

Climate Change and the Military

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India is a responsible regional and global power. The military is a highly energy and material intensive part of a nation. It is also destructive in its primary mission. It is incumbent that the Indian military also must be part of the adaptation and mitigation process of climate change and related matters such as arresting environmental degradation and restoration of natural capital. This article shows some indirect linkages of climate change and war in the past. In addressing the contemporary debate on climate change it shows the existing initiatives and ethos in the military in green consciousness. Areas where the military needs to understand the scientific basis of impact on its warfighting capacity is a priority issue which has been highlighted from the open domain. The military's efforts in arresting climate change including ozone depletion is just one part of the spectrum. It also includes future challenges of reducing, to the extent possible due to operational reasons, the military's impact on the environment in the future and some areas for further research.

Background

Climate change is a complex security challenge which needs to be addressed. India is a developing country. It in the first place never caused the problem. However, an impression is being created that India is the part of the problem. These are strategies in geopolitics to put pressure on India to limit its fossil fuel emission. Industrialised countries have not shown any inclination to deliver and accept their common but differentiated duties. However, India is a responsible country. It has shown how it can adapt as also mitigate by innovation. The Copenhagen Accord arrived at in December 2009 during the 15th Meeting of Parties to the Framework Convention of Climate Change has an Indian proposal for voluntary reduction of carbon intensity by 20-25% by 2020 based on the year 2005. What it means is that we need to act at home while diplomats put pressure on the implementation of emission reduction by industrialised countries for meaningful mitigation.

The National Action Plan on Climate change under the stewardship of the Prime Minister is about to operationalise the eight missions.¹

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These will reduce our emission voluntarily and we will be in synchrony by being mindful of the environment. But we all know, that in international diplomacy a country has to show verifiable, truthful and sincere results by having necessary legal instruments and incorporating the actions in governance. Surely an equitable solution will be arrived as negotiations proceed. However, this does not absolve any military to shy away or ignore its role in the environment.

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The military as a cultural practice has been performing green practices. The cantonments are having green cover, there are ecological task forces of the Indian Army greening arid desert and barren mountains. Water harvesting, green awareness including non use of poly bags, renewable energy like solar panels are in use. The Military Engineering Service is reported to be attempting to incorporate ecological friendly and green building specifications, though it may need a top down push under the urban mission to get the right budgetary and policy support. Ecologically conscious leadership after raising an ecological cell under Quartermaster General Branch in the early 1990s have now entrusted the coordination of environmental issue with the HQ of the Integrated Defence Staff. Formations regularly conduct events on raising ecological consciousness of the troops and families.

But as an institution having an energy intensive equipment and destructive capacity, much more needs to be done. This paper highlights what are the issues that need further consolidation and how the military can help in combating climate change. The paper will include

- (a) Current Historical Work on Link of Climate Change and War
- (b) Current Initiatives taken by the Military
- (c) Impact on Warfighting Capability
- (d) Areas of Future Research and Inquiry by the Indian Military

Historical Research on Link of Climate Change and War

It needs to be noted that that not all civilizations ended due to wars brought about by environmental degradation, resource scarcities and climate change. Severe tectonic disturbances by earth quake in 2000 BC affected the course of the Indus, which helped dry the Ghaggar- Hakra rivers. Modern remote

sensing confirms the theory that dramatic shifts in river courses might have created floods that could have cut off food production areas from cities of the Harappan Civilization.² During the Mature Harappan period, about 2500 BC, there was a great rise in the amount of rainfall, but by the beginning of the second millennium BC, it had dropped markedly with damaging effect on food production, further resulting in de-population of cities. One of the reasons for the unpredictability of the rainfall was the extreme deforestation and loss of tree cover caused by burning charcoal in brick-baking kilns. In sum, shifting rivers, rainfall decline, insufficient food led to a slow but inevitable collapse of Indus system. It was a combination of civil unrest, weak central authority, resultant out migration, and by about 1700 BC Mohenjodaro became a ghost town.³

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Why Mongols expanded their empire between 1190 and 1258 AD? One possible reason could be climatic. Yale historian Valerie Hansen avers that a steep and regular decline in the mean annual temperature in Mongolia between 1175 and 1260 resulted in less grass for Mongol herds, prompting the Mongols to conquer new territories.⁴ Andrew Wilson also places the Mongol expansion on environmental change.⁵ David Zhang, geography professor at the University of Hong Kong links the 13th century drought as a reason for the Mongols to invade China.⁶

