. 2.
OPERATIONAL FLEXIBILITY THROUGH LOGISTICS CAPABILITIES – MOVEMENT OF CARGO

Military Traffic Management Command (MTMC), the army component of Transportation Command, for example, delivered large quantities of supplies to US troops in record speed and with fewer vessels than it used for Desert Storm. In the initial months, it delivered 42.2 million meals to Iraq. This amount of food can feed the entire New Delhi for three days. It loaded cargo covering 15 million square feet in 60 days and transported 1.5 million tons of equipment and cargo, about the total air load of 300,000 747 jetliners. It moved 98,890 containers, which lined up would cover a span of 375 miles, a distance from Delhi to Lucknow. This was undertaken by adopting the following innovative measures:

(a) **Unit-Based Loading of Ships.** Ships were loaded based on unit loads and not commodity or composite loads as is normally done for ease of initial loading and facilitating dispatch. MTMC suggested that it was delivering combat power which was indicated by the short period of 12 days in which 101st Airborne Division rolled out on five vessels and arrived in Kuwait. This also facilitated combat flexibility, dispersion and maintenance of surprise as formations could be moved to deployment areas at the last minute.

(b) **High Capacity Transportation Vessels.** The large medium speed roll on/roll off vessels enabled a brigade combat team of 101 Airborne Division to be moved on just two ships, as compared to four ships earlier.

(c) **Containerisation of Loads.** Containerisation of loads into ships facilitated reduction in loading times from 14 days to 6 days for an ammunition container ship.

(d) **Focus on the Combat Unit.** MTMC focus is on the combat unit and how to deliver logistics to enhance its capabilities. This ensures that the units receive their loads in combat lots and do not have to undertake bulk breaking, thereby saving time in the launch pads.


6. Ibid.
VERSATILITY OF TRANSPORT AIRCRAFT

The need for maintaining a versatile fleet of transport aircraft was well brought out during OEF. The C-17 proved to be a highly valuable transporter to lift critical loads from the US mainland directly on to the sparsely surfaced and badly damaged airfields of Afghanistan. Airlifters like C-5 and C-130, on the other hand, were extremely useful for carriage of oversized cargo and landing on shorter runways respectively. The employment of the C-17, however, provided the greatest flexibility and economy as supplies, including Apache helicopters, could be carried on the rough and ready airfields of Afghanistan. Crew fatigue was critical as the C-17 crew faced immense pressure with long working hours, limited rest, refuelling and even combat fire. These difficulties were quickly overcome through innovative measures such as additional loadmasters, a third pilot and stops en route.

CREATION AND ESTABLISHMENT OF BASES

Preparation of forward operating locations was a key requirement for operations by the air force. These had to be prepared post-haste and given the global nature of the requirement, a complex set of factors needed attention such as country clearance, real estate accessibility, contract support available, and so on. Advance knowledge enabled prior selection of these bases. Area specialists were flown in to support the embassy staff. The lack of infrastructure in the form of bases implied that these such as at Al Udeid had to be established from scratch which was carried out by the civil engineers rapidly. Forward placement of heavy loads such as ammunition was also considered critical as Diego Garcia, which had been developed as a forward base over the years, did not have adequate ammunition and it took a number of airlifts to preposition stocks until the criticality was overcome and these could be moved by sea.

IN-TRANSIT VISIBILITY (ITV)
The improvement in visibility of assets is said to be of an order of eight during OIF rather than three which was obtained during the Gulf War. The radio frequency identification tags were used extensively in OEF as well as OIF, which were the key to providing better ITV. RF tags were placed on all items of supply such as food, spare parts, vehicles, ammunition, medical supplies and construction material. This is a satellite enabled tracking system providing high level of visibility. The “Pure Pallet” initiative, with RFID application, greatly reduces distribution process time-lines and significantly enhances in-transit visibility. The scale of operations can be seen from the number of such tags used each month as follows:
(a) 50,000-60,000 US/UK tagged pallets/containers tracked monthly.
(b) 500+ US/UK read/write sites.

In India, VI eTrans is already providing such a system to major cargo movers such as Maruti, Tata Steel, and Nestle in a modified form wherein the truck drivers have to swipe their cards at Bharat Petroleum outlets.

FED EX
The use of civil agencies such as Fed Ex also proved highly effective, though it had its disadvantages such as lack of information of assets creating a visibility gap and was also expensive. However, it is believed that it has far greater speed and velocity, the principal requirements of a force undertaking rapid operations in underdeveloped terrain. A cost analysis of the civil courier route vis-a-vis organic airlift options needs to be carried out before the system is implemented effectively.

PART III – SUPPORTING THE FORCES

DISTRIBUTION-BASED LOGISTICS
Support of forces in the field during OIF was based on the concept of distribution-based logistics (DBL), which aims at providing equal or better combat service support with fewer unit resources and stocks through better distribution rather than stockpiles of supplies held and carried around by units. It exchanges “warehousing” capacity for frequent, consistent flows. DBL entailed maintenance of low levels of inventory to cover the disruptions that were anticipated during operations. Thus, just one to two days of supply stocks were maintained in the logistics support areas, with the rest at the intermediate support base in Kuwait. This system was, however, found to be under strain during the critical period when a sandstorm occurred and resulted in disruption of about two days at the end of which troops had reached a very low level of stocks. This would, thus, need careful analysis and would depend on a number of factors such as in-transit visibility of supplies, communications and the anticipated disruption due to weather as well as enemy action.

SUPPLY PUSH MODEL
The supply push model was to provide effective logistics cover to the forces during OIF and OEF. Logisticians making decisions on what and where to push material forward were able to tap into logistics alerts as a part of battle space awareness that existed for combat units. A commonly fused picture and greater interaction facilitated by improved communications eliminated the differential that normally exists between the operational and logistics staff. The basic issues were as follows:

(a) “Supply push” envisaged meeting real-time demand signals and the extensive use of “cross-service, electronic order, asset and inventory visibility [and] decision support tools,” by pushing forward supplies based on

13. Ibid.
anticipated demands of all commodities, including ammunition.\(^\text{14}\) It involved moving material forward to the troops without waiting for specific requests.

(b) High Level of Visibility of in-Transit Stores. This greatly facilitated supply push.

(c) Cross-Service Support. Cross-Service support to bare basing, implying meeting air force requirements being fulfilled by army units in a self-synchronous manner was another important facet of supply push.

**SUPPLY OF FUEL**

Modern armed forces, particularly the air force, are increasingly in need of supply of high grade fuel in large quantities to sustain 24/7 operations. The importance of fuel can well be recognised by the diverse grades of special fuel which would be required not only by aircraft but also ships, unmanned aerial vehicles (UAVs), and vehicles, many operating from remote locations in Afghanistan. Aviation gas was also essential at a number of locations across the globe for induction of men and material into the theatre.\(^\text{15}\) Very few private companies can provide the high grade and large quantity of fuel required for aviation. An efficient fuel supply was one of the key achievements of both OIF and OEF. This was achieved by the following measures:

(a) A preparatory analysis of availability of air bases and of suitable contractors on the routes of induction was carried out. Provision of fuel was then made by contracting it from national oil carriers and private players. Flexibility was of the essence as indicated by the last minute cancellation of contracts in Turkey when the government did not accede to provide base facilities for OIF.\(^\text{16}\)

\(^{14}\) Keith J. Costa, “New Study Looks For Evidence Of Network-Centric Logistics In Iraq... The work will be tested in a number of upcoming experiments,” downloaded from www.ofit.osd.mil/library/library_files/article_231_Inside%20The%20Pentagon.doc, August 14, 2006.


