

AIR POWER

Journal of Air Power and Space Studies

Vol. 13 No. 3 • Monsoon 2018
(July-September)



Contributors

Mr S Jaishankar • Air Marshal KK Nohwar • Prof Rajaram Nagappa
• Mr Avinash P • Ms Riffath Khaji • Group Captain RK Narang
• Group Captain JPS Bains • Ms Hina Pandey • Dr Stuti Banerjee
• Ms Pooja Bhatt • Mr Cyriac S Pampackal

CENTRE FOR AIR POWER STUDIES, NEW DELHI

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Cyriac S Pampackal

➤ EDITOR'S NOTE

As we shift gear and move into the third quarter of 2018, it is time to reflect on how the 'earth-shattering' events of the last quarter actually panned out.

The 'trade war' between the US and China has intensified into more than just a slug fest, with the volume of tariffs being imposed on each other's imports reaching incomprehensible levels with each passing day. The economies of both nations are bracing for a staring contest to see which blinks first. With China's mounting debt, and the fact that as much as 44 percent of its nominal Gross Domestic Product (GDP) in December 2017 was on account of infrastructure investments – as compared with 20-25 percent for the US – it would not be a surprise if China is the first to blink. In a surprise move, in the third week of September, the US imposed sanctions on the Chinese for the purchase of the Su-35 and the S-400 missile system from Rosoboronexport – Russia's main arms exporter – in terms of the US' Countering American Adversaries Through Sanctions Act (CAATSA) that was signed into law by President Trump on July 24, 2017, and is meant to 'punish' the Russian president for interfering in the US elections, and for Russia's involvement in Ukraine and Syria. Although China has protested strongly against this unilateral action by the US, and warned the US to revoke the sanctions or be prepared to "bear the consequences", the chances of the US backing away from enforcing the CAATSA provisions are slim.

The economic cold war has just begun.

Closer home, the 'two plus two' dialogue has resulted in the signing of the Communications Compatibility and Security Agreement (COMCASA) that is meant to "facilitate access to advanced defense systems and (that will) enable India to optimally utilize its existing U.S.-origin platforms". More

than how the COMCASA would play out in the days ahead, the vexing issue is that of the CAATSA. How exactly the CAATSA provisions would apply to India's proposed purchase of the Russian S-400 SAM system would become clear only in the coming days.

The historic meeting between President Trump and his North Korean counterpart, Kim Jong-un – that held the promise for a complete denuclearisation of the Korean peninsula – has not seen any forward movement. Although North Korea has announced measures that include halting further nuclear and missile tests, the ground reality appears to be completely different, based on recent UN reports. The US has, therefore, continued with its tough sanctions against North Korea in an effort to rein in its nuclear weapons programme.

This Monsoon edition begins with an article on 'National Security' by **Shri S Jaishankar**, the former foreign secretary, that was delivered by him during the Jasjit Singh Memorial Lecture on July 18, 2018. Delivered in his inimitable style, the lecture encapsulated the significant contributions of the founder Director General of the Centre for Air Power Studies (CAPS) to national security. He emphasised very lucidly the relevance of "integration and jointness" – as propounded by Air Cmde Jasjit Singh – but added that in contemporary times, their relevance goes well beyond their applicability merely to the armed forces. Mr Jaishankar explained that integration, jointness, coordination and sharing are connected challenges of all large organisations, and, historically, all those who have acted in a more integrated manner have prevailed. He lamented that even 71 years after independence, security challenges continue to be faced by the nation, and suggested the 'securitising' of the foreign policy as an imperative, and also suggested a change in the culture of working in silos in Lutyens' Delhi.

The incessant chatter on the need for Integrated Theatre Commands (ITCs) had reached a crescendo last year. The views of CAPS on the inadvisability of ITCs in the Indian context appeared in these pages as early as the *Journal's* Summer issue of 2017 wherein "joint planning for operations" was given primacy. The common refrain and clamour for the creation of the chief of defence staff was also argued against. The second

article in this Monsoon issue is titled “**Air Power in Joint Operations: Primacy of Joint Training**” and traces the preeminent role that air power has played in joint operations in the various wars India has fought since independence. The gaps in achieving jointmanship have been highlighted by the author. The article also traces the combat training being carried out by the Indian Air Force (IAF), the Pakistan Air Force (PAF), and the People’s Liberation Army Air Force (PLAAF). The threats likely to be faced by the nation in the future, and the need for the armed forces to train jointly to tackle these threats, becomes an inescapable issue. While considering any change to the higher defence organisation, the importance of joint planning and joint training has been amplified. Finally, the article deals with the subject of ITCs in the Indian context.