Jared Diamond similarly documents the demise of the Polynesian from Easter Island due to deforestation and other ecological problems and warfare as a result. He calls it ecocide: people inadvertently destroying the environmental resources on which their societies depend and narrates the story of the demise of the ancient Maya, the Greenland Vikings and present day problems in Rwanda, Haiti and the Dominican Republic. Climate change is a new complication.⁷

Recent Work on China . These examples could possibly be termed as anecdotal by some critics. Hard scientific data is required to reconstruct and interpret the past. Recent work on China led by David D. Zhang has attempted to explore relationship between climatic change and war by comparing high-resolution paleo-climatic reconstruction with known war incidences in the last millennium.⁸ A strong correlation between climatic change, war occurrences, harvest level, population size and dynastic transition was found. During the cold phase in northern China, the country suffered more often from frequent wars, population decline and dynastic change. As result of recent scientific breakthroughs in establishing precise paleo-climatic records, this experiment was extended to study global and continental levels between AD

1400 and AD 1900, during the Little Ice Age. The proposed hypothesis of the study posits that long-term climate change has significant direct effect on land - carrying capacity (as measured in agricultural production). Fluctuation of the carrying capacity in turn effects the food supply per capita. A shortage of food resources in populated areas increases the likelihood of armed conflicts, famines, epidemics and reduction in population size. In the same manner as Northern Hemisphere (NH) temperature variations, the incidence of warfare in the NH, Europe, Asia, and the arid areas of the NH (i.e., the arid zone from Eurasia to North Africa) in A.D. 1400 – 1900 tends to follow a cyclic pattern with a turbulent period followed by relatively tranquil one.⁹

Historical Work on India. Unfortunately in India not much of historical data in terms of climate history based on paleo-climatic records, detailed documentation of wars, record of agricultural production and population data has been compiled for analysis and interpretation.¹⁰ One study on northwest India due to changes in the Indian summer monsoon concludes that: “The India summer monsoon reached the peak of its intensification in the early Holocene¹¹ 10,000- 7000 calendar(cal) years before present (BP) and thereafter weakened gradually. Several major rivers, including the Indus were flowing with full vigour during this time. The abundant summer rain in the early Holocene helped early people to augment their agricultural practices and grow a variety of cereals, lentils and grains. This brought about a change in the living style of the people from hunting, gathering and pastoralism to subsistence economy, one centred around settled agriculture and domestication of wild animals. Weakening of the summer monsoon led to the beginning of arid phase in South Asia ~ 5000 – 4000 cal yrs BP. This triggered a chain of change in agricultural practice and food habits in South Asian population. In some cases, societies adapted to monsoon failure by constructing ponds, dams, and other rain harvesting structures. In other situation people migrated eastward towards Ganga plain, where rainfall was sufficient to sustain burden of new influx of human population.”¹²

Ongoing Project by Oslo Peace Research Institute. There is no consensus of climate change to conflict.¹³ Scholars from the Center for the Study of Civil War, International Peace Research Institute Oslo (PRIO) are researching on “Implications of Climate Change for Armed Conflict” with a view to get the link being mentioned in the forthcoming IPCC report (the Fifth) on climate change.¹⁴

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resource struggle and war. Thus we need to cooperate and avoid conflict. Technology, science, life styles changes and good practices will not let violent conflicts happen. Good strategy in 21st century is premised on absence of wars and an attitude which rejects beggar thy neighbour concepts of the violent past. The military here needs to take the lead.

Current Initiatives taken by the Military

What stands out as unique is the involvement of the military in implement the Montréal Protocol. The protocol attempts to protect the vital stratospheric ozone layer from damage by manmade ozone destroying substances (ODS) being used in air condition and firefighting industry including its use by the military. The nation has entrusted the banking of Halon (A critical fire fighting ODS gas under phase out used in aircraft, ships and tanks) to the military and The Centre for Fire, Explosive and Environment Safety (CFEES) of Defence Research and Development Organisation (DRDO). A joint service committee has been set up to reduce and finally eliminate use of ODS in defence applications and find climate friendly replacements. For coordinating the effort, Headquarters (HQ) Technical Group, Electronics and Mechanical Engineers (TG EME), New Delhi have been made the nodal agency by Perspective Planning Directorate. A seminar to come to grip with the problem and evolve an action plan was held at TG EME on 29 April 2009. The Vice Chief of the Army Staff was the Chief Guest - which indicates the concern the military has on environmental matters. It was correctly pointed out that ozone depletion is just one of the issues impacting on climate change. Climate change is interrelated and is also happening due to excess of green house gases in the atmosphere emitted by mankind due to fossil fuel use and other activities.

