POLICY BRIEF

Indian Strategic-Military Transformation

Revolutionary in Nature, Evolutionary in Character

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Executive Summary

This policy brief examines the ways and means by which an Indian strategic-military transformational initiative may be conceptualised and instituted. As an emerging power with one of the largest armed forces in the world, the Indian strategic-military establishment – given its continued reliance on third-generation equipment, pyramidal organisational structures, and on conventionally-designed concepts of operations - will progressively find itself hampered in addressing the challenges that twenty-first century battlespaces will increasingly pose. In a bid to sense and respond adequately to such challenges, this policy brief lays out the background and a pathway against and along which the Indian strategic-military establishment can trigger and sustain a strategic-military transformation programme. This will involve, in the first instance, recognising that the nature and character of the twenty-first century global strategic-military commons is undergoing a radical change; second, putting in place a sustained process by which revolutionary military concepts that can exploit asymmetric opportunities in emergent battlespaces can be created; third, by identifying and developing critical and emergent areas of science and technologies that can be weaponised; fourth, by undertaking innovative and weaponisable concept-technology pairings; fifth, by building flattened and modular organisational structures that can take advantage of advanced information and communication technologies to foster highly efficient and sensitive command and control systems; and sixth, by designing and employing military operations that deliver tangible effects across the physical, informational and, most importantly, cognitive domains. The policy brief concludes by recommending the creation of a core transformational space and process which would spearhead the Indian strategic-military transformational initiative and which, over time, by exerting a centrifugal-like force, would have its impact across the entire Indian strategic-military spectrum thereby enabling the Indian strategic-military transformation initiative to be revolutionary in nature while being evolutionary in character.

Introduction

The disintegration of the bi-polar world into a multi-polar international system has proliferated competing interests that are strategic, economic, socio-cultural, and political in nature – all this occurring within a context of constant change and flux. Simultaneously, there have been other, often subtle, but no less critical, changes that have taken place. The most critical of them has been the advent of the so-called Age of Information that has brought in its wake a plethora of technologies, which – more often than not – has called into question fundamental issues such as the nature and character of "the human", of "the social", of "security", etc. Thus, as Manuel Castells points out, "[w]e live in confusing times…[because]…the intellectual categories that we use to understand what happens around us have been coined in different circumstances, and can hardly grasp what is new by referring to the past." Castells further points out that by "around the end of the second millennium of the common era a number of major social, technological, economic, and cultural transformations came together to give rise to a new form of society, the network society…"[1] Collectively, these and other phenomena have contributed to a significant complexification of politico-strategic-military affairs.

This has led some of the more progressive, and perhaps speculative, theorists of war and military affairs to assert that even "[a] cursory look into the development of some of the most time-honoured ideas that comprise the principles [of war] will find historical contexts that are completely foreign to us today"[2] and that a heightened awareness of these changes "…will, in the coming decade…unfetter us from the requirement to be synchronous in time and space…"[3] They insist that the "time we live in [is] unlike

[1] Castells, Manuel, *The Rise of the Network Society: The Information, Economy, Society and Culture*, Vol. I, Oxford: Wiley-Blackwell Pub., 2010, p xvii
[2] Leonhard, Robert, R., *The Principles of War for the Information Age*, New York, NY: Presido Press, 1998, p 9
[3] Stenbit, John, "Introduction" in Alberts and Hayes, *Power to the Edge: Command and Control in the Information Age*, Information Age Transformation Series, Washington, DC: US DoD, CCRP, 2003, p xiii

any other, a time when the pace of change demands that *we change*…it is a time when our analysis methods are becoming less and less able to shed light on the choices we face."[4]

In effect, what these military theorists and scholars of strategy and war are urging is for the abandoning of a paradigm in which "…we still persist in studying a type of warfare that no longer exists and that we shall never fight again."[5] Others - like Szafranski - when discussing war in the Age of Information, even call for different "modes of response" to what are claimed to be the emerging "epistemological challenges" that modern-day governments and societies have to contend with.[6] It is, therefore, not uncommon to increasingly hear reiterated that the emergent *battlespace* is among the most complex phenomena of the twenty-first century, and it is this which draws our attention to the emergence of a qualitatively different 'strategic commons'. This suggests that one of the critical pre-requisites for a nation-state to be an effective and impactful player in this emerging strategic commons is to reorient or, if necessary, redesign – in fundamental terms – the nature and character of its strategic-military power and capabilities in ways that are responsive to the opportunities and threats afforded by it.

In what follows, after briefly detailing the principal features of the emergent strategic commons of the twenty-first century, we will (i) outline India's emergent strategic-security calculus, (ii) identify the necessary pre-conditions for the development of an Indian strategic-military transformation, and (iii) lay out a tentative roadmap by means of which an Indian strategic-military transformation initiative - one that is cognitively and materially different from a project of modernisation – may be designed and operationalised.

The Emerging Strategic-Military Commons of the Twenty-first Century

Without discounting the possibility of inter-state wars being fought in the classical manner in the foreseeable future, the profusion of information-centric and digital technologies leads us to suggest that the character of the battlespace of the twenty-first century will be increasingly fragmented and granular. One of the principal reasons for this is that high-intensity wars will progressively become financially and economically unsustainable. By way of an example one could cite figures amounting to US$4-6 Trillion spent by the U.S. on its most recent campaigns in Afghanistan and Iraq.[7] Additionally, the U.K. (a primary coalition partner in the war) is said to have spent approximately £4.5 billion on the Iraq campaign, and if the costs of the Afghan campaign are included, the cumulative costs rise to approximately £20 billion.[8] This state of affairs would lead most combatants to seek cheaper ways of waging war.

A second, and equally important, reason for the fragmentation of the emergent battlespace is the observation that global militaries have been compelled to make in the aftermath of the Iraq War of 2003. They have recognised that the asymmetric lead that the U.S. military forces have over the rest of the world is, for the foreseeable future, unassailable. In this connection, it is interesting to note that the Chinese strategic-military establishment has also reached similar conclusions.[9] In other words, there is an emerging collective assessment that a direct confrontation with a military force as well equipped as the American military juggernaut would lead to disaster.