The claimed range of 450 km in respect of Pakistan’s submarine launched cruise missile, the Babur-3, has been carefully assessed by a team of scholars from the National Institute of Advanced Studies (NIAS), Bengaluru, led by **Prof Rajaram Nagappa**. The article examines whether the fielding of the Babur-3 would have any impact on Pakistan’s progress towards achieving a credible second strike capability and argues against the Babur-3 changing the strategic balance in the South Asian region.

Swarm technology holds great promise for military applications in the future, not the least because of the purported drone swarm attack on a Russian air base on the night of January 5-6, 2018, in Syria. Over the last two years or so, there has been an effort by the Chinese to match the US in ‘swarm’ technology. The emphasis on Artificial Intelligence (AI) as well as advanced Unmanned Aerial Vehicle (UAV) industries of both nations has been the catalyst for this development. Swarm UAV technology – with its possible military applications – has been considered as ‘disruptive’ and the challenge in the future would be to develop ‘anti-swarm’ defences. **Gp Capt Narang** explores China’s leap in cutting edge technology, especially with respect to UAV swarms in the next article. The ability of swarms to fly in Global Positioning System (GPS)-denied areas appears to be the focus of research by the US; something that the Chinese are still trying to ‘catch-up’ with.

The continuing important role that Counter-Surface Force Operations (CSFOs) have played in conflicts since the end of World War II is discussed by **Gp Capt Bains** in the next article. While the lethality of Surface-to-Air Guided Weapons (SAGW) was proved in the 1973 Yom Kippur War, it also revealed the necessity of Suppression of Enemy Air Defences (SEAD) and Destruction of Enemy Air Defences (DEAD) campaigns towards ensuring survivability of strike aircraft in the Tactical Battle Area (TBA) prior to commencement of CSFO missions. The debilitating impact of air power on the enemy's surface forces as well as on his command and control structures was best exemplified during Operation Desert Storm (Gulf War, 1991), although the vulnerability of strike aircraft/helicopters to the Man-Portable Air Defense Systems (MANPADS) remained. Forward Air Controllers (FACs) were still relevant in a fast moving battle if fratricide was to be avoided. The requirement of joint training was an important takeaway from this war. With the growing sophistication of Air Defence (AD) weapons, the necessity of the SEAD/DEAD campaign prior to undertaking CSFO missions was once again highlighted during the Kosovo War. The near absence of joint planning led to cases of fratricide during Op Enduring Freedom – the war on terror unleashed by the US in Afghanistan post 9/11. This was despite the use of space-based assets – that made the battlefield transparent – and Special Operations Forces (SOFs) personnel designating targets for attack by aircraft armed with Laser-Guided Bombs (LGBs).

The world stood with bated breath as the future of the Korean peninsula was at stake. The June 12 meeting between President Trump and his North Korean counterpart, Kim Jong-un was nothing short of a miracle as we had covered in the previous issue of this *Journal*. Were the promises made by both leaders merely optics or were they serious on delivering on the assurances given by both on June 12? **Hina Pandey** revisits the past to find pointers for the future of US-North Korea relations.

While all the brouhaha was on regarding the reclamation of islands by China in the South China Sea, China was simultaneously upgrading its ice breaking research vessel, the *Xue Long* (among the world's biggest). Obviously, as a participant to the Spitzbergen Treaty since 1925, China did

not want to be left out of the race for a share of the oil rich Arctic region – specifically the Svalbard region – which was soon to be ‘up for grabs’, largely due to the adverse impact on the Polar ice cap owing to global warming. What are the geostrategic implications of the redefinition of the Arctic land mass once the Polar ice cap starts melting makes for some shrewd *realpolitik* in the future? How should India play its cards to ensure that it gets its due share in the region, particularly in view of having signed the Svalbard Treaty as early as 1920? These are some of the issues that have been deftly examined by **Stuti Banerjee** and **Pooja Bhatt** in the penultimate article.

The rise of sea levels due to climate change brought about on account of global warming is the biggest environmental challenge confronting the world, especially coastal nations. For India, with a coastline of more than 7,500 km and with island territories both in the east as well as the west, the dangers are real. **Cyriac S Pampackal** discusses the adverse effect of climate change that could lead to a rise in sea levels, and examines its impact on the territorial security of India. Without sounding alarmist, he clinically examines the military infrastructure that is at risk due to possible sea level rise. He also makes a strong pitch for the creation of alternative space launch facilities – an assessment that is ‘spot-on’.