Another path breaking project initiated by the Centre for Air Power Studies on 15 September 2009 was the launch of International Project "Climate Change and the Military : Copenhagen and Beyond". The importance of how seriously the military is now interested in the topic can be argued by the fact that as in the seminar on ODS, this time the Vice Chief of the Air Staff Air Marshall P.K. Barbora, PVSM, VM, ADC delivered the key note address in which he questioned whether the issue is impact of military on climate change or is it the other way round- the impact of climate change on the military. It was argued that both are interrelated and he urged that more work needs to be done on the impact of climate change on military activities like more humanitarian work due to more disasters, and cutting down ODS in defence applications. The crux of the message was that the project on climate change and military indicates that the military will get involved more and more in the subject.¹⁵

Impact on Warfighting Capability

Recent studies at the IDSA have also attempted to flesh out the impact on

war fighting capability. Recommendations are enumerated below. There is enough scope for more number of issues being identified.¹⁶

Military Operations.: Comprehensive and detailed scientific assessments and projections need to be undertaken to estimate the probable extent of glacial melt in the next 10-15 years, especially in areas where the Indian military operates. Adaptation changes in operational and tactical strategies, logistics plans, equipment and infrastructure to the likely meltdown scenario, then need to be worked out in a planning document.¹⁷

Factoring Long-Term Slow Impacts: The long-term slow impacts of climate change would force gradual adjustments in military operations. Detailed and explicit field studies are required especially with respect to:

Campaign season.

Logistics.

Surface mobility by vehicles, draft animal and on foot.

Weaponry like change in firing tables and conditions for artillery fire.

Health impacts due to spread of diseases, both new and old (for both humans and animals).

Naval Operations. The future security environment and operational conditions being shaped by climate change will affect the Indian Navy the most, being the oceanic global arm

Strategic Level: At the strategic level, the Indian Navy will need to revisit its strategic interests and mission types in view of the changing geopolitics, the energy security dynamics, likely future emission constraints, operational conditions, changes in marine biosystems and increased relief, recovery and humanitarian commitments being shaped by climate change. Securing sea lines of communications—an important mission factor—would have newer dimensions. Likely Arctic ocean operations in the future need immediate focus.

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Force Structuring: Increased relief and humanitarian missions, changing operational oceanography, shoreline morphology, extreme weather operations and likely future emission constraints require force structure and decision planning, now envisioning the future scenarios,

while balancing present strategic and operational imperatives.

Sea Level Rise: Sea level rise would affect Indian naval operations at all levels of warfare—strategic, operational and tactical—impinging on issues of maritime boundaries, EEZ, port operations, shallow water operations—notably for submarines—and naval tactics. For the various scenarios of sea level rise, impact studies need to be undertaken specifically with respect to:

1. Maritime zones and Exclusive Economic Zone (EEZ).
2. Port operations.
3. Protection of bases and coastal installations.

Ship Design, Equipment and Manning: Ship design with reduced carbon footprint for greater role adaptability for crew and hull for rapid response and deployments, and greater sea-keeping ability to cope with higher sea states and prolonged extreme weather operations. Naval equipment needs to be relevant to climate-induced disaster relief missions especially in construction, sanitation, fuel and water transportation, pharmaceuticals and medical supplies, power generation equipment, etc. Manning and training policies need to factor in carrying humanitarian and civil relief workers more frequently, requiring a shift in operating principles and including them in regular training missions too, in non-crisis periods.

Air Operations.