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[4] Alberts, Gartska, Stein, Signouri, *Understanding Information Warfare*, Washington, DC: US DoD, CCRP, 2002, p xiii.

[5] Quoted in Leonard, Robert, L., *The Principles of War for the Information Age*, p 1

[6] Mentioned in Arquilla and Ronfeldt, "The Advent of Netwar (Revisited)" in Arquilla and Ronfeldt (Eds.), *Networks and Netwars: The Future of Terror, Crime, and Militancy*, Santa Monica, CA: RAND, 2001, p 14

[7] Bilmes Linda, J., "The Financial Legacy of Iraq and Afghanistan: How Wartime Spending Decisions Will Constrain Future National Security Budgets", *Harvard Kennedy School (HKS) Faculty Research Working Paper Series,* RWP13-006, March 2013. Available at https://research.hks.harvard.edu/publications/getFile.aspx?Id=923 Accessed on June 20, 2013. See also Stiglitz and Bilmes, *The Three Trillion Dollar War: The True Cost of the Iraq Conflict,* London: Allen Lane, 2008; Bilmes and Stiglitz, "The long-term costs of conflict: the case the Iraq War", in Derek L. Braddon and Keith Hartley (Eds.), *The Handbook on the Economics of Conflict,* Cheltenham, UK: Edward Elgar Publishing: 2011

[8] See Ledwidge, Frank, *Investment in Blood: The True Cost of Britain's Afghan War,* New Haven: Yale Univ. Press, 2013; See also "Cost of wars in Iraq and Afghanistan tops £20bn", BBC News UK, June 20, 2010. Available at http://www.bbc.co.uk/news/10359548. Accessed on June 5, 2013

[9] Heng, Gao, "Future Military Trends" in *Chinese Views of Future War*, Revised Edition, Michael Pillsbury (Ed.), Washington, DC: National Defense Univ. Press, 1998, p 94. Note: This assessment was made post the prosecution of the First Gulf War (1991) by the USA. Not much would have changed since then in the Chinese assessment. If anything, their assessments would have been further reinforced by the U.S. performance both in Afghanistan and Iraq since 2001.

Significantly, however, having recognised and accepted such instances of technological and *matériel* asymmetry, global strategic-military establishments have also discerned – and this has been borne out and reinforced by recent campaign experiences – that despite their overwhelming *matériel* and technological superiority, the U.S. military forces have often found themselves at a disadvantage in close-quarter combat conditions. Examples such as the Battle of Mogadishu (Oct 1993), the Second Battle of Fallujah (Nov–Dec 2004), among others, suggest that much of the American strategic and combat capabilities – in this instance being representative of those displayed by highly technologised military forces - can be blunted if they are drawn into battles fought in (i) heavily populated areas, and (ii) in areas where freedom of manoeuvre is limited. The lessons drawn from these and other recent American experiences have been, essentially, two-fold in nature. By creating conditions wherein a heavily technologised force is compelled to engage in battle in heavily populated spaces and in terrains (physical, informational and cognitive) where its freedom of manoeuvre is restricted, first, the cost of battle (where cost is construed not simply in economic terms, but also in terms of casualties which, aside from having negative strategic-political consequences, disrupts the fluidity of combat operations) rises significantly; secondly, such conditions considerably degrade the ability of technologically superior forces to bring to bear the advantages of, among other things, their advanced stand-off weaponry and surveillance assets.[10] Abstracting out of these conclusions, it could thus be ventured that war and its conduct, in the foreseeable future, may also be expected to increasingly unfold across what is currently referred to as "the human terrain". This will inevitably bring in its wake a considerable dilution of the ability to identify and confront adversarial targets with high degrees of precision which, in turn, will lead to higher levels of collateral damage thereby raising the strategic-political costs of any engagement.[11]

While this is already true in the case of irregular warfare where at least one of the combatants is a non-state actor, there is an increasing probability that professional militaries will use similar means to disorient their more structured (and, possibly, technologically advanced) adversaries as a means to gain tactical and, in some cases, even strategic advantages. Thus, in the foreseeable future, it is suggested that while conventionally-organised forces will continue, for the most part, to pose conventional threats, in the face of overwhelming force, some elements of such forces may be expected to re-create and re-present themselves asymmetrically. A potent example of this was the "transformation" of the Iraqi Armed Forces post its battlefield defeat by the U.S.-led Coalition forces in 2003. The overpowering combat force brought to bear by the U.S.-led Coalition forces shattered and splintered the Iraqi Armed Forces which, as a consequence, lost its cohesiveness as a conventionally-organised combat entity. While this sounded the death-knell of the formal Iraqi Armed Forces, armed elements of it rapidly organized themselves (more often than not in collusion with foreign Al Qaeda fighters) into 'combat cells' and initiated a ferocious subversive campaign against the U.S.-led Coalition forces. This campaign, which was primarily conducted using urban warfare tactics involving IEDs (Improvised Explosive Devices), ambushes, targeted killings, and by a vicious propaganda program aimed at inciting the local populace against the Coalition forces, compelled the U.S.-led forces to adopt – at least in the initial stages – a defensive orientation, which exponentially raised the political costs of the war and deprived the Coalition forces of the benefits of the initiative that they had initially seized in the battlespace.

While the aforementioned example was dictated by conditions of necessity, it is likely that in the foreseeable future a nation-state's forces may deliberately choose to adopt a more amorphous form backed by unconventional combat methods to confront a technologically superior force. As may be expected, such a state of affairs will call

[10] See, for example, Poole, Frank, *Phantom Soldier: The Enemy's Answer to US Firepower*, Emerald Isle, NC: Posterity Press, 2002

[11] One example of this is the fallout from the drone attacks that the U.S. forces have launched against the Taliban. Thus, for example, a "…study by Stanford Law School and New York University's School of Law calls for a re-evaluation of the practice [that of drone attacks], saying the number of "high-level" targets killed as a percentage of total casualties is extremely low -- about 2 per cent. See "Drone strikes kill, maim and traumatize too many civilians, U.S. study says", CNN Wire Staff, Sept. 26. 2012. Available at http://edition.cnn.com/2012/09/25/world/asia/pakistan-us-drone-strikes. Accessed on June 20, 2013. See also "Emerging from the shadows: US covert drone strikes in 2012", Woods, Chris, Searle, Jack, and Ross, Alice, K., *The Bureau of Investigative Journalism*, Available at http://www.thebureauinvestigates.com/2013/01/03/emerging-from-the-shadows-us-covert-drone-strikes-in-2012-2/. Accessed on June 20, 2013

for a fresh re-evaluation of current combat doctrines and postures by the more formalised and hierarchically organised strategic-military establishments.