Happy reading



JASJIT SINGH MEMORIAL LECTURE

S JAISHANKAR

It is a great privilege to be invited to deliver the Air Cmde Jasjit Singh Memorial Lecture this year. All of us here would have known of him, and some would have worked with him. This is an occasion to reflect on the contribution of a somewhat unusual soldier-scholar, who helped shape the strategic thinking of our times. Debating contemporary challenges in that sphere with his openness of mind would be the best tribute to Air Cmde Jasjit.

My own association with Jasjit was both official and personal. I first knew of him through Air Mshl Vir Narain when we were both together in Moscow. Thereafter, he was a visitor at my father's home, where I also resided at that time. Once he joined the Institute for Defence Studies and Analyses (IDSA)—which for me was a second family—our acquaintance got much closer. But I really got to know him well when I was posted in Washington, DC and he was sent as part of a government campaign to discourage the United States from supplying Airborne Warning and Control System (AWACS) aircraft to Pakistan. I travelled the length and breadth of the United States with him, including the Air War College in Montgomery, Alabama, and the Pacific Command (PACOM) headquarters in Hawaii. The IDSA culture that my father embodied was one that focussed on the business of muscular advocacy.

This address was delivered by Mr S Jaishankar, former foreign secretary to the Government of India, as the second Jasjit Singh Memorial Lecture on July 18, 2018. The day is marked by the Centre for Air Power Studies (CAPS) to commemorate the birthday of the late Air Cmde Jasjit Singh AVSM VrC VM, founder director of CAPS and a foremost strategic thinker and analyst of India.

Mine, in contrast, was more one that relied on the power of persuasion. Jasjit, to my relief and even admiration, managed to bridge these two requirements very comfortably. His formidable knowledge clearly put American policy-makers dealing with the AWACS issue from 40,000 ft. at visible disadvantage. As you all know, that deal did not go through for a variety of reasons. But I can state that at a critical juncture, Jasjit helped to raise important question marks about the wisdom of the proposal.

Thereafter, as he assumed the directorship of IDSA and made his presence felt in think-tank circles, I had other occasions to interact with him and even host him in various capitals in the world. It was evident that moving out of the military domain, he was putting across with authority views on the political and strategic challenges of the day. That was an era when India-Pakistan rather than India-China relations took up most of the oxygen. The exercise of the nuclear option was another critical issue. Managing the consequences of that exercise was also important, a point that escaped the more primitive analyses on this subject. The opening to the United States after the end of the Cold War was another significant initiative that brought together realists in this country. The *Look East* policy and its security expressions were the accompanying phenomena. Jasjit was involved in all this and more. He was not only deeply respected in policy-making circles but widely consulted, especially by those who really appreciated the complexities of national security.

There are many messages from Jasjit's life. His personal courage was publicly recognised; his leadership widely noted; his knowledge and judgement greatly appreciated; and his scholarship broadly admired. But today, from his various qualities, I would like to pick a particular facet that is relevant to contemporary times. This is the issue of integration and jointness, a debate that is usually associated with the more efficient working of the armed forces. My remarks go well beyond that narrow field, as indeed did Jasjit's world view.

Integration, jointness, coordination and sharing are connected challenges of all large organisations. Allowing for some latitude in terms of the spectrum that they represent, it can be safely asserted that historically, those who have

acted in a more integrated manner have prevailed. This is the explanation for smaller forces often defeating larger ones in the battlefield. It is at the heart of organisational efficiency and the recipe for business success. In any field of human activity, ranging from politics to sports, bringing to bear the full potential at one's command makes all the difference. Tighter coordination and distinct entities working together brings out a value that is often unrealised otherwise. This is as true for the bureaucratic and corporate world as it is for the security one. Equally, lack of coordination is the bane of policy implementation. Many of you would recall that this was at the heart of the 9/11 Commission Report recommendations. Most analysis of setbacks tend to be in this space.