- In general, to maintain a credible military aviation structure, it is essential to cater for changing climatic patterns. This would be only possible if existing structures like the meteorological branches of the Army, Navy and Air Force are trained and equipped to address future challenges. Also, India Met Department would have to play a key role in respect of data and technology sharing with the armed forces.
- Aerosol concentration in the atmosphere affects the performance of Precision-Guided Munitions (PGMs). Moisture content in the atmosphere, fog particles, dust particles, etc., adversely impact the performance of such weapons. Such minute changes in the aerosol concentration of the atmosphere need to be monitored on a continuous basis. Also, the gaseous concentration in the atmosphere may also change due to climate change. All such types of effects may have a direct or indirect impact on the aviation activities.
- Any military aviation infrastructure constitutes significant ground assets in the form of maintenance services for the aerial platforms, network of fixed and re-deployable radars, fuel depots, missile silos, etc. Particularly, for the units close to the sea coast, care need to be taken for a likely rise in sea levels.

Areas of Further Research and Inquiry by the Indian Military

For reasons of inaccessibility, ruggedness of the terrain and sparse network of gauging sites, the hydrology of the rivers and the nature of climate change in the region of Himalayas have not been studied adequately.¹⁸ It is lonely, time consuming work, equally demanding of body and mind.¹⁹ In 2007 out of 9,575 glaciers in India, research had been conducted only on around 25 to 30.²⁰ The military is deployed along high altitude in the Himalayas. The current need is that we need India specific studies including Tibet rather than those of say the Alps or Andes. A coordinated effort must be launched to monitor climate and glacier and related issues. The services must reach out to various institutes and organisation studying the problem.

Besides consolidating the good work done so far by the military,²¹ there is a need to identify areas like green consciousness and how military can reduce its carbon signature and ecological footprint. Scholars in best Western universities are researching on a comparative analysis including the incentives for militaries to take action on environmental issues (legal compliance, financial, national security etc.) and the historical role of military and defence funding in promoting technological innovation and the rapid development and deployment of technologies that are currently in wide spread civilian use (e.g. cell phones, the Internet, nuclear power generation etc.).

Green Military. One set of questions which has been asked is reproduced below and may give a good conceptual background for policy makers to facilitate research by data availability and encouragement.

1. Has the Indian Military established special teams dedicated to looking a climate change risks?
2. Is the Indian military subject to environmental legal obligations? Is that an important incentive for action?
3. Does the military conduct greenhouse gas emission assessments? Are we aware of other institutions that have estimated the military's annual greenhouse gas emission?
4. Energy conservation and energy efficiency – Has the military issued guidelines on these matters?
5. Are we familiar with involvement or deployment of “Green Buildings” commitments and standards?
6. Are we familiar with trying to move to electric and hybrid vehicles?
7. Is the military involved in other environmental technology implementation such as land remediation, water treatment, and waste reduction?
8. Is the Indian military in a position to lead changes within other governmental agencies and generally in the country? How will its leadership be viewed in the eyes of the public?

Military's Impact on Environment

As negotiations for second commitment to the Kyoto Protocol proceed (now under the title of Copenhagen Accord), in future there is a likelihood of more number of issues that may impinge upon the military- like impact of aviation on climate change or emission of ships at sea. Surely the future may include clauses and protocols on treaties regulating it as climate change may actually become an existential security threat overriding narrow sovereign security arguments.

World's shipping emissions may grow 30 per cent and by 2020 shipping may be responsible for nearly 6 % of global emission.

An air power related factor is the contribution of civil and military aircraft to climate change. For the example of the US, surface transport contributes 24.2 per cent of green house gas emission and aircraft 3.2%. Earlier research as reported in mainstream journals the worldwide airlines produce only around 3 % of the world's man-made emissions.²² Recent research as in December 2009 in *Nature* places it between 4 and 8 per cent with aircraft vapour trails responsible for 15-20 per cent warming of Arctic.²³

High altitude emission are disproportionately damaging to environment. Nitrogen oxide from jet- engines exhaust leads to formation of ozone, another green house gas. Contrails are also suspect of enhancing formation of cirrus clouds which adds to global warming. Inter-Governmental Panel on Climate Change had estimated the overall impact of global warming of aircraft is between two and four times of their CO₂ emission.²⁴ With the projected growth of aviation industry like air travel, the contribution is going to increase. Air Traffic Controller operations where aircraft do not waste fuel due to landing restrictions also need a disciplined and professional management to the civil industry in which the IAF can contribute.²⁵

In climate negotiations, the world community in future may also pose restrictions to control aviation's contribution to global warming. Military aircraft in future may also be included in the global total: though due to national interests and sovereignty principles of nations, the time is not ripe for any country to have climate friendly aircraft (like propeller driven aircraft in place of jets), future planners cannot ignore this new environmental security challenge.²⁶

For a good beginning , emissions prevented must be worked out by military aviation sector with use of simulators. If incentives are given then further emission can be cut by creative use of simulators without sacrificing the need for “real” live training.