\(^{16}\) Funk, Ibid.
(b) Innovative contract management procedures were followed as contracts had to be executed in areas devoid of such processes as in Afghanistan, such as the air bases at Kandahar and Bagram.

(c) Additives are an important issue which was not fully appreciated.

(d) The lessons learnt are being implemented through a fuel automation system employing enterprise resource planning software.\(^{17}\)

(e) The Hose Reel System. The Americans designed a fuel pipeline which supported the forces advancing through Iraq over a distance of 150 km from Kuwait to the Forward Operating Base System at Jallibah, Iraq, to enable transportation of 8 million gallons of fuel, thereby, reducing the load on fuel trucks. However, the efficacy of such a pipeline where there is a parity of air situation needs consideration.\(^{18}\)

**MAINTENANCE ISSUES**

Easy availability of spare parts is said to have eased the problems of maintenance turnaround of aircraft considerably. Though in the beginning of 2001 there was a deficiency of 610,000 parts, it was brought down to 150,000 parts within a period of one and half years, which was also a function of funding. Reduction in cannibalisation is said to have gone down to 11 and a half per 100 sorties from the 15 to 20 per cent instances observed in 1997 and 1998. This increased the overall serviceability of aircraft.

Maintenance of aircraft was also eased by the high rate of retention of technical airmen after their first term which ensured that a better skilled and more experienced person was available to ensure correct diagnosis which also reduced the number of cannibalisations required.

**THE VERSATILE MRE (MEALS READY TO EAT)**

The MRE is one innovation which the Indian armed forces have already adapted, though the meal provided is not very palatable. Essentially being a prepackaged ration to be consumed during operations, this was an innovation of the Gulf War.

\(^{17}\) Ibid

\(^{18}\) Williams, n. 3.
1991 but greatly improved after a decade of use in varied conditions; it has a calorific value which can sustain a person for six to eight hours, while, at the same time, it is lightweight and can be eaten immediately or after heating. Special types of MRE, including vegetarian and halal were also catered for by the Americans. Reportedly, 350,000 MREs are being consumed by American troops in all theatres even to this day.\textsuperscript{19}

\textit{Logistics Support During Operations}
The Marine Expeditionary Force had advanced from Kuwait to Tikrit, a distance of 720 km. To support such an advance there was a need to establish 8 support areas, 18 resupply and replenishment points which were within 48 hours turnaround of the 1 Marine Division.\textsuperscript{20} The Combat Service Support Battalion in support of the division is said to have moved 21 times in 3 weeks or a virtual move every day, leapfrogging its resupply points.

\textit{Forward Resuscitative Surgical Support (FRSS)}
These were small, mobile surgical support teams which were formed from the surgical companies of Medical Battalions mounted on two HMMWVs with trailers and could provide surgical assistance requiring the attention of trauma surgeons within the “Golden Hour”. They had the distinction of avoiding a single death of any casualty brought to them for surgery.\textsuperscript{21}

\textit{Effective and Efficient Contracting System}
The Americans used electronic end-to-end combat contracting tools based on technology which enabled two contingency contracting teams to deploy quickly and it is claimed that these acted as “force multipliers”, contracting transportation, food service, and maintenance support globally. From September 2002 to November 2003, Combat Contracting Marines awarded over 2,000

\textsuperscript{19} Williams, Ibid.

\textsuperscript{20} Testimony of Brigadier General Edward G. Usher III, Director Logistics Plans, Policies and Strategic Mobility, United States Marine Corps Before the House Armed Services Committee Subcommittee on Readiness, United States House of Representatives Regarding Logistics. Downloaded from http://www.globalsecurity.org/military/library/congress/2004_hr/04-03-30usher.htm on August 20, 2006.

\textsuperscript{21} Ibid.
contracts totalling over $700 million from the operational area. This was achieved by use of the Battle Ready Contingency Contracting System which enabled automated contract writing. Adoption of such a system of active contracting may need some consideration to meet varied contingencies.  

Innovations During Operations
A reverse osmosis system was innovated by soldiers at a forward base rather than drinking bottled water, which resulted in producing adequate water for sanitation, cooking, and cleaning for the entire population located on the base.

DLA Representatives – Forward Units
Embedding representatives with combat units from the DLA proved highly successful. DLA had representatives at 71 different locations before the operations began and also provided 72 logistics experts within the theatre who communicated directly back to the DLA for early warning and speedy processing of requests.

PART IV - CONCEPTUAL ISSUES

FOCUSSSED LOGISTICS
The overall concept of logistics in the US armed forces is said to be focussed logistics, designed to seamlessly integrate information, logistics and transportation through a technological process that can envisage a crisis developing through a full system perspective provided on a visible interface. It enables flexibility in shifting the logistics requirements from non-crisis to crisis areas and delivers the packages directly at every level, be it strategic, operational or tactical. The speed in support is said to be provided in hours rather than weeks. The key issues include networked provision rather than the linear approach, modular and tailored support packages and integration of best practices from the civilian sector. The various processes under focussed logistics are, however, still under development.

22. Ibid.
23. Williams, n. 3.

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VELOCITY MANAGEMENT: PROCESS OF IMPROVING LOGISTICS SUPPORT

The logistics legacy has been ruled by the primary consideration of avoiding a breakdown at all costs. This has resulted in focussing attention on creating vast surpluses of supplies, spare parts, ammunition and vehicles. It may have been relevant for the times for which it was evolved; however, with greater production capabilities and large stocks now available with the trade, there is scope for reducing actual inventories and relying on just-in-time logistics to provide the forces their logistics needs. Velocity management is a new model which has been developed to replace the old and time-worn concepts of mass logistics. Thus, this is seen to be the transformation from “just-in-case” to “just-in-time” logistics.

Velocity management ensures greater responsiveness, efficiency and economy. The process involves three steps: Define, Measure and Improve (DMI). The define phase attempts to understand the customer, including all his needs and deliverables. The entire process is then broken into sub-processes. The process of measurement aims at evolving the activity metrics in terms of time, quality and cost, and the final phase to improve the delivery based on the knowledge developed thus far. This is undertaken in a cycle which enables improvements taking place at each rotation of the DMI process. Special teams such as Process and Site Improvement Teams conduct the actual improvement which are army-wide as well as location specific.