Yet, however obvious it may be as a conceptual proposition, the fact is that integration and coordination are extremely challenging for any large organisation. They grapple with set habits, vested interests and distinct identities. Agreeing at the headlines level rarely leads automatically to it working out operationally. Some of it may be conscious, but much of that is because history and experience pull in the opposite direction. Indeed, other than building better capabilities, breaking silos is as close as one can come to a silver bullet in the field of policy implementation. We, in India, are particularly given to operating with sub-optimal coordination. Our history is replete with examples that came at great cost to the country. Some of that arises from our extreme individualism. It could be aggravated by a possessiveness which has been enhanced by shortages. Bureaucratism has always been entrenched in our society. What perhaps adds to all of this is a focus on processes rather than concern over outcomes.

None of this is particularly new and I'm sure that aspects of this problem have occurred to each of you in your particular workplace context. Within the government, an important step that was taken to address the national security dimension of this challenge was the creation of the institution of the National Security Advisor (NSA) and its Secretariat. In the Services, this debate is reflected in the emergence of the Chief of Integrated Defence Staff to the Chairman Chiefs of Staff Committee (CISC) and Defence Intelligence Agency (DIA), though there are larger issues of jointness, creation of the

Chief of Defence Staff (CDS) or even Theatre Commands to be considered. On the civilian side, mechanisms such as inter-ministerial committees at the political and bureaucratic levels are seen as the solution. My focus today is less on institutional fixes and more on creating a culture of integration that would best serve national interests. By culture, I refer to the need to promote habits and change thinking. To my mind, there are six broad integration challenges that today would determine the quality of our policy-making and implementation. Allow me to dwell on them.

The first requirement is one that I draw from my direct professional experience in foreign policy over four decades. The fact is that even 71 years after independence, there are still significant hard security challenges facing India. Unresolved borders are the most important of them. But these challenges have been aggravated by the sustained assault that our society has faced from state-sponsored terrorism. From time to time, other attempts have been made to also undermine our national integrity and unity. This is not just the past; they continue to present challenges for the foreseeable future. The diplomacy of such a nation must be closely interlinked with its security interests and mechanisms. It is very different from that of a more secure environment where the levels of threat are considerably lower. Today, 'securitising' foreign policy is an imperative. Our diplomatic interactions have to take into account the requirements on the defence front, as well as the sensitivities of internal security. This is particularly so in the neighbourhood where there are hard security factors on which the margins for compromise are limited. In the minds of our diplomats, these considerations must be foremost. Obviously, diplomacy itself is a creative and optimistic profession. But, it should not indulge itself to a point where it is divorced from the realities on the ground. Nor can fashionable debating points become the basis for serious policy.

One realisation that struck me while reviewing our diplomacy vis-à-vis China just prior to the 1962 conflict was of how much importance was being given to working with that country on global issues and how little on the resolution of the looming differences on the boundary and Tibet. Even with Pakistan, the binary choices of engaging or not engaging on

issues of difference do not take in to account the broad spectrum of options that the security side of the business can generate. Perhaps, some of this is generational. But the Indian polity is itself maturing in the direction of more integrated policy-making. Certainly, my recent experience was of very tight working together of our foreign policy apparatus, the defence structures including the Services, our internal security and our agencies. In fact, this has been one of the areas of progress in the last few years. I saw this during the Doklam faceoff, the preparations for the 2016 surgical strikes and on other occasions. It has not only reflected in better coordination, but also more cross-fertilisation. The placement of personnel across institutions and greater degree of exchanges is also encouraging. Deepening and widening these practices would certainly help change the culture of silos in Lutyens Delhi. So too would the creation of more multi-Service training institutions.

Conversely, our defence and security agencies also need to develop a better sense of the world. There are three broad arguments which favour such an approach. One, a more globalised world has made borders less relevant and the threats more seamless. Without an adequate understanding of other polities and societies, it is difficult to accurately anticipate threats to ours. Second, just as in the economy, defence too suffers from various limitations of capabilities and balanced growth. Our near term future will be of leveraging external options while seeking to build up our domestic ones. In fact, one of the most significant contributions that Indian diplomacy has made to national security is that it has maximised our defence options abroad. There are few countries that can claim today to have the wide array of technology and capability access that we enjoy. But exercising it effectively and getting the most from that option requires a larger strategic understanding of the global landscape. There is much truth to the observation that when you buy an aircraft, you actually buy into a relationship. Third, as India goes up the ladder of power in international politics, we will have to shoulder greater responsibility abroad while getting involved beyond our borders. Humanitarian Assistance and Disaster Relief (HADR) situations are an obvious example, but there are also considerations such as stability in societies vital to our interests or even the welfare of the diaspora. All of

this would require an appreciation of global trends and developments. The short point is that just as diplomats need to understand defence and security better, soldiers and security specialists have to develop a finer understanding of world politics.