This brief analysis leads us to suggest the following as being signatures of emergent battlespaces and of constituting – particularly when considered in capability-centric terms – the emergent strategic-military challenges of the twenty-first century:

1. Combat Operations unfolding in built-up areas
2. Degradation of a state-military's heavy-weapons capabilities
3. Face-off between structured and unstructured/ irregular forces
4. Employment of hyper-camouflage
5. Enforcing/engaging in disjointed mobility
6. Forcing battle simultaneously across multiple terrains (physical, informational and cognitive)
7. Leveraging information, molecular and biological sciences and technologies to achieve strategic and tactical advantages in a variety of battlespaces
8. Using commercially-off-the-shelf (COTS) technologies to self-organize and synchronise operations
9. Denial of the employment of a pervasive info-structure (like the Global Information Grid) to envelope the nooks and crannies of the post-modern battlespace

India's Emergent Strategic-Security Calculus

If the emergent conditions of the twenty-first century strategic-military commons as described above serve as a contextual backdrop, then India's emergent strategic-security calculus can be said to be constituted by *seven generic conditions*. Thus, any Indian strategic-military transformational project will necessarily have to develop concepts and technologies against the backdrop of these strategic-military possibilities. These may be listed as under:

1. Low Intensity and Sub-Conventional Conflicts – Domestic/Overseas
2. Conventional Conflicts (primarily region-specific) where the maximal condition would involve a two-front war plus an out-of-area theatre of operations; the most likely condition would be a one-half front war
3. Nuclear, Chemical, Biological attacks against force and value centres
4. Singular and/or sustained attacks on civil and military infrastructure using cyber-centric, high-energy, and electro-magnetic weapons
5. Single or multiple localised Out-of-Area Contingencies
6. Expeditionary and Area-Control operations - to protect resource bases overseas
7. As a node in a (likely, international) Coalition

Additionally, from a capability-centric point of view, the Indian strategic-military establishment may have to confront:

1. An ultra-high-tech adversary or multiples thereof
2. A combinatorial adversarial alliance involving low-tech and high-tech capabilities
3. An ultra-low-tech adversary or multiples thereof
4. An adversary (or multiples thereof) employing an admixture of high-technology and very low-technology
5. An approximate peer-competitive (in terms of technology) adversary (or multiples thereof)

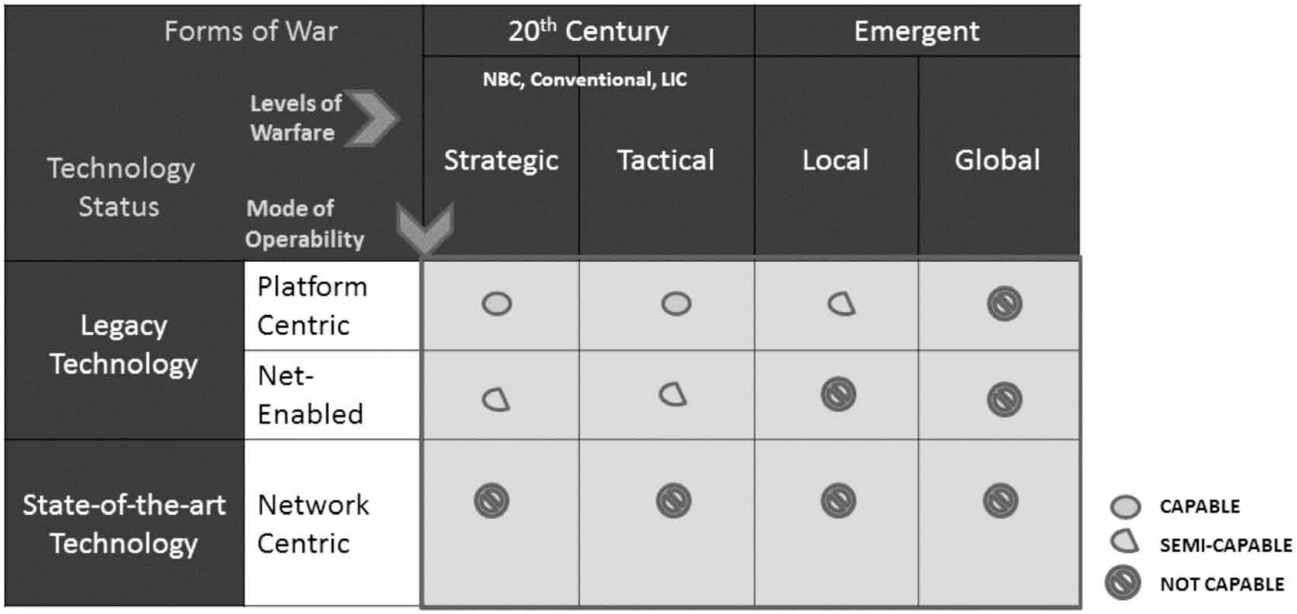
Against this backdrop, even a cursory assessment of India's current strategic-military profile suggests that it remains woefully inadequate – in capability-centric terms - to address the emergent challenges as outlined above. Though boasting the third-largest volunteer war-fighting force in the world with a reasonable complement of heavy weapons capabilities, the profile of the Indian Armed Forces remains decidedly third-generation in nature and character. The legacy-equipment component of the Indian Armed Forces remains high which, when coupled with its associated operational doctrines, will increasingly prove to be burdensome when dealing with the strategic-security challenges of the twenty-first century.