Similarly B vehicle fleet of the army can not continue to be high emitters. It is unlikely that military surface transport can switch to gas as matching infrastructure in field not available. For efficiency liquid fuel will always be the preferred choice for operational and logistical reasons. However, there is a good case of achieving both fuel efficiency with reducing carbon intensity and more work on this needs to be done for replacement fleet by incorporating the private sector.

With the employment for man pack or animal pack movement, there is also a case to study how much emission have been saved by the Indian military in operations in the Himalayas. Combined with this is the possibility of reducing tonnages of winter stocking in the operational areas by procuring material locally if possible or by innovative use of local draft animals or porters and cut down emission by fixed wing, rotary wing air craft or by surface mechanical transport. Here cost of preventing ecological degradation would have to be weighed against getting the material from rear depots in the hinterland. It is well know that daily maintenance tonnages are dominated by ammunition and fuel which can not be procured locally. Sometimes operational necessity may override carbon footprint needs. This however must be well studied. Reuse and recycling also needs to be further refined.

Conclusions

Climate change is no more a specialist subject to be addressed by scientists or diplomats . Since the dawn of 21st century , the adverse impact of climate change as global warming is high on the security agenda of the international community. This article has attempted to capture the current practices of the military and what the future policy and activity should be. The military budget is over two per cent, but surely its green house gas emission are more than that figure due to energy intensive nature. By contributing to reduce carbon footprint , the military will be contributing immensely to the national and global mitigation action. None of the actions suggested here will make us regret later, rather will also lead to ecological restoration of our country and the earth.