The same logic also applies to the domain of trade and economics. A globalised world is necessarily a more inter-dependent and constrained one. Competition among powers is today expressed essentially through the economic medium. In fact, if one looks at the rise of China from the larger perspective of history, it stands out because that has taken place without any military conflict. China may have now built up capabilities, but its global influence derives more from trade balances, market shares, production dependence and investible surplus. That each of these factors has been used in a strategic manner is also something that Indians must understand and emulate to the extent possible. Given the steady externalisation of our own economy over the last 25 years, it is imperative that our system too approaches economic issues with a better sense of its foreign policy implications. There are tactical aspects to this domain too, among them developing the skills to close out negotiations on optimal terms. Whether it is bilateral or multilateral, engaging with other cultures and making judgements about the best terms that can be obtained requires both training and experience.

Currently, much of the foreign policy discourse revolves around concluding trade agreements: the Trans-Pacific Partnership (TPP) in its updated incarnation, the fate of the North American Free Trade Agreement (NAFTA), the application of bilateral tariffs and its impact on the World Trade Organisation (WTO), and other regional initiatives still under negotiation. India itself is engaged with East Asia in the Regional Comprehensive Economic Partnership (RCEP) negotiations, with Europe on the Bilateral Trade and Investments Agreement (BTIA) discussions and with a number of other nations on a bilateral format. While the content is about trade, investment and services, the undeniable reality is that these are really central to our strategic positioning. Very often, the terms of an economic agreement envisage a time period that is meant to prepare our defences in terms of standards and policies. That we have used this so inadequately for domestic

preparations underlines how casually we have traditionally approached economic negotiations. Nor have we strategically exploited opportunities. Whether it is in defining the larger objectives, determining the pace of the negotiations or taking a call on the give and take of the process, the line between politics and economics starts to disappear. That understanding could perhaps give a more purposeful direction to India's efforts in this domain.

Today, trade issues are at the core of the Trump Administration's foreign policy and it is difficult to deal with them in isolation. In fact, it is India that stands to benefit from a broader consideration of the issues on the table. Similarly, with China, the enormous trade deficit has not only acquired political connotations but has serious strategic implications for India. Like other countries, we cannot be neglectful of the security repercussions of investments in sensitive areas. Connectivity is now a new area of sensitivity, but also of great opportunity. It is at the heart of credibly implementing a *Neighbourhood First* policy. At the same time, when carried out in an opaque manner without market viability, it understandably raises red flags. The strategisation of connectivity is as significant as the weaponisation of finance. For us in India, both call for coordinated multi-sectoral responses. We have the example of Hambantota in 2008 to remind us how complacency and departmental thinking created the basis for a strategic blunder.

While inter-departmental, inter-agency and inter-Service challenges are widely recognised, one that is usually neglected is the 'intra' one. Even within, organisational structures tend to be narrow and possessive, usually at the cost of efficiency. For that reason, cross-cutting laterals are tasked with compensating for this deficiency. This is actually quite a pervasive phenomenon and we have had our fair share, including in the Foreign Ministry. Usually, silos are defended in the name of tradition and entitlement. Not surprisingly, consideration of outcomes is not a factor. The truth is that any serious effort at team building has to take on this challenge. Anachronisms are difficult to justify in the face of the mounting pressures of our contemporary world. In fact, it is only when there is a real emphasis on performance that such old-fashioned thinking can be overcome.

The need for greater interpenetration between the worlds of national security and technology has been recognised more strongly. Traditionally, we have always thought of atomic energy and space as sectors that have strategic significance. In both cases, there has been a history of external collaboration and our successes in these fields have directly contributed to national capability and prestige. We are now in a very different world, one of Internet of Things (IOT) driven industry, cyber capabilities, artificial intelligence and big data. The correlation between technology and security has only got stronger. One part of the challenge is to upgrade technological capabilities; the other is to acquire and develop them with greater consciousness of their ramifications. It is revealing that at the heart of the US-China trade tensions is the American belief that China has obtained technology by unfair means. That the United States, in turn, is targeting the *Make in China 2025* programme says much for the centrality of technology to future power balances. Similarly, the introduction of the General Data Protection Regulation (GDPR) in Europe has considerable ramifications beyond the stated objective of protecting privacy. Given that the primary mode of global competition has shifted to the economic and technological domains, it is vital for foreign and even national security policy to factor this in more centrally than is currently the case.