STRATEGIC DISTRIBUTION (SD)

US strategic reach encompasses global operations. To provide logistics support, a strategic distribution system is under development, again partially fielded during OIF and OEF, based on the 3 S of stock positioning, scheduled movements and synchronisation. Stock positioning has been achieved by placing the inventory in

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25. Ibid.
the right place in the Continental US (CONUS) implying at two points each on the east and west coasts. Scheduling movements implies cargo leaving these two points at the same time each day and arriving at the destination again at a set time and finally synchronising these movements to avoid queuing. This is also explained with examples relevant to the three Services thus:

(a) During OEF, the supply of cargo to the air force base at Diego Garcia, from where 18 B-1 and B-52 bombers operated and whose operational readiness was extremely significant to the outcome of the operations was achieved through a process of SD. The first step was to evolve a joint procedure between numerous agencies such as the Transport Command and Air Mobility Command to provide commercial charters to move the loads to Diego Garcia. Thereafter, synchronisation was carried out to reduce the timing to Diego Garcia from 14 days to 9 days, which is said to compare favourably with comparative services by professional courier companies such as Worldwide Express.

(b) The navy had its carrier battle groups in the theatre going up from one to four. It had less problems as it has been operating in the Persian Gulf; however, the level of support had increased four-fold, for which commercial charters flying within the military air system were used. The large capacity Boeing 747s were effectively utilised for a logistics surge. The surge capability of civilian charters within the military air system can be seen from the increase in deliverables from 463 tons in June-August 2001 to over 2,000 tons in October-December, while the supply by military aircraft increased from 333 to a meagre 727 tons.

(c) For the army deploying in Karshi Khanabad in Uzbekistan, support was provided from October-December 2001 in a timeframe of request to receipt of 16 days.

PRIME VENDOR PROGRAMME
The US Defence Logistics Agency has a prime vendor programme which enables commercial providers to supply their products and services to the armed forces

units in the designated area within a given time of placement of order.\textsuperscript{27} This is provided at the cost that is pre-fixed with the prime vendor. These commercial products are designated branded products of high quality, the inventory of which is maintained by the vendor and not the Services’ supply agencies. A system probably closely related to the CSD (I) system in the Indian armed forces, where the vendor is supplying items to various regional CSD depots. The estimated reduction in inventory costs in medical items alone was said to be $177 million between 1993 to FY 1997. The total value of the prime vendor programme in 2003 is said to be $7 billion or roughly one-fourth of the procurements. The success of the programme is evident with the kitting up of USNS Comfort, a 1,000-bed hospital ship, to support Operation Iraqi Freedom in 2003 within a period of 3½ working days to 80 per cent of the level of readiness, with the balance being promised to be delivered either in the theatre or en route.

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LOGISTICS - COMMUNICATIONS
Provision of the communications network for logistics organisations was an immediate advantage that provided great flexibility.\textsuperscript{28} A secure Internet is seemingly the best means of communications used by the staff and provided real-time inputs, independent of mediators, from the signal men to the user. The difference between e-mail and snail mail which is not frequently recognised is that it cuts out a minimum of six and maximum of eight intermediaries between the originator of a message and its receipt.


SENSE AND RESPOND LOGISTICS: NETWORK-CENTRIC LOGISTICS
To support network-centric warfare, a logistics system which is termed as sense and response logistics (SRLC) is under development in the USA, based on the lessons learnt in OIF and OEF. This will overcome some of the problems encountered by specialised units operating in joint teams which found that their logistics needs were not catered for by the parent unit as well as the supported unit. SRLC is, thus, being designed to provide a networked logistics chain based on a high degree of communications capability to logistics providers. Once it is fully operational, it would envisage stimulating logistics procurement inputs, based on sensor monitors which, having sensed the operational needs and deficiencies, automatically trigger warnings for inducting the flow of critical supplies. It is operation-centric rather than plan-centric logistics which has better capability to react to the changing ground situations, based on sensed inputs rather than demands, thereby, the authority to supply is of the lowest logistics commander, based on automated, systemic inputs. It is also designed to remove the tactical surpluses at certain points and shortages at others.

CONCLUSION
Frederick the Great, in Instructions for his Generals, II, stated in 1747, "In order to make assured conquests, it is necessary to proceed within the rules; to advance, to establish yourself solidly, to advance and establish yourself again, and always prepare to have within reach of your army, your resources and your requirements." The Allied forces in OEF and OIF followed the basic principles enunciated by the warrior king of the 18th century, transposing the same to the 21st century to ensure that the tip of the sword was not blunted for the lack of gumption of an empty stomach.

30. Ibid.
HAS IT WORKED?
THE GOLDWATER-NICHOLS
REORGANISATION ACT

JAMES R. LOCHER III

Organisation has traditionally been a weak element of the American system of national defence. For the nation's first 150 years, the public actually favoured a fractured military; so inattention to organisational issues has historical roots. The United States entered World War II with the Departments of War and Navy that were organisationally backward and "virtually autonomous."1 Observing American inexperience and lack of multi-Service coordination at the war's start, a British general wrote to London, "The whole organisation belongs to the days of George Washington."2 Army-navy disputes complicated finding more appropriate war-time arrangements. The navy entered the war embracing its cherished concepts of independent command at sea and decentralised organisations relying on cooperation and coordination. The army's shortcomings in the Spanish-American War and its mobilisation challenges during World War I had pushed that Service in the direction of centralised authority and control.

The army and the navy were not able to solve their differences during World War II. Afterward, Congress settled the dispute in terms broadly favourable to

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Despite repeated operational setbacks over the next forty years, subsequent reorganisation efforts offered only slight improvements. Such was the setting for the mid-1980s battle that produced the Goldwater-Nichols Department of Defence Reorganisation Act of 1986.

In this article, we will examine the changes mandated by the Goldwater-Nichols Act and assess whether they have worked. We will begin by reviewing briefly the history of the defence organisation and then, with that as background, outline the organisation problems of the mid-1980s. Then we will turn our attention to the Goldwater-Nichols Act itself—first outlining its key objectives and various provisions, and then assessing its effectiveness and results. Finally—as if the first four headings will not be controversial enough—we will address the unfinished business of Goldwater-Nichols and organisational steps for the future.

DEFENCE ORGANISATION
Many of the problems of defence organisation the United States experienced in 1986 had their origins early in the nation's history, at the beginning of the republic. It would be possible, however, to begin an analysis at the Spanish-American War, when Americans first realised that they needed a centralised authority in both the War and Navy Departments and also some mechanism for cooperation between those two departments. But for our purposes, we need go back only to World War II.
The United States entered World War II with an archaic organisation that was incapable of coordinating land, sea, and air activities across the two military departments, or even of harmonising business (procurement, logistics, construction, transportation, etc) efforts within the departments themselves. In February 1942, President Franklin D. Roosevelt created by executive direction the Joint Chiefs of Staff (or JCS), primarily to work with the British, who had a combined Chiefs of Staff organisation. The Joint Chiefs of Staff assumed an enormous role. Next to the president, they were the most powerful Americans in the war effort. They not only had major military responsibilities but also collectively played crucial roles in political, intelligence, and even economic decisions. The American public’s outcry over Pearl Harbour prompted the creation of unified theatre commanders, like General Dwight D. Eisenhower in Europe. Service politics and jealousies prevented unifying the Pacific theatre; it was divided into two commands—one led by General Douglas MacArthur, the other by Admiral Chester Nimitz.