To the extent that the Indian strategic-military establishment has been inducting newer weapon-systems, the model of weapon/equipment acquisition and induction remains focused on modernisation when the need of the hour – given the emergent global strategic-security calculus – is to be transformational. Thus, for example, in the recent past India has (i) acquired and inducted a number of airborne electronic warfare and (manned and unmanned) surveillance platforms, (ii) augmented its strategic heavy and medium lift capability;

introduced tactical ground-attack helicopters and a variety of short and medium range missiles (including supersonic cruise missiles), and (iii) increased the complement of its strike combat aircraft. Additional measures have been (and are being) taken to strengthen the Indian nuclear capability (including miniaturising warhead sizes and developing multiple warhead re-entry capabilities) and related land and sea-based delivery platforms. While each of these acquisition and deployment programmes are efforts to modernise the capability-profile of the Indian strategic-military forces – and to that extent they are laudatory exercises – nevertheless, they retain and reinforce a perspective that presumes a threat-calculus that is conceived in terms of conventional threats (expressed conventionally) emanating from India's western and northern borders.[12]

While there is some merit in retaining these traditional and conventional perspectives on potential sources of threats and their attendant battlespaces, the critical question to be asked is whether or not these perspectives will retain their relevance as India's profile as an emergent power in the twenty-first century matures. The matrix provided below attempts a provisional summarisation of this state of affairs.

Figure1: Situating the current Indian Strategic-Military Capability



An Indian Strategic-Military Transformation Initiative: Essential Pre-conditions

The preceding discussion on the nature and character of the emergent strategic-military commons suggests that it would be foolhardy to deny that there is now an urgent and overriding need to rethink how future wars may evolve and how to prepare for and wage such wars. The importance of this is further underscored by the fact that the current transformation in strategic-military affairs (alternately, a transformation in and of the global strategic-military commons) is a world-wide phenomenon that cannot be ignored or wished away. In this sense, therefore, from the perspective of a nation-state, it becomes *a strategic-military imperative to determine how and under what conditions the evolution of war and combat capabilities is taking place and to urgently explore the possibilities of exploiting this fast-becoming-common paradigm of war and combat*.

For the Indian strategic-military establishment, to effectively initiate a deep, sustained and meaningful transformation programme, it is necessary to first identify

[12] The use of the word "conventional" here includes scenarios involving the potential use of and/ or defending against nuclear weapons. The point that is being made here is that such scenarios are constructed/ imagined conventionally, that is to say, in traditional terms. In other words, the need of the hour is to rethink – creatively – how nuclear weapons may be used by and/ or against Indian interests strategically and tactically.

the low-level transformations that are contributing to and/or will contribute to the emergence of new (or different) ways of thinking about war. Aside from the conceptual work that this will entail, such an initiative will also require intensive testing – physical and simulated – with field formations, operational and strategic decision-making nodes. This will allow the principles underlying a comprehensive strategic-military transformational project to metastasise and will result in its gradual absorption as an organising principle for and within the Indian strategic-military establishment.

Optimally, transformational concepts, technologies, and applications should allow a strategic-military establishment to explore new (alternatively, asymmetrically different) operational concepts and paradigms. Unfortunately, as mentioned above, the current and on-going modernisation efforts of the Indian strategic-military establishment are restricted to the introduction of newer weapon platforms, which are a little more than enhancements of third-generation combat and force-multiplier equipment, and the employment of add-on digital capabilities, which merely involves the use of information technology to marginally enhance the lethality index of the Indian strategic-military forces. Neither of these efforts are sufficient nor are they effective – either individually or collectively – in either qualitatively transforming the nature of the Indian strategic-military force, which remains decidedly third-generation in nature, or of its organisation, which remains stove-piped and hierarchical in design and structure. Put another way, it could be said that if net-centricity is considered to be one prominent signature of a strategic-military transformation relevant to the demands of the twenty-first century strategic commons, then the current and on-going Indian strategic-military modernisation efforts do little in this regard. In effect, the modernisation efforts of the Indian strategic-military establishment remain, at best, a heightened form of net-enablement grounded within a platform-centric world-view.

The object of any future-oriented strategic-military transformational initiative lies in the development of a capability that is able to absorb all variables that present themselves for every interim variation of the full spectrum of warfare – from the platform-centric to the fully networked and beyond. Thus, the original *concept of operations* envisioned by the theorists of the network-centric paradigm of war, which forms the kernel of what is commonly known as the "transformation of force project", involved *operating in the physical battle-space and deriving force-multiplier benefits by leveraging the Informational and Cognitive Domains.* In all of this, the Cognitive domain was and remains under-explored as the focus of interest continues to be fixated on exploiting the technological and operational benefits of networking and connectivity within the battlespace. However, if, as Szafranski suggests, "military power resides in the domain of the mind and the will…the provinces of choice, 'thinking', valuing or 'attitude,' and insight or 'imagination'"[13], then *the cognitive domain retains the greatest transformative potential* to "fuel the nightmares and disorientation…in the enemy's internal world."[14]

To this end, the primary macro-objective of an Indian strategic-military transformation effort should be oriented towards the development of capabilities that will enable the designing and employment of effects-based operations (EBOs) that could be delivered in the form of "global strikes" and whose effects can be calibrated to have not only global effects, but also granular, local, and trickle-down effects, which can be both kinetic and non-kinetic in nature and character.[15] When designed and employed effectively, such measures, among others, will enable the Indian strategic-military ensemble to better engage in fragmentary battlespaces and target adversarial forces who may be distributed across the physical, informational and, most importantly, cognitive domains. *To effectively develop such capabilities will, in turn, require a concomitant emphasis on the creation of revolutionary military concepts and technologies that will allow for the design of such multi-layered and multi-level operations*.

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[13] Szafranski, Richard, "Neocortical Warfare? The Acme of Skill," in *In Athena's Camp: Preparing for Conflict in the Information Age*, Ed. J. Arquilla and D. Ronfeldt, (Eds.), Santa Monica: Rand Corp., 1997, p 395 and 407 respectively.