The fifth big area for greater coordination is between government and business. A number of factors make a compelling case for that, among them the nature of India's growth and development in the last quarter century. It stands to reason that a larger economy with a different composition and greater global influence would lead to changed stakeholdership. I recall a conversation about a decade ago with President Kalam where we were discussing the reasons for India's changing international image. While economic growth broadly and the nuclear tests specifically were factors in this regard, perhaps the most impact was made by the dotcom revolution and the Y2K scare. Out of that grew the global image of the 'techie' Indian. But in parallel, the globalisation of Indian businesses had a profound impact on the thinking of elites across the world. The problem now is no longer of image; that is reasonably well established. What is more pressing is the need to build

and deploy capabilities. If India is to be influential in its neighbourhood and in say, Africa, that will only happen if it delivers on economic projects. If its global reach and influence are to grow, it must become more relevant to the growth prospects of other nations. As stated earlier, the tectonic shifts will no longer be military, but economic and technological. In our country, all these factors require harnessing the energies of our businesses for national goals more effectively. That requires stronger conversations, deeper buy ins and greater support. In many geographies, our business connections are perhaps of longer standing and more deeply rooted than political relationships. By their very nature, they tend to be more stable and less partisan. Harmonising the interests and activities of our businesses with larger national goals is, therefore, a subject worthy of greater attention. Most other major polities have fashioned their systems to take this into account. At the end of the day, India in world politics will only be as good as its economic performance and delivery capabilities.

The last but certainly not the least of the integration challenges is that between those who make policies and others who debate and analyse them. This is a subject unto itself, but on this occasion, let me make some brief observations. I must confess that I often read descriptions of our strategic thinking which are difficult to recognise, leave alone understand. Much of that arises from the fact that policy-making and policy analysis are two distinct worlds. We do not have a system of exchanges between them and consequently, some of what is written reaches the level of the unreal. Common shortcomings are an obsession with textualism, a focus on events rather than trends, confusing tactics for strategy and being dismissive of structural realities. Partiality and prejudices also colour the picture, something that foreign observers of India find particularly difficult to grasp. To the extent there is a better understanding of the strategic direction of our policies, a grasp of risk factors and some insight into arriving at a balanced judgement, we could close the gap between policy and projection. Efforts have been made to improve the dissemination of policy thinking through greater engagement with the think-tank community. Clearly, there is great value in stepping that up.

Air Cmde Jasjit served this nation over a long period in various capacities, always excelling in his given responsibilities. He rose above the politics of the day to address longer term challenges. His ability to span different worlds made him stand out even in a competitive environment. But above all, his sense of duty and commitment to national interest were exceptional. In many ways, he was a hero, perhaps even more so for someone like me who was educated in an Air Force School.

AIR POWER IN JOINT OPERATIONS: PRIMACY OF JOINT TRAINING

KK NOHWAR

INTRODUCTION

The primary role of militaries down the ages has been to protect kingdoms from external aggression, and also to fight their rulers' wars in the quest for expansion of empires. Most such battles took place on land in early times. Some of the more adventurous nations felt the need to 'explore' the world in search of new lands – well beyond their shores – that they could dominate and thereby expand their influence. For this, having a strong military – including a versatile maritime force – was essential. The search for new lands by such expeditionary forces was invariably dependent on ships to carry soldiers to distant lands. The division of responsibilities of the various 'professionals' entrusted with the task of 'showing the flag' was clearly demarcated. The sailors were responsible for the safe passage of troops. In case of any opposition enroute, battles were fought, with naval tactics coming to the fore. No commander of ground forces – even though embarked – would ever interfere in the conduct of such battles (unless it involved hand-to-hand fighting); his job was to command his troops once landed. All was fine and expeditionary nations prospered under this arrangement. **Joint training** for the naval and land forces was not felt necessary as they both had independent, fairly well demarcated areas of military prowess – now better understood

Air Marshal **KK Nohwar**, PVSM VM (Retd) is Director General, Centre for Air Power Studies, New Delhi.

While it is often suggested that as practitioners of war, military leaders need to study campaigns of the past so as to learn from history and not commit the mistakes made earlier, the nature of warfare in the future – if the present ongoing conflicts in the world are any indication—will demand a very different approach to warfare.

as ‘core competencies’ – and no serious thought was ever given to train the forces together for war.