This joint centralisation was paralleled by the creation of effective central authority within the War and Navy Departments, necessitated by the war effort, especially the enormous logistical tasks involved.

However, the contributions of the JCS were lessened by its adoption on its own of the principle of reaching unanimous agreement before speaking ex cathedra. Accordingly, the war-time Joint Chiefs—General Hap Arnold, the commanding general of the army air forces; General George Marshall, the chief of staff of the army; Admiral William Leahy, the chief of staff to the commander-in-chief (that is, President Roosevelt); and Admiral Ernest King, the chief of naval operations—had essentially to operate by cooperation.

A vivid example of the limitations on the ability of the JCS to do their work arose in connection with material allocations. The British had recommended that steel be diverted from the construction of battleships and heavy cruisers to convoy escorts and landing craft. Admiral Leahy, who had just joined the JCS, “remarked that it looked to him as though ‘the vote is three to one.’” [Admiral] King replied coldly that as far as he was concerned, the Joint Chiefs was not a voting organisation on any matter in which the
interests of the Navy were involved."^{3} Essentially, he demanded veto power. For the most part, the joint chiefs operated upon that principle throughout the war (and, in fact, until 1986). Things would proceed when the chiefs could come to unanimous agreement—which often required watering down their collective advice.

Often, however, they could not agree. There was a fair amount of inter-Service rivalry during World War II, both in Washington and in the field. A British air marshal once said, "The violence of inter-service rivalry in the United States had to be seen to be believed and was an appreciable handicap to their war effort."^{4} In fact, in 1943, the army attempted to create a single military department, in place of the War (that is, the army and army air forces) and Navy Departments, because it had become convinced that the current arrangement was too inefficient. However, disputes between the army and the navy were so severe that the idea of unifying the two military departments had to be put off until after the war, when President Harry Truman supported the War Department proposals for a single department, with a single chief of staff and assistant secretaries for land, sea, and air. Truman, who had been an artillery captain during World War I and had stayed in the National Guard until 1940, rising to the rank of colonel, was very sympathetic to the army’s ideas on organisation.

The navy and the marine corps opposed unification, initially on organisational principles. The way the army wanted to organise things was completely alien to the way the navy was used to operating, rooted in the traditional ideal of independent command at sea.

aviation and land missions; the marine corps, in fact, saw unification as a threat to its survival. The US Army Air Forces had emerged from World War II as a giant; the navy was not certain that it could compete in a unified department with the powerful army air forces, with its atomic mission, and its large parent Service, the army.

Congress was also divided on the unification issue; each Service’s view had strong supporters. But Congress ended up opposing Truman’s proposals, for two main reasons. One was its own constitutional competition with the executive branch. Members of Congress feared that the executive branch might be able to organise its military affairs so effectively that Congress would be at a disadvantage. The second reason had to do with constituencies—where ships were to be built, where battalions would be posted, where jobs would be created; Congress would have more bargaining leverage vis-a-vis a military establishment in which authority was diffused. Congress came down, then, on the side of the navy and the marine corps, forcing President Truman and the War Department to modify their approach; the National Security Act of 1947 was the ultimate result.

Many people believe that the National Security Act of 1947 created the Department of Defence. It did not. Instead, it created something that was called, strangely, the “National Military Establishment,” to be placed on top of the War and Navy Departments. The Act prescribed a weak secretary of defence, with very limited powers and a small staff, and retained the World War II boards to govern the new organisation. It gave legal standing to the Joint Chiefs of Staff but gave the group no chairman. The Act not only continued the powerful secretaries of the military departments as Cabinet members but also made them members of a new National Security Council. The Services soon used their power to erect a Service-dominated system. They emasculated the unified commands, despite the value they had shown in war-time. When the Services were finished, the commands were unified in name only.

In 1958, President Dwight D. Eisenhower, assessing the compromises the original Act reflected between Truman and Congress and between the army and the navy, said: “In that battle, the lessons were lost, tradition won. The three services were but loosely joined. The entire structure... was little more than a
There were three revisions—in 1949, 1953 and 1958. The 1949 legislation created the Department of Defence. All three sought to strengthen the secretary of defence. The 1949 revision established the position of chairman of the JCS.

It has been charitably said (by the Office of the Secretary of Defence Historical Office) that the National Security Act of 1947 "confirmed the principle of unification by cooperation and mutual consent." 5

Truman and Eisenhower spent much of their energies trying to strengthen the National Security Act. There were revisions in 1949, 1953, and 1958—the latter two under Eisenhower. The 1949 legislation created the Department of Defence. All three sought to strengthen the secretary of defence. The 1949 revision established the position of chairman of the JCS. (In the beginning, however, the chairman was not given a vote. Interestingly, some of Truman's early correspondence on the subject spoke of creating a chairman as principal military advisor, specifically to get away from the idea of JCS operation by consensus.) The military departments were downgraded in the various revisions; the secretaries were removed from the Cabinet and from the National Security Council. The 1958 legislation removed the Service secretaries and chiefs from the operational chain of command, in order to strengthen civilian control, as Eisenhower wished. It also gave the unified commanders full operational command of assigned forces. However, those provisions were not effectively implemented. The military departments retained a de facto role in the operational chain of command and never complied with the provision strengthening the unified commanders.

From 1958 to 1983, there were no major changes to the defence organisation; the alliance between Congress and the Services was too powerful. Even Eisenhower, a war hero, was unable to overcome this alliance, and that was a salient lesson for subsequent presidents and secretaries of defence. There were continuing calls for

The military suffered several operational setbacks. These failures had a number of common denominators—poor military advice to political leaders, lack of unity of command, and inability to operate jointly.

Desert One
In April 1980, the United States conducted a raid to rescue 53 Americans held hostage in Tehran. The military had six months to organise, plan, and train as well as fairly recent experience in conducting such a mission—the Son Tay raid about ten years before. Nonetheless, only six of the eight helicopters involved arrived at the rendezvous point, known as “Desert One,” in the middle of Iran; one of the six that got that far suffered mechanical problems and could not proceed. That did not leave enough helicopter capacity to carry out the mission, and it was aborted. As the rescue force was departing, a helicopter collided with one of the C-130s that were carrying commandos and helicopter fuel; eight Servicemen died. The helicopters, with valuable secret documents, weapons, and communications gear on board, were hastily abandoned.

What were the underlying problems? No existing joint organisation was capable of conducting such a raid. There was no useful contingency plan, no planning staff with the required expertise, no joint doctrine or procedures, and no relevant cross-Service experience. The joint task force commander, Major General James Vaught, an Army Ranger, was a distinguished combat veteran,
but he had no experience in operations with other Services. The participating Service units trained separately; they met for the first time in the desert in Iran, at Desert One. Even there, they did not establish command and control procedures or clear lines of authority. Colonel James Kyle, US Air Force, who was the senior commander at Desert One, would recall that there were “four commanders at the scene without visible identification, incompatible radios, and no agreed-upon plan, not even a designated location for the commander.” How could this state of affairs have possibly arisen? It happened because the Services were so separate and so determined to remain separate.