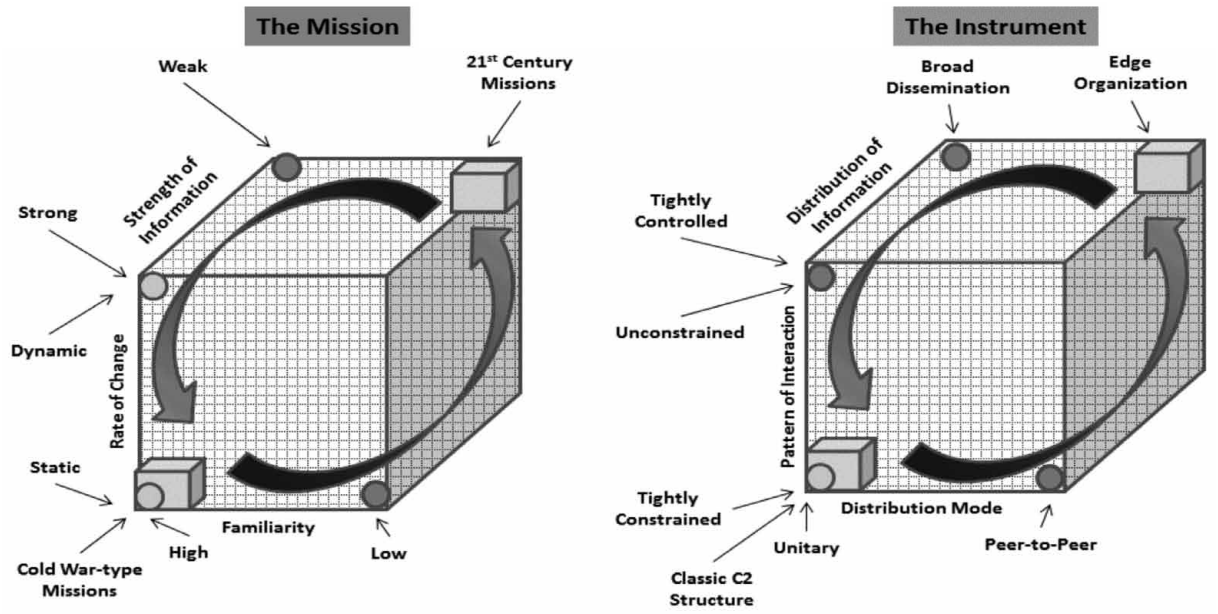
[14] Ibid. My emphasis.

[15] For a fuller description of effects-based operations see Davies, Paul, *Effects-based Operations: A Grand Challenge for the Analytical Community*, Santa Monica, CA: RAND, 2001, MR-1477-USJFCOM/AF; Smith, Edwards, A., *Effects Based Operations – Applying Network Centric Warfare in Peace, Crisis and, War*, Information Age Transformation Series, Washington, DC: US DoD, CCRP, 2003

As a necessary corollary to the above, a prospective Indian strategic-military transformation initiative will also need to focus on developing concepts and capabilities that will interdict, infect and distort an adversary's Common Operational Picture (COP), that is to say, his operational ecology. This can take place by (i) making available data/information that is both misleading (deceptive) and malicious, (ii) distorting the data/information collection, processing, analysis and dissemination processes, (iii) infiltrating and modifying the processes by which the Common Operational Picture (COP) is created and cognised, (iv) creating instances of friction in the assembling of a Collective Engagement Capability (CEC), and (v) deliberately disturbing the Comprehensive Battlespace Awareness (CBA) of an adversary. It is important to note that *the posture necessary to fulfil this mandate will be unavoidably a long-range and offensively-oriented one with the deliberate intent to target an adversary's strategic and tactical battle-networks across the cognitive, informational and physical domains.* In this connection, it is important and necessary to distinguish this from what is commonly known as "cyber warfare". While some elements of the above actions may take the form of "cyber operations", collectively, they are more in the realm of what is best termed as "strategic information warfare", which includes, but also transcends, the operational-tactical nuances involved in cyber operations and cyber warfare.

One of the pre-requisites of being able to engage within fragmented battlespaces is the ability to operate outside a command and control structure that is beholden to the traditionally stove-piped decision-making systems endemic to strategic-military establishments. Thus, a critical element of an Indian strategic-military transformation initiative will involve creating conditions wherein agility of command and control (C2) functions can be fostered, and where C2 structures are designed in a flexible enough manner to exploit and operate within fragmentary battlespaces without disrupting the somatic coherence of the strategic-military establishment's structure. In other words, emergent battlespaces of the twenty-first century, which are increasingly being marked by varying degrees of information densities and rates of change, require an agile strategic-military ensemble which can effectively "sense and respond" to their stresses and strains. What the diagram below attempts to highlight is the organic flexibility that a twenty-first century strategic-military ensemble – both in terms of its C2 structure and operational capabilities - is required to exhibit to be able to "sense, respond, and evolve" to the pulls and pushes of the battlespaces of the twenty-first century without sacrificing the need to respond to the demands of traditional battlespaces.

Figure 2: Strategic-military Challenges for C2 Structures in the foreseeable future [16] *(modified by author)*



[16] Source: Alberts, David, S., "Complexity, Agility, and Network Centric Operations", Oct., 2007 and Schlicter, J., McEver, J., Hayes, R. E., "Maturity Frameworks for Enterprise Agility in the 21st Century", PMI Global Congress 2010, North America (Session #TRN10)

To be able to achieve (and, potentially, transcend) these levels of C2 agility, an Indian strategic-military transformational initiative will have to lay emphasis on developing the concepts and related technologies of "self-synchronisation" and "self-awareness" of forces (manned and unmanned), wherein, with adequate (shared) awareness of a "higher command's intent", "edge elements" can take localised decisions based on their local perceptions and situations, while being wholly aware of the larger picture, thus, synchronising globally while acting locally. This, in turn, will have a cascading effect on how the Indian strategic-military establishment is organised. It will – to extract the maximum benefits from such an exercise – have to think in terms of progressively re-orienting itself from being a pyramidal and hierarchical structure into a flattened organisation that is capable of pushing "power to the edge".[17]

Consequent to this, the primary strategic-operational preconditions that an effective Indian strategic-transformational initiative will need to take into account may be listed as under:

1. How to effectively engage with compressed (in terms of time and space) operations and levels of war?
2. How to transform into and/or create an agile, flexible, and responsive strategic-military ensemble that can effectively sense and respond to emergent battlespaces?
3. How to achieve rapid speed of command?
4. How to achieve dynamic self-coordination and self-organisation capabilities?
5. How to design force structures that can operate in dispersed and de-massed forms?
6. Determining what kinds of stealth/counter-stealth and "persistent gaze" capabilities are necessary for strategic, operational and tactical purposes
7. How to achieve superior information levels?
8. How to develop highly refined levels of "shared awareness"?
9. How to proactively alter initial conditions at increased rates of change in battle?
10. What kinds of deep sensor-reach capabilities require development to exponentially multiply the lethality-index of combat forces?
11. Designing a wide array of pre-emptive precision strike capabilities
12. How to develop global strike capabilities that can have effective and impactful micro-level effects?
13. How to create and employ modular organisations of combat capabilities?
14. Determining the nature of, designing, and deploying resilient info-structures that can withstand the most arduous of combat conditions
15. Designing battlespace ontologies to facilitate the construction of combat-related service-oriented architectures for combat and training purposes
16. How to design and operationalise effects-based (kinetic and non-kinetic) operations?

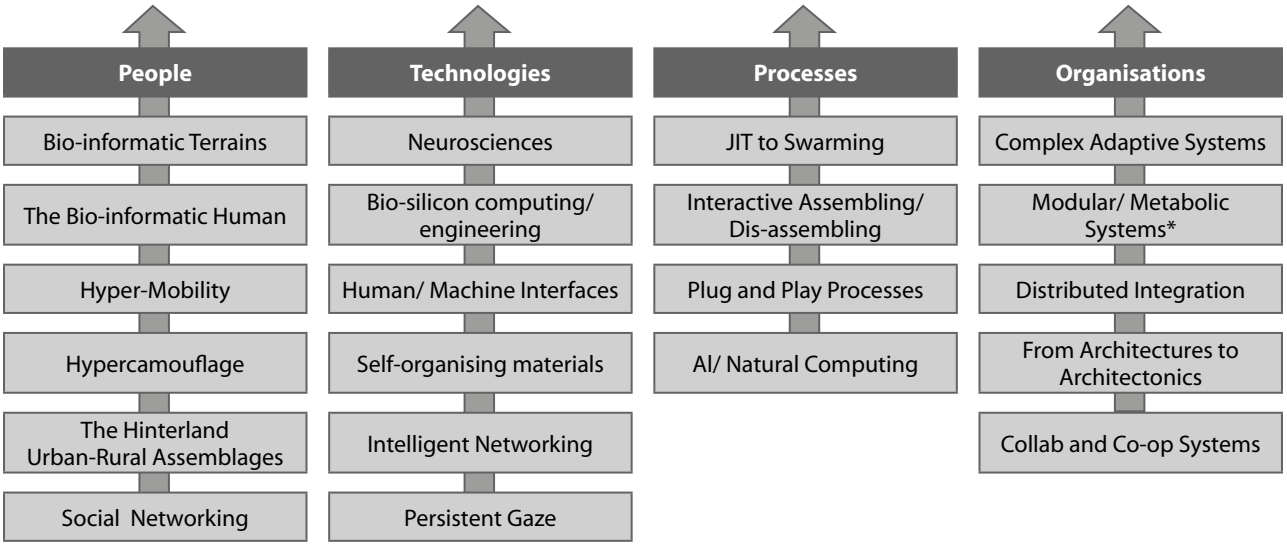
Further, for these (and related) capabilities to be relevant in and for the battlespaces of the twenty-first century, it is also imperative for the Indian strategic-military establishment to identify some of the more critical *generic* science and technology (S&T) areas/domains around which they can be organised. A tentative list of such areas/ domains may be listed as under:

1. Big Data computing and analytic technologies (including AI-driven and semantic search and decision-making systems)
2. Artificial Intelligence (AI) with an emphasis on Natural Computing and Service-oriented architectures
3. Bio-chem-medical Sciences
4. Molecular Sciences/Nano Sciences
5. Space Sciences
6. Transformative/Adaptive Materials Sciences
7. Robotics
8. Information, Communication, and Network (including wireless) sciences and technologies
9. Cognitive, Behavioural, Neuro Sciences
10. Dynamic Networking and Sensor Technologies
11. Social Computing (including Human-Machine Interface technologies)
12. Energy Sciences

[17] As Alberts and Hayes puts it, "Power to the edge involves the empowerment of individuals at the edge of an organization (where the organization interacts with its operating environment to have an impact or effect on that environment) or, in the case of systems, edge devices." See Alberts and Hayes, *Power to the Edge: Command and Control in the Information Age*, 2003, p5

When considered in the context of a deep and foundational strategic-military transformational effort, the identification of these areas/domains of S&T should serve as a prelude to their weaponisation. If we think of war as being a synthetic aggregation of people, technologies, processes and organisations, then it is useful to organise the areas/domains listed above under such headings. One of the key advantages of doing so is that it will allow for developing possible linkages and co-development possibilities with the object of deriving cumulative benefits – both in immediate operational terms and in terms of identifying areas where blue-sky research may be undertaken - with the object of subsequent weaponisation. The chart below depicts how such an organisation of the generic S&T areas – in their potentially weaponised form - may be undertaken. It is also indicative of the most likely ways in which fast-moving developments will take place and which will have a material and cascading impact on the transformation of war and its conduct.

Figure 3: Weaponisable S&T for Strategic-Military Transformational Purposes



A Roadmap for an Indian Strategic-Military Transformation Program

"[Strategic-]Military transformation is the act of creating and harnessing a revolution in military affairs. It requires developing new technologies, operational concepts, and organisational structures to conduct war in dramatically new ways."[18] Thus, if the Indian strategic-military complex intends to effect a deep and sustained transformation as opposed to a modernisation of its profile and capabilities, then the immediate task on hand is to design a credible roadmap for an India-specific Transformation in Strategic-Military Affairs. In the first instance, this would involve the following:

1. Accepting the fact that the nature and contours of the battlespace in the twenty-first century have changed irrevocably.
2. Appreciating the fact that transformations in strategic-military affairs are expressions of changes originally triggered by the production of revolutionary military concepts.
3. Making the creation of revolutionary military concepts involving force (in its various configurations) and its application the centrepiece of any strategic military-technological development process.
4. Developing and support research initiatives by which concept-creation and experimentation – with specific reference to war and its conduct – can be facilitated.
5. Creating doctrines and modes of operability organised around emergent military concepts.