With the invention of the airplane, the cat was thrown among the pigeons, World War I being more of a testing ground for the potential of this new war-fighting machine. However, by the end of the war, the aircraft’s ability to carry the war into the enemy’s heartland – bypassing the enemy’s fielded forces and overcoming the obstacles of terrain – had been established. During World War II, there were instances where aerial duels between opposing air forces alone had decided the outcome of

the battle, e.g. the Battle of Britain (July to October 1940), while there were some in which carrier-based air power had played a preeminent role, without the participation of the surface force(s) of the opposing navies. This was best exemplified during the various engagements between the US Navy and the Imperial Japanese Navy in the Pacific.

The British Army had failed to acknowledge the role of air power in the initial stages of World War II, despite having witnessed its tactical usage by the Germans in their advances through Europe. While it is often suggested that as practitioners of war, military leaders need to study campaigns of the past so as to learn from history and not commit the mistakes made earlier, the nature of warfare in the future – if the present ongoing conflicts in the world are any indication – will demand a very different approach to war-fighting. What is the model of **jointness** that needs to be adopted for tackling future conflicts in the Indian context, and how does one **train jointly** to deal with the emerging threats, therefore, bears careful examination.

But first, a little peep into history.

THE INDIAN EXPERIENCE OF JOINTNESS SINCE 1947

We shall first examine the use of air power in the Indian subcontinent post-Independence and the extent of jointness in various wars fought since then. We shall also critically examine the state of training and the role **joint training** – and **joint planning** – played in the outcome of these wars.

FIRST INDIA-PAKISTAN WAR, 1947

Once the Dominion of India received the Letter of Accession signed by Maharaja Hari Singh of Jammu and Kashmir State on October 26, 1947, the Indian Air Force (IAF) flew troops of 1st Sikh into Srinagar in the early morning on October 27, 1947, to stop the marauding Pathan tribals from capturing the city. The airlift was repeated with civil aircraft also being requisitioned. The Indian Army swung into action and repelled the attacks through a brave display of leadership and superb fighting skills. The Royal Indian Air Force (RIAF¹) fighters (Spitfires and Tempests) and Harvards (trainer aircraft) provided close support to the army, most notably during the Battles of Badgam and Shelatang, enough for the Brigade Commander, Brig LP Sen to comment, *“The RIAF, in this crucial engagement and during the follow up, played a decisive role”*.² The Battle of Shelatang lasted for 12 hours and was one of the **finest examples of inter-Service coordination and cooperation** that was responsible for the retreat of the tribal marauders from virtually the doorstep of Srinagar in November 1947. The pilots carried out their missions against the raiders based on the briefing they received from the Ground Liaison Officer (GLO) before getting airborne and also on the situation that they assessed on reaching the affected areas. Their training, superb airmanship, and indomitable offensive spirit ensured that

The Battle of Shelatang lasted for 12 hours and was one of the finest examples of inter-Service coordination and cooperation that was responsible for the retreat of the tribal marauders from virtually the doorstep of Srinagar in November 1947.

1. The IAF at that time still had the prefix ‘Royal’ attached to it.

2. *Defending Kashmir* (The Publications Division, Ministry of Information and Broadcasting, Government of India, 1949), p. 26.

the marauders were soundly beaten back. The transport fleet of the RIAF (No. 12 Squadron, equipped with Dakota aircraft) also proved its mettle and came to the assistance of the beleaguered Indian Army garrison at Poonch by landing on the extremely small (600 yards) airstrip. The 25-pounder guns that were flown in by night – with Air Cmde 'Baba' Mehar Singh himself flying one of the Dakotas into Poonch – helped the army dislodge the enemy. No. 12 Squadron provided 4,21,000 lb of supplies and evacuated 35,000 refugees from Poonch.³ As the threat to Leh grew more serious, 'Baba' Mehar Singh carried out a daring mission once again by flying a Dakota at 23,000 ft, without oxygen, and landing on a rough, improvised airstrip at Leh at an altitude of 11,554 ft above mean sea level (amsl). Accompanying him was Maj Gen KS Thimayya, General Officer Commanding (GOC) 19 Div [and later the Chief of Army Staff (COAS)] who carried out an on the spot assessment of the situation and decided that reinforcements were required to be flown in urgently. Once again, this was an **outstanding example of inter-service coordination at the higher levels of leadership**. The Dakotas of No. 12 Squadron carried out the task successfully.⁴ Although the RIAF was poorly equipped, the support provided to the army was exemplary, with pilots risking their all in order to beat back the marauders. This earned them the appreciation of the General Officer Commanding-in-Chief (GOC-in-C), Western Command.⁵