The Department of Defence—which in this period made no effort to reorganise itself fundamentally—was also suffering all manner of administrative problems. The nation was formulating security strategy unconstrained by realistic estimates of available fiscal resources, because the Services could never agree on a fiscally constrained strategy and the allocation of resources to support it. Communications, refuelling, and other vital systems and devices were not interoperable across the Services. There were modernisation/readiness imbalances, because the all-powerful Services were pushing for more modernisation, while the readiness needs of the weak unified commanders were underrepresented.

There were numerous procurement and spare parts horror stories during this period. A memorable one involved the coffee pots the air force bought for its C-5A Galaxy aircraft at a price of $7,000 each. The pots were so advanced that they could keep brewing in conditions that would kill the crews.

“The System Is Broken”

The process that led to Goldwater-Nichols began when General David Jones, the chairman of the Joint Chiefs of Staff, went before the House Armed Services Committee in a closed session on February, 1982, about five months before he was to retire, and said, essentially, “The system is broken. I have tried to reform it from inside, but I cannot. Congress is going to have to mandate necessary

reforms.” General Jones was the catalyst, the most important factor in ultimately bringing about the Goldwater-Nichols Act; the four-year, 241-day battle had begun.

Shortly after General Jones’s call for reform, General Edward “Shy” Meyer, the army chief of staff, urged fundamental reorganisation of the JCS. During congressional testimony, a third sitting JCS member, General Lew Allen, the air force chief of staff, also voiced support for reorganisation. The naval Service’s JCS members—Admiral Thomas Hayward, chief of naval operations, and General Robert Barrow, commandant of the marine corps—vigorously opposed reform efforts. The 1982 debate—bitterly pitting the army and air force against the navy and marine corps—reenacted the post war disputes over unification.

In the summer of 1982, three Joint Chiefs—Generals Jones and Allen and Admiral Hayward—reached the end of their tenures. General John Vessey, of the army, became the new chairman and adopted an anti-reform stance. The new air force chief of staff, General Charles Gabriel, also showed no interest in JCS reform. Admiral James Watkins, the new chief of naval operations, shared Admiral Hayward’s strong anti-reform sentiments. Suddenly, General Meyer was the only joint chief in favour of reorganisation. In late 1982, the JCS, responding to a study request by Secretary of Defence Caspar Weinberger, recommended against major JCS reorganisation. Secretary Weinberger and President Ronald Reagan supported this recommendation, and the Administration took for the first time an official position in opposition to JCS reform. This stance set the stage for a fierce fight between Congress and the Pentagon.

In the meantime, the House Armed Services Committee—spurred to action by General Jones’s reform plea—held extensive hearings and formulated a Bill on JCS reorganisation, which the House of Representatives passed on August 16, 1982. Congressman Richard White (D-Texas), chairman of the Investigations Subcommittee, led the 1982 effort. In 1983, Congressman William Nichols (D-Alabama) assumed the chair of the Investigations Subcommittee and responsibility for pushing the reform legislation.

The Senate did not enter the fray until June 1983, when Senator John Tower (R-Texas), chairman of the Senate Armed Services Committee, launched a major
HAS IT WORKED? THE GOLDWATER-NICHOLS REORGANISATION ACT

inquiry on organisation of the entire Department of Defence. At the same time, the last JCS reform supporter—General Meyer—retired. His replacement, General John Wickham, joined the anti-reform ranks. A new marine commandant, General P. X. Kelley, was also appointed that summer. Like his predecessor, General Kelley was a determined opponent of reorganisation. All five joint chiefs were now united in opposition to reorganisation. When Senator Tower manoeuvred to keep his committee in the anti-reform camp, the 1983-84 battle lines had the Pentagon and Senate squaring off against the House of Representatives. This division also reflected party politics. A Republican Administration and Republican-controlled Senate were united in battling a Democratic-controlled House.

In 1985, four events began to shift the balance in favour of reform. Senator Barry Goldwater (R-Arizona) became chairman of the Senate Armed Services Committee and made defence reorganisation his top priority. He formed a partnership with the committee's top Democrat, Senator Sam Nunn (D-Georgia). The bipartisan partnership of these two defence giants became the second most important factor leading to the passage of the Goldwater-Nichols Act. The second event in 1985 was the elevation of Congressman Les Aspin (D-Wisconsin) to the chairmanship of the House Armed Services Committee. He was strongly pro-reform and provided important political and intellectual support to Congressman Nichols' efforts.

The other two events occurred in the Administration. Robert McFarlane, the national security advisor, convinced President Reagan to establish a commission—the Packard Commission—to examine defence reorganisation. The commission eventually endorsed reforms being considered by the Senate and House Armed Services Committees. On October 1, 1985, Admiral William Crowe, a supporter of defence reorganisation, became the chairman of the JCS. The Pentagon's official position in opposition constrained his public efforts, but behind the scenes, Admiral Crowe pushed for reorganisation. In 1986, these factors led the Senate and House to enact sweeping reforms despite the continued opposition of the Pentagon.

PURPOSES AND PROVISIONS

The organisational problems addressed by Goldwater-Nichols had existed for more than four decades. When Congress went to work on the Bill, there were studies on
hand by the JCS and by various commissions for presidents and secretaries of defence dating back to the 1940s; there was a tremendous amount of evidence to make use of. We should note, however, that by 1996, the tenth anniversary of the Act, the JCS chairman, General John Shalikashvili, could say: “The effects of Goldwater-Nichols have been so imbedded in the military that many members of the Armed Forces no longer remember the organisational problems that brought about this law.” That is certainly even truer today. In fact, there were really ten fundamental problems in the Defence Department to which the Congress turned its attention. Their seriousness is evidenced by the fact that Congress—which, as we have seen, had reason to like things the way they were—now collectively acknowledged that it would have to give up prerogatives in the defence area. Many in uniform also recognised the problems, although the Department of Defence and the four Services, as institutions, were dead set against addressing them.

The organisational problems addressed by Goldwater-Nichols had existed for more than four decades. When Congress went to work on the Bill, there were studies on hand by the JCS and by various commissions for presidents and secretaries of defence dating back to the 1940s.

The number one problem plaguing the Department of Defence was an imbalance between Service and joint interests. The Services absolutely dominated: they had de facto vetoes in the JCS, and they had weakened the unified commanders. On issues of major interest to them, the Services aligned in opposition to the secretary of

The Congressional Perspective

The number one problem plaguing the Department of Defence was an imbalance between Service and joint interests. The Services absolutely dominated: they had de facto vetoes in the JCS.

defence. General Jones had assembled a group of retired officers, the Chairman's Special Study Group, to study reform of the joint system; it agreed, "The problem is one of balance. A certain amount of service independence is healthy and desirable, but the balance now favors the parochial interests of the Services too much, and the larger needs of the nation's defence too little."