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1. Eight National Missions, form the core of the National Action Plan, representing multi-pronged, long term and integrated strategies for achieving key goals in the context of climate change. These national missions are : Solar, Enhanced Energy Efficiency, Sustainable Habitat, Water, Sustaining the Himalayan Eco-system, Green India, Sustainable Agriculture and Strategic Knowledge for Climate Change.
2. Burjor Avari, *India: The Ancient Past, A History of the Indian sub- continent from c. 7000 BC to AD 1200*, London/ New York, Routledge, 2007, pp.53-54.
3. Ibid.
4. As quoted in Nayan Chanda, *Bound Together: How Traders, Preachers, Adventures and Warriors Shaped Globalization*, New Delhi, Penguin/Vikings, 2007, p.184.
5. Andrew R. Wilson, "War and The East", *Orbis, A Journal of World Affairs*, Vol.52. No. 2, spring 2008, pp.358-371.
6. See Reuters, *The Hindustan Times* (New Delhi), November 23, 2007. Also see Andrew R. Wilson, "War and The East", *Orbis, A journal of World Affairs*, Vol.52. No. 2, Spring 2008, pp.358-371.
7. Jared Diamond, *Collapse: How Societies Choose to Fail and Succeed*, London, Penguin Books, 2005.
8. David D. Zhang, C.Y. Jim, George C-S Lin, Yuan – Qing He, James J. Wang and Harry F. Lee, " Climatic Change, Wars and Dynastic Cycles in China Over the Last Millennium", *Climatic Change*, Vol. 76, Nos 304, June 2006, pp.459- 477. 1672 wars from 1000 to 1911 AD were used as data base
9. David D. Zhang, Peter Brecke, Harry F. Lee, Yuan- Qing He, and Jane Zhang, " Global climate change, war, and population decline in human history", *Proceedings of the National Academy of Sciences* , vol. 104, No. 49, December 4, 2007, pp.19214-19219.
10. Prof David Zhang when queried about India responded by e mail on 06 March 2008. In his study wars in India during the last millennium were included. According to Prof Zhang, the wars in India do not reflect temperature cooling because the country is sub- tropical and tropical where the cooling did not lead to environmental crisis. The situation was the same as in Southern China.
11. The Holocene is the name given to the last 10,000 years of the Earth's history the time since the end of the last major glacial epoch, or "ice age." Since then, there have been small-scale climate shifts -- notably the "Little Ice Age" between about 14th to end of 19th century, but in general, the Holocene has been a relatively warm period in between ice ages.
12. Anil K. Gupta, David M. Anderson, Deep N. Pandey and Ashok K. Singhvi, " Adaptation and human migration, and evidence of agricultural coincident with changes in the Indian summer monsoon during the Holocene", *Current Science*, Vol. 90, No.8, 25 April 2006, pp.1082-1090. The Indo- US joint project was based on proxy records of monsoon winds from marine sediments from Arabian sea, land records from southern Oman and Tibetan plateau. Previous palynological and archaeological evidence was used. Another study in *Current Science* though strictly speaking is not on climate change but has studied the rise and fall of Vijayanagar Empire in 13th – 16th century AD based on trade in natural resource. See K.N. Ganeshaiah, R. Uma Shaanker and R. Vasudeva, "Bio- resource and empire building: What favoured the growth of Vijayanagra Empire?", *Current Science*, Vol. 93, No. 2, 25 July 2007, pp. 140 – 146.
13. Idean Salehyan, " From Climate Change to Conflict? No Consensus Yet", *Journal of Peace Research*, Vol. 45, no.3, 2008, pp.315-326.
14. Presentation by Dr Halvard Buhaug with Dr Ashild Kolas at IDSA on 30 November 2009.
15. As the first step a joint effort with United Nations Environmental Programme (UNEP) and other agencies, Centre for Air Power Studies (CAPS) has produced a monograph in 2009 on the good practice of the military in environmental stewardship. See AK Singh, Manoj Kumar and Atul Bagai, "Ozone Protection and National Security: Toolkit for Defence Forces", Multilateral Fund for Implementation of Montreal Protocol, UNEP, Nairobi and CAPS, nd.
16. This section is based on a recent study, see Sunil Chauhan, P.K. Gautam and Ajey Lele, "Impact on Warfighting Capability of the Indian Military", in Report of the IDSA Working Group, Security Implications of Climate Change for India, New Delhi Academic Foundation, 2009, Chapter 8, pp. 143- 158.
17. It needs to be noted that according to a discussion paper placed on the web by Ministry of Environment and Forests in 2009, it is premature to attribute glacier retreat abnormally due to global warming. See MoEF Discussion paper, V. 'K Raina, "Himalayan Glaciers: A State- of – Art Review of Glacial Studies, Glacial Retreat and Climate Change".
18. M. R. Bhutiyan, Vishwas S. Kale and N. J. Pawar, " Changing stream patterns in the rivers of northwestern Himalayas: Implications of global warming in the 20th century, *Current Science*, Vol. 95, No. 5, 10 September 2008, pp. 618-626.
19. As told by glaciologist D.P. Dholal of the Wadia Institute of Himalayan Geology, Dehradun, in Somini Sengupta, "The retreat of the Himalayan glaciers", *New York Times* reproduced in *The Hindu* (New Delhi), July 19, 2007.
20. As told by former Deputy Director General of Geological Survey of India Shri V.K. Raina,
21. *The Hindustan Times*, March 03, 2007.
21. P.K. Gautam, "An Overview of Ecological Task Force (ETF) and Ecological Institutions of the Indian Army", *The Journal of the United Service Institution of India*, Vol.CXXXIX., No.576, April- June 2009, pp. 267- 273. and
22. *Environmental Security: New Challenges and Role of Military*, New Delhi, Shipra Publications, 2010
22. *The Economist*, June 10th, 2006, pp.9, 61-62 and 67-69.

23. R. Prasad, "Effect of aircraft emission studied", *The Hindu* (New Delhi), December 24, 2009.
24. *Ibid.*
25. Former Chief of the Air Staff Air Chief Marshall S. Krishnaswamy has suggested that the IAF and civil aviation should complement each other. See "Fly over this divide", *The Indian Express*, August 8, 2005.
26. The request for proposal for the fighter aircraft by India must also include an assurance for assured supply of a halon or its replacement by the vendor. At a seminar at CAPS on Phase out of Ozone Depleting Substance on August 19, 2009 it was mentioned that probably this aspect had been inadvertently overlooked