[18] Binnendijk, Hans, "Introduction" in *Transforming America's Military*, H. Binnendijk (Ed.), Washington, DC: National Defense Univ. Press, 2002, p xvii

At the heart of the matter lies the following:

1. Linking creativity to implementation by innovative concept-technology pairings
2. Exploring and experimenting with new ways of strategic-military thinking and modes of operability
3. Working at the intersection of unarticulated needs and non-consensual change in the wider socio-technical-strategic-military domain
4. Identifying and managing disruptive strategic-military concepts and technological innovations
5. Identifying ways and means to instil an entrepreneurial strategic-military mindset.[19]

This can be achieved by:

1. Rethinking the nature and characteristics of emergent battlespaces;
2. Conceptualising revolutionary (strategic-military) concepts;
3. Conducting concept-technology paring exercises;
4. Conceptualising and developing evolutionary Battlespace Ontologies;
5. Designing service-oriented Combat Architectures;
6. Designing continuum-based Threat Identification and Evaluation Systems;
7. Developing multi-level Data Fusion capabilities

Simultaneously, efforts should be made to (i) create dynamic architectures that will allow for the formation of Common Operational Pictures, (ii) develop rapid Shared Situational Awareness Services, (iii) design flexible and extensible global and local info-structures to promote strategic, operational and tactical agility, (iv) formulate concepts and designs of Cognitive and Informational Battle Units.

An integral part of this process would involve the incubation and fostering of dynamic physical and simulation/emulation-based test-beds, which would be useful for testing and demonstrating the relevance of the concept-technology pairing solutions, proof of solution-designs, the integrative and extensibility potential of solution components, performance under simulated (constrained) field scenarios, and for supporting limited in-field engineering studies. These efforts would not/should not be independent and/or mutually exclusive processes; instead, they should be integrated efforts that should, optimally, segue into each other and, in this way, will necessarily have cascading effects and impacts on successive developments.

The operative assumption – as mentioned above – is that emergent battlespaces may be expected to vary between platform-centric through a vast range of interim variations to fully networked states or conditions. Thus, the concepts, technologies, and operational solutions that the Indian strategic-military establishment should aim to develop by means of a sustained and evolving strategic-military transformation program must allow for operating in the full range of variations that a battlespace may exhibit due to any increase/decrease in the level of complexity and/or evolution without any loss of command and control.

In a generic sense, therefore, the critical questions that such a transformation of force programme should pose for itself with respect to the above-listed aims and approach may be listed as, but not limited to, the following:

1. How to rethink the problematic of war, strategy, tactics in conjunction with emergent technologies and the human condition, *especially in the context of the deep-future*?
2. How to design weapon-systems as a consequence of innovative concept-technology pairings?
3. How to harmonise between the dictates of a force modernisation strategy and a force transformation strategy?
4. How to efficiently translate (and, as a counter-measure, effectively distort the translation of) the data/information/intelligence that circulates between and across the Physical, Informational and Cognitive Domains?
5. How to leverage (indeed, shift the weight of battle to) the Cognitive Domain to influence strategic-military operations across the Physical and Informational Domains?

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[19] A modified version of these points was originally listed on the Office of Force Transformation, U.S. DoD website and was available at http://www.oft.osd.mil/apart.cfm, which is currently unavailable (as of June 20th, 2013). However, a tangential reference to this may be elicited from a briefing made by the Late VADM Arthur Cebrowski, Director, Office of Force Transformation which may be accessed at: http://www.au.af.mil/au/awc/awcgate/transformation/t11272001_t1127ceb.htm. Accessed on June 20th, 2013

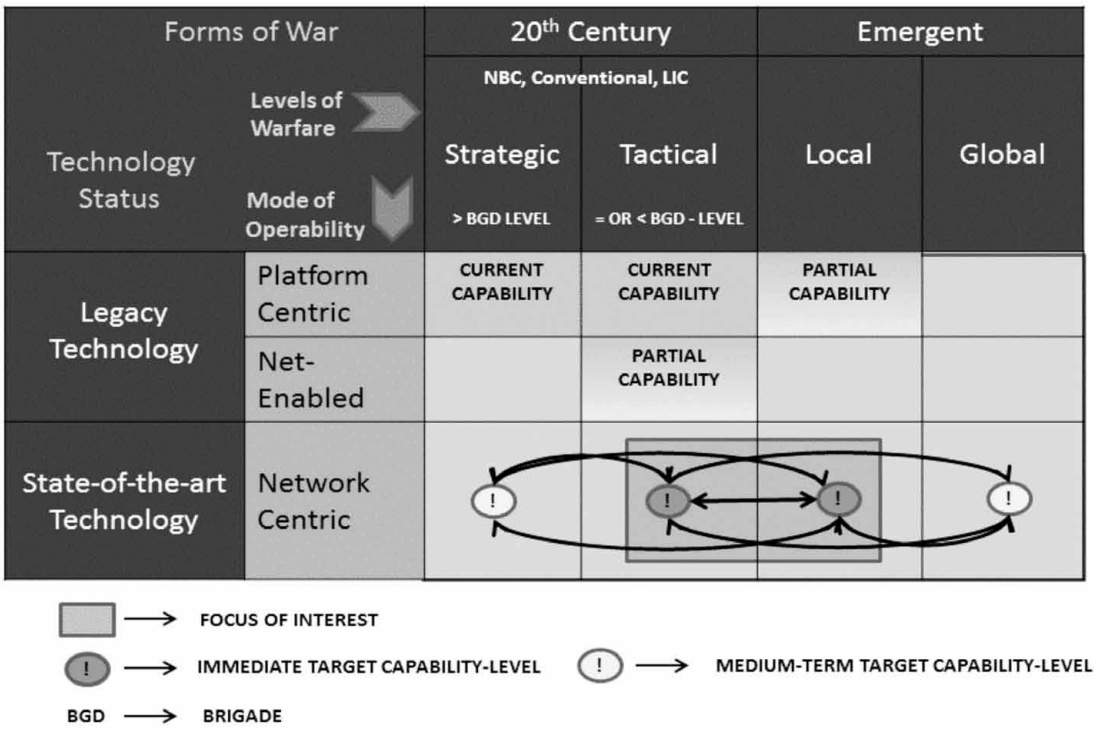
6. How to create a C2 ensemble that can display a very high level of agility, flexibility, and resilience?
7. How to create fragmentary battlespaces thereby denying an adversary the ability to identify and target critical centres of gravity?
8. How to operate in battlespaces of one's own choosing and, in turn, refuse to operate within a battlespace crafted by an adversary?
9. How to design effects-based operations that deliberately creates asymmetric conditions within which an adversary may be compelled to wage war?
10. How to deny an adversary the acquisition of a wide range of data - at various levels of granularity - thereby also denying the adversary the ability to construct common operational pictures with high levels of confidence?
11. How to interdict the hardware and software systems that are progressively underwriting the information grid?
12. How to ramp up offensive strategic information-warfare systems that can be employed both during wartime and during times of peace?
13. How to develop training procedures that will allow for individual creativity to come into play – conceptually, technically and operationally - within the formalised environments of the military establishment?