Second, military advice to the political leadership was inadequate. As before, it was being watered down to the lowest common denominator, so that all of the Services could agree. General Jones said, "The corporate advice provided by the Joint Chiefs of Staff is not crisp, timely, very useful, or very influential."\(^9\) James Schlesinger, secretary of defence from 1973 to 1975, was even harsher: "The proffered advice is generally irrelevant, normally unread, and almost always disregarded."\(^11\)

Third, military officers serving in joint-duty assignments were insufficiently qualified, by either education or experience. As Congress found, officers did not want to serve in joint assignments; they knew that in such billets they would be monitored for loyalty by their parent Service. In the navy, in the mid-1980s, joint duty was considered the "kiss of death"; it meant that one's career was over. General George Crist of the marine corps, as commander-in-chief of Central Command, testified to Congress that there had not been a single volunteer for any of the thousand billets on his headquarters staff—all of them joint billets. Everyone on his staff had been forced to serve there. Officers unlucky enough to

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\(^10\) Congress, House, Committee on Armed Services [HASC], Investigations Subcommittee, Reorganization Proposals/or the Joint Chiefs of Staff Hearings before the Investigations Subcommittee, 97th Cong., 2d sess., 1982, HASC no.97-47, p. 54.

be assigned to joint duty got orders out of it as soon as they could; their tours of duty became dysfunctionally short.

A fourth point, already mentioned, was the imbalance between the responsibility and authority of each unified commander: his responsibilities were vast, his authority weak.

A fifth, related problem was that operational chains of command were confused and cumbersome. The Services challenged the operational role of the secretary of defence. The joint chiefs collectively and the Service chiefs individually were not in the operational chain of command; nonetheless, the JCS often acted as if it were part of the chain, and individual chiefs played operational roles when the unified commanders involved were from their respective Services. Chains of command within a unified command were obstructed by what came to be called “the wall of the component.”

Unified four-star commanders had difficulty penetrating the “walls” of their Service component commands; three-star or four-star commanders whom the Service chiefs tended to protect, led these components. Accordingly, joint commanders were unable really to pull their commands together to carry out their missions. In 1970, the Blue Ribbon Defence Panel had declared: “Unification” of either command or of the forces is more cosmetic than substantive.”

Samuel Huntington in 1984 observed, “Each service continues to exercise great autonomy.... Unified commands are not really commands, and they certainly aren’t unified.”

Sixth, strategic planning was ineffective.

Strategic planning was ineffective. The entire Pentagon was devoting its attention to programming and budgeting, and neglecting the formulation of long-range plans.

been created—the Defence Logistics Agency, the Defence Intelligence Agency—to provide common supply and Service functions for all components, but mechanisms for supervising or controlling them were ineffective. An eighth issue was confusion as to the roles of the Service secretaries; the National Security Act of 1947 had not defined them. The secretary of defence had been placed on top, but his relationships with the Service secretaries had been left unspecified, because addressing them would have been too controversial. Ninth, unnecessary duplication existed in the military department headquarters. Each military department had (as they still do) two headquarters staffs—that of the secretary, and that of the Service chief. The Department of the Navy—comprising two Service chiefs—actually has three headquarters staffs.

Tenth and last was the major problem of congressional micro-management—even as seen from Capitol Hill. Congress was finding itself too often “in the weeds,” immersed in details, not doing its job as the “board of directors,” providing clear, but broad, strategic direction. Senator Nunn spoke of Congress' preoccupation with trivia: “Last year [1984], Congress changed the number of smoke grenade launchers and muzzle boresights the Army requested. We directed the Navy to pare back its request for parachute flares, practice bombs, and passenger vehicles. Congress specified that the Air Force should cut its request for garbage trucks, street cleaners, and scoop loaders. This is a bit ridiculous.”

Striking the Balance
The overarching objective of the Goldwater-Nichols Act, as it was ultimately formulated was to balance joint and Service interests. It was not to thwart Service prerogatives; the Services were, and would remain, the most important elements of the Department of Defence. They were, and are, the foundations on which everything else had to be constructed. To strike that balance, the drafters of the Goldwater-Nichols Act adopted nine objectives:

- Strengthen civilian authority
- Improve military advice to the president (in his constitutionally specified

15. Congress, Senate, Senator Nunn of Georgia speaking on congressional oversight of national defence, 99th Cong., 1st sess., Congressional Record, October 1, 1985, pp. 25350-25354.
capacity as commander-in-chief of the armed forces), secretary of defence, and National Security Council

- Place clear responsibilities on the unified commanders-in-chief for mission accomplishment
- Ensure that a unified commander's authority is commensurate with his responsibilities
- Increase attention to strategy formulation and contingency planning
- Provide for the more efficient use of resources
- Improve joint officer management
- Enhance the effectiveness of military operations
- Improve Defence Department management and administration.

In the past, Congress had tried to limit the authority of the secretary of defence, because, as has been noted, its direct links with the Services, and to the industries that served them, worked to the benefit of members of Congress in local politics. But in the report accompanying the Goldwater-Nichols Act, Congress finally declared: "The secretary of defence has sole and ultimate power within the Department of Defence on any matter on which the secretary chooses to act." That is, no one in the Defence Department, civilian or military, possessed authority that was independent of the secretary. Eisenhower had decreed effectively the same thing in 1953, through an executive directive; only in 1986 was Congress prepared to legislate the point.

To strengthen further civilian authority, Goldwater-Nichols gave the secretary a powerful military ally in the JCS chairman. The chairman was freed from the necessity of negotiating with the Service chiefs, and his institutional perspective was to be similar to that of the secretary. The 1986 legislation also specified the responsibilities of each Service secretary to the defence secretary. Addressing civilian authority at the military department level, it clarified and strengthened the roles of each Service secretary.

To improve military advice, the Act transferred all corporate functions of the JCS to the chairman (in which he was to be assisted by a newly created vice
Specifically, it designated the chairman of the Joints Chief of Staff as the principal military advisor, with a mandate to provide that advice on the basis of the broadest military perspective. Further, it made the Joint Staff (which supports the Joint Chiefs) responsible exclusively to the chairman, and it made elaborate provisions to improve the quality of officers assigned to the Joint Staff, as well as to the staffs of the unified commanders-in-chief.

It did so by ordering fundamental improvements in joint officer management generally—an arena that became the last battleground in the drafting, passage, and ultimate enactment of the Goldwater-Nichols legislation. The Services saw that if they retained absolute control of promotions and assignments, Congress could pass all the laws it wanted—not much was going to change in the Department of Defence. Congress was equally determined to reward officers who accepted and performed well in billets that were outside of their Services; to that end, it created through Goldwater-Nichols, a joint officer management system. Specifically, a joint career specialty was established, and joint education was much more closely regulated—the Services, for example, had been sending officers to joint schools but had assigned only a few graduates to joint billets.

As for the unified commanders-in-chief, the Act made them clearly responsible to the president and the secretary of defence—constituted collectively as the “national command authority”—for the performance of missions and the preparedness of their commands. Goldwater-Nichols required the assignment of all combat forces to the unified commanders and removed the JCS from the operational chain of command. No longer could the Services move forces in and out of regional commands without the approval, or even the knowledge, of the commanders-in-chief. (An investigation after the 1983 bombing of the marine barracks in Beirut found that 31 units in Beirut had been sent there unbeknownst to the commander-in-chief, US European Command.)

To ensure sufficient authority for the unified commanders, the law essentially gave them all the authority that is traditionally given to a military commander. Unified commanders were empowered to issue authoritative direction on all aspects of operations, joint training, and logistics, to prescribe internal chains of command, to organise commands and forces, and to employ forces. A unified
commander-in-chief could now assign command functions to subordinate commanders and approve certain aspects of administration and support. In addition, unified commanders could now exercise personnel authority: they could select their headquarters staffs and subordinate commanders (matters in which they had had almost no say in the past); they could suspend subordinates; and they could convene courts-martial. As might be imagined, all of this caused heartburn among the Services. But Congress had decided that unified commanders had to have these kinds of authority if they were to be effective.

Goldwater-Nichols addressed the lack of emphasis on high-level planning by requiring the president to submit annually a national security strategy, on the basis of which the chairman was to prepare fiscally constrained strategic plans. (The Pentagon at first had major objections here, but a year’s experience with the new process put them to rest.) The secretary of defence was to provide—with the assistance of the under-secretary of defence for policy—guidance to the chairman of the JCS and unified commanders for the preparation and review of contingency plans. Goldwater-Nichols also prescribed a role for the under secretary in assisting the secretary’s review of the plans. (These were major advances. Lacking policy and political guidance, the military drafters of contingency plans had been forced to formulate their own assumptions. Also, until then, the JCS had jealously guarded contingency plans, permitting only the secretary—and no other civilian—to see them in completed form.)

In the resource area, the Act called upon the secretary to provide policy guidance for the effective use of resources. He was to address objectives and policies, mission priorities, and resource constraints. Interestingly, Goldwater-Nichols told the military departments, in effect, that their collective role, their entire raison d’etre, was now to fulfill, as far as practicable, the

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current and future requirements of unified commanders-in-chief. To the same
end, the Act strengthened the supervision, budget review, and combat readiness
of the growing defence agencies. Congress also assigned ten new resource-
related duties to the chairman of the JCS, in the search for the independent joint
budget perspective that had been missing.

Many of the above initiatives, taken together, constituted Congress' effort to
improve the effectiveness of military operations. That left a final goal, improved
management and administration—and here Congress' concerns included
excessive spans of control. The Office of the Secretary of Defence and the Service
headquarters staffs had grown very large, and organisationally "excessively flat"
—42 people reported directly to the secretary of defence, and some Service chiefs
directly supervised more than 50. The Goldwater-Nichols drafters moved to
reduce these spans of control. Believing that Pentagon Headquarters were too
large, they mandated personnel reductions in them. Addressing unnecessary
duplication between Service secretariats and military headquarters staffs,
Goldwater-Nichols consolidated seven functions in the secretariats. Last, the Act
sought to promote a mission orientation in the Pentagon and overcome the
excessive focus on functional activities—manpower, research and development,
health affairs, and so on.

RESULTS
How well have the objectives that Goldwater-Nichols set been achieved? Have
those objectives been met in terms of the Defence Department's performance?

Some commentators believe they have. Congressman (later secretary of
defence) Les Aspin immediately called Goldwater-Nichols "one of the landmark
laws of American history ... probably the greatest sea change in the history of the
American military since the Continental Congress created the Continental Army
in 1775."17 Admiral William Owens believes it was "the watershed event for the
military since the Second World War."18 William J. Perry, secretary of defence
from 1994 to 1997, considers Goldwater-Nichols "perhaps the most important

17. Les Aspin, quoted in House Armed Services Committee, "House-Senate Conference Wraps Up
defence legislation since World War II."  

A few have been more critical. John Lehman, secretary of the navy in the Ronald Reagan years, charged in 1995 that the new joint staff reflected a gradual edging toward the old German general-staff system. Richard Kohn has expressed concern about erosion of civilian control of the military. The drafters of Goldwater-Nichols hoped for a Joint Staff that was as capable as the Office of the Secretary of Defence. Now, unfortunately, the Joint Staff is much more capable than the staff of the secretary of defence, and only partly due to improved quality of the work of the former—the performance of the Office of the Secretary of Defence has been weaker. Others have had similar unease regarding the current viability of civilian control. Professor Mackubin Owens of the Naval War College has argued, "The contributions of the Goldwater-Nichols Act... are marginal at best, and...the unintended consequences of the Act may well create problems in the future that outweigh any current benefits."  

Let us review the objectives again, this time in the light of the experience of a decade and a half.

There is no dispute about the stature of the secretary of defence. He clearly is the ultimate authority in the Department of Defence, and his role in the chain of command is clear. He enjoys the independent military advice of the chairman of the Joint Chiefs of Staff, to such an extent that policy disputes are now generally between the secretary and chairman on one side, and the Services on the other; such debates are no longer civil/military in nature, and that is previously, initiatives in the Joint Staff went through five levels of review, in which each Service had, effectively, a veto. Papers tended to be reduced to the lowest common denominator, inoffensive to any Service, even before they reached the chiefs themselves.

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fortunate. The secretary of defence now has well-understood relationships with the Service secretaries, and their internal authority, in turn, has been clarified. There does appear to have been a reluctance on the part of the secretaries of defence to exercise fully their newly won authority. The weaker performance of the Office of the Secretary of Defence—leading to an imbalance between the influence of that office and the Joint Staff—has diminished the civilian voice in decision-making. The Goldwater-Nichols objective of strengthening civilian authority has produced results of a "B-minus," middling quality; there are problems here. Still, they are manageable ones; the problems that once crippled the secretary’s authority have been overcome.

As for the quality of military advice to the national command authority, recent advisors and advisees have described it as greatly improved. Richard Cheney, as the secretary of defence under President George H. W. Bush, thought it represented "a significant improvement" over the "lowest common denominator." General Shalikashvili said, "We have been able to provide far better, more focused advice." Previously, initiatives in the Joint Staff went through five levels of review, in which each Service had, effectively, a veto. Papers tended to be reduced to the lowest common denominator, inoffensive to any Service, even before they reached the chiefs themselves, where the necessity for unanimous agreement caused them to be denatured even further. In the end, the secretary of defence would turn to his own civilian staff for the substantial advice that he could not get from military officers. Goldwater-Nichols freed the JCS from these staffing procedures. The Joint Staff now works for the chairman, and the chairman—though he may consult the Service chiefs and unified commanders—need "coordinate" his advice with no one. Not all observers are impressed; Secretary Lehman believes that making the chairman principal military advisor has "limited not only the scope of military advice available to the political leadership, but also the policy- and priority-setting roles of the

service chiefs and civilian service secretaries.” Nonetheless, the overwhelming opinion believes that progress in this part of Goldwater-Nichols merits a grade of A, for tremendous improvement.

It is universally agreed that the same is true regarding clarifying the mission responsibility of the unified commanders-in-chief. Military officers and defence officials have repeatedly cited the benefits of a clear, short operational chain of command. General Norman Schwarzkopf, commander-in-chief of Central Command during Desert Storm found that the clarification of his responsibilities made a tremendous difference: “Goldwater-Nichols established very, very clear lines of command authority and responsibilities for subordinate commanders, and that meant a much more effective fighting force.” I would give this an A as well.