The above being given, it is also important to recognise that the panacea to the problems posed by emergent battlespaces is not necessarily scientific-technological in nature and character. Indeed, formulating purely scientific-technological solutions to the demands of emergent battlespaces may not always lead to desired outcomes. Perhaps a more effective approach may be to harness science and technology to serve an Indian strategic-military transformational design. In other words, *concepts*, which are a product of the imagination, should be the vanguard in the designing of an Indian strategic-military transformation project with science and technology playing the critical role of actualising such concepts into employable solutions. Further, given that science and technology are near-universal in nature, the key factor of differentiation between competitors in the global strategic-military space lies in how concepts are designed and how they are paired with technologies. It is important to remember that while the science and technology may be mirrored, concepts are less easily replicated for they are products of knowledge-networks that are usually specific to philosophico-cultural milieus. India, like China, in this instance, is in a position of relative advantage given her rich cultural and philosophical traditions which, if carefully considered, may provide a rich source bed from which startlingly innovative strategic-military concepts may be fashioned. It is, therefore, important to recognise and appreciate the fact that the way by which an Indian strategic-military transformation project will come to realise its full potential and, over time, be able to distinguish itself from other such competing projects that may be currently underway globally (or that may be undertaken in the future) is by foregrounding innovative concepts, that is to say, by designing (and operationalising) revolutionary military concepts.

Conclusion

Any initiative that aims to effect a strategic-military transformation must remain cognisant of the dangers that attend such a venture. Earlier, in passing, we had occasion to contrast the projects of transformation and modernisation. It is important to bear in mind that these projects are not mutually exclusive. In the specific instance of an Indian strategic-military transformation, given the recurrent threats that India faces along her northern and western borders, it would be unwise to initiate a wholesale transformation of her strategic-military forces. A more nuanced approach would involve creating a core transformational space that would spearhead such a process. The objective, in this instance, should be to have a core strategic-military transformation process exercising a centrifugal-like force – over time – across the entire Indian strategic-military spectrum. In other words, *a strategic-military transformation with Indian characteristics should be revolutionary in nature, but evolutionary in character*. When rendered in the form of a matrix, this may be represented as per the diagram below.

Figure 4: Situating an Indian Strategic-military Transformation Initiative



It is also worth pointing out that a nation-state's strategic-military ensemble's plasticity, malleability, elasticity, resilience – or lack thereof – is evident in the manner in which it contends with *technological and doctrinal surprise* in the battlespace. This is one of the most critical challenges that a strategic-military ensemble can face. It is under such situations that its adaptability, resilience, depth of capabilities, modularity, tactical flexibility, operational elasticity etc. are put to severe test. Thus, how a strategic-military ensemble manages technological and doctrinal surprise/change in a comprehensive battlespace (that includes but which is not limited to the operational level) may be said to be indicative of its *transformational quotient*. Based on this, it could be said that in modern and emergent battlespaces, given the pace at which technology and doctrine (science and strategy at a higher level of abstraction) are pushing the envelope of "what is possible", strategic-military competition is, in effect, a competition between transformational quotients. Seen in this light, therefore, being compelled to assume a reactive stance in the face of techno-doctrinal surprise/change is already a measure of accepting defeat.

There is an undeniable strategic-military imperative to expose the Indian strategic-military establishment to concepts and technologies pertaining to the transformation of force in a structured and programmatic manner. This process will necessarily involve developing and disseminating revolutionary strategic-military concepts, which would be actualised technologically and operationally - in an evolutionary manner. This will allow the Indian strategic-military establishment to gradually absorb such transformations and segue towards the creation and exercise of capabilities that will enable it to effectively address and confront the vagaries of the twenty-first century battlespace and the evolving "strategic-military commons".

Author's Biography

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Since June 2012, this project by the Institute of Defence and Strategic Studies (IDSS is a constituent unit of RSIS) has been engaged in identifying and analysing the key sources of strategic stability and instability in contemporary Asia. We sought to augment the prevailing understanding of how forces that stabilise Asia can be strengthened, and how forces that destabilise Asia (or have the potential for doing so) can be managed, and their adverse effects mitigated or contained.

The project addresses three key research concerns: First, examine major power relations in Asia. Second, analyse interstate dynamics within the maritime domain. And finally evaluate the impact of new and emerging military technologies in Asia. To that end, we organised three workshops during January-February 2013. We also commissioned a number of policy briefs, research papers, monographs, and edited volumes on critical security issues that have the potential to affect the security order in Asia over this decade.

The project is funded through a grant from the Chicago-based John D. and Catherine T. MacArthur Foundation.

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