Goldwater-Nichols has also effectively made the authority of the unified commanders commensurate with their responsibilities. Overwhelming successes in military operations and peace-time activities have provided visible evidence of the positive results. The Act’s provisions have worked out very well because the Goldwater-Nichols drafters had a great model—the authority that the military has traditionally given to a unit commander—to use in assigning command authority to unified commanders. General Shalikashvili has characterised the improvement here in very positive terms: “This act, by providing both the responsibility and the authority needed by the CINCs [commanders-in-chief], had made the combatant commanders vastly more capable of fulfilling their warfighting role.” Observers are divided as to whether the unified commanders have too much, or too little, influence in resource issues. Nonetheless, the current state of affairs is probably about right—another grade of A.

Of course, the most conspicuous success for Goldwater-Nichols has been in the realm of military effectiveness; there have been overwhelming operational successes since the law was passed. General Colin Powell observed,
“Performance of the Armed Forces in joint operations has improved significantly and Goldwater-Nichols deserves a great deal of the credit.”28 Of US joint warfighting capabilities, General Shalikashvili said, “No other nation can match our ability to combine forces on the battlefield and fight jointly.”29 Areas of concern might be slow progress on joint doctrine and resistance to the missions of the Joint Forces Command (formerly Atlantic Command) in the training, integration, and provision of joint forces and experimentation with new concepts. Nonetheless, the Department of Defence has clearly been doing “A” work in the Goldwater-Nichols structure to improve operational effectiveness.

World events and regional trends have thrust the unified commanders with geographic responsibilities into broader roles, in which they are seen as representing the US government. Of all government agencies, only the Department of Defence has officials in the field with regionwide responsibilities. The unified commanders have performed well in this role, but to have US security interests represented so powerfully around the world by military officers may, in the long-term, become unacceptable, because the military dimension of national-security interests overseas is decreasing.

In the remaining objective areas, the Goldwater-Nichols experience has been less pleasant. Strategy formulation has improved, but the results are not yet very strong; published strategic documents still betray strong attachment to the past. Contingency plans have been improved tremendously, but there are still barriers between the civilian policy-makers and operational staffs in crisis-action contingency planning. Strategy making and contingency planning under Goldwater-Nichols collectively merits a grade of C—unimpressive.

The effect of Goldwater-Nichols with respect to more efficient use of resources has been barely acceptable, if that—a grade of D. There have been some positives—the Base Force, recommended after the Cold War by General Colin Powell, then chairman of the Joint Chiefs of Staff, to reduce the military by 25 per cent; and the Joint Warfighting Capability Assessments developed in the Joint Staff, largely at the initiative of Admiral Owens. But the Services continue

29. Shalikashvili, “A Word from the Chairman.”
to fund Cold War systems, cannot seem to break their attachment to them, and the Joint Requirements Oversight Council has rubber-stamped the Services’ choices. As Admiral Owens has argued, the inability of the defence establishment to make some fundamental decisions has squandered the post-Cold War period.\(^{30}\)

The remedies applied by Goldwater-Nichols to defence management and administration have largely been ineffective. The qualifications of joint officers have improved dramatically—thanks not to the Department of Defence, which has been until recently indifferent in its implementation of the Act’s joint officer provisions, but to the initiative of the officers themselves. These officers have come to see joint experience as something that can promote their careers or provide useful skill sets for the future. The department itself, however, still has no concept of its needs for joint officers or of how to prepare and reward them. The officer corps is much smaller now than it was when Goldwater-Nichols was passed; this is no area in which to be adrift. It requires, again, a balance between joint and Service emphasis. Joint officer education can be pushed too far; Service capabilities and perspectives are very important, for instance, and they can be taught only at command-and-staff and war colleges. The bottom-line grade for Goldwater-Nichols’ objective of improving joint officer management is a C+.

Finally, the remedies applied by Goldwater-Nichols to defence management and administration have largely been ineffective. They were never a priority for the Act’s drafters, and troubling trends remain. Management of the large defence agencies is still weak. The Pentagon, with its large staffs, including two (or three) headquarters staffs in each military department, is choking on bureaucracy. The division of work among the major components is blurred. The orientation to mission in business activities is still weak, and management doctrine, so to speak, is a relic of the 1960s. The Defence Department under Goldwater-Nichols gets a D here—barely getting by.

The overall report card, then, is mixed. In the areas that the original sponsors of the Goldwater-Nichols Act considered most pressing—military advice, the

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The "business" reforms of Goldwater-Nichols, however, have not worked. These concerns, which may have been secondary 15 years ago, are urgent now.

YESTERDAY'S WINNING FORMULA

The unfinished business of Goldwater-Nichols cannot be resolved from the bottom up; the Department of Defence is too large, and the rate of change it confronts is too rapid. The process will have to be driven from the top, by leadership with vision and communication skills. In 1997, Secretary of Defence William S. Cohen sought to stimulate a "revolution in business affairs" in the Defence Department—the office of the secretary, the military departments, "business activities," and the defence agencies. He wanted to "bring to the department management techniques and business practices that have restored American corporations to leadership in the marketplace." 31 The effort needs to be accelerated tremendously—in a Defence Department with a culture that is markedly change resistant.

Resistance to change is a natural tendency of both humans and large organisations, but in a world characterised by accelerating change, it is a strategic liability. As two business scholars observed, "Yesterday's winning formula ossifies into today's conventional wisdom before petrifying into tomorrow's tablets of stone." 32 The world is moving very rapidly—and the US Department of Defence is too attached to the past.

Joint Forces Command needs—in fact, all joint activities should have—a budget and authority to buy systems unique to joint operations. The dual headquarters at the top of each of the military departments must be combined into one; the current arrangement is far too inefficient for a fast-paced world, and it consumes far too much manpower. The defence agencies—which now expend more money than the Department of the Army—should be collected into a “fourth department,” for support of the entire Defence Department—under an executive, a director of defence support, who can impose high-quality management techniques in this vital area. In the operational area, standing joint task force headquarters should be established in each regional unified command, despite the personnel and resource commitment that will involve; as it is, the military assembles forces for operations as if it were picking teams in a neighbourhood basketball game. Joint Forces Command needs—in fact, all joint activities should have—a budget and authority to buy systems unique to joint operations. The present dependence on service executive agents gives the Services too much control over progress in joint activities.

The Goldwater-Nichols story offers, in my view, two key lessons. First, defence organisation is important; it deserves continuous and innovative attention. Congress came to the department’s rescue in 1986, but today the Pentagon’s organisational problems are again stacking up, and at an ever faster pace. Second, Goldwater-Nichols brings to the fore the struggle of each officer to find that balance between loyalty to the Service and devotion to the larger needs of the nation. All who work in elements of large organisations face a similar challenge. The natural impulse is to defend that element—to protect it against marauders, to be sure it gets its fair share, to demonstrate that its contributions are more vital than those of others, and, when necessary, to fight against its evil foes. Such impulses have their time and place, but increasingly, America will need officers who can resist them when the nation’s security demands something more.