THE 1962 INDIA-CHINA WAR

During the India-China War in October-November 1962, the IAF was not permitted to carry out offensive operations against the Chinese Army, possibly for fear of retaliation by the numerically superior People's Liberation Army Air Force (PLAAF) that was supposedly also capable of carrying out bombing of the important Indian cities of Delhi and Calcutta. The IAF, however, carried out extensive helicopter operations in support of the army both in the Northeast (NE) as well as the Ladakh sectors. IAF helicopters carried out casualty evacuation, air maintenance and intra-

3. Ibid.

4. Ibid., pp. 68-69

5. Ibid., p. 112.

theatre airlift of troops. The intrepid helicopter pilots, having inducted into the eastern sector barely days before the outbreak of hostilities, exploited their machines to the maximum, often well beyond the manufacturer's limits, and carried out some daring rescues, including by night. This was a significant achievement as the helicopters were not cleared for operations by night at that time.⁶ The An-12 transport aircraft of the IAF air-landed troops, twelve 25-pounder guns, ammunition and eight AMX-13 tanks to the beleaguered garrisons at Chushul. Although limited, the role played by the IAF in support of the Indian Army during this operation was indeed noteworthy. The IAF lost an opportunity to assist the war effort in what could have been an effective way to check the advance of the vastly superior (in numbers) PLA. Interdiction of the large number of Chinese forces could have paid rich dividends.⁷ What was of significance during this conflict was the total **absence of joint planning** between the army and air force despite the existence of a *"fairly comprehensive system for joint military operational planning (that) had been established within weeks of our independence. The Chiefs of Staff Committee (COSC), the highest military professional level, was to provide military advice to the political leadership – in specific terms to the Defence Committee of the Cabinet (DCC) chaired by the Prime Minister – but had not met since 1959 or so."*⁸ Similarly, the Joint Intelligence Committee (JIC) and Joint Planning Committee (JPC) had been defunct since the mid-1950s. While the JIC's role had virtually been hijacked by the Intelligence Bureau (IB), the JPC, that was mandated to prepare **joint military plans** for the joint employment of the three Services – and was to be manned by a permanent joint staff as per Cabinet orders – had never met, *"leave alone professionally addressed the issue of the use of combat air power as part of the planning process before the war or as a joint response during the war."*⁹

6. Bharat Kumar, *Unknown and Unsung: Indian Air Force in Sino-Indian War of 1962* (New Delhi: KW Publishers, 2013), p.202.

7. Jasjit Singh, *Defence From the Skies* (New Delhi: KW Publishers, 2013), p. 98.

8. *Ibid.*, p. 93.

9. *Ibid.*, p. 94.

THE 1965 INDIA-PAKISTAN WAR

Before we discuss the first real conflict between the two neighbours, it is important to examine the relative strengths of the two air forces, not only from the point of view of numbers but also the state of **training** – and, consequently, their operational preparedness. The Pakistan Air Force (PAF) had received eight squadrons (120 aircraft) of the highly successful F-86 Sabre jets (of the Korean War fame) from the US under the Military Assistance Programme. Twenty-four Sabres were modified to carry the AIM-9B Sidewinder air-to-air missiles. The PAF had also received one squadron (14 aircraft) of the state-of-the-art F-104 (Starfighter) that was also armed with the AIM-9 Sidewinder air-to-air missile. The PAF also had two squadrons of the Canberra bomber. Its pilots had participated in various exercises with the US Air Force (USAF) by virtue of Pakistan being a member of the Southeast Asia Treaty Organisation (SEATO) since 1954 and were, thus, conversant with the latest air combat tactics. The IAF, on the other hand, had a mix of French and British aircraft forming the bulk of its fleet: six Hawker Hunter, six first generation (1940s' vintage) Vampire, and five Folland Gnat squadrons (all of British origin), and five Mystere IVA and three Ouragan (Toofani) squadrons (both French aircraft). The IAF also had three Canberra squadrons and had just received its first Mach 2.0 plus supersonic fighter squadron equipped with the MiG- 21 that was capable of carrying two K-13 air-to-air missiles. The IAF pilots had no experience of **training** with foreign air forces till then, and, thus, relied only on the *“training that had been carried out in-house”*.¹⁰ In order to ensure that India's eastern flank was also protected against any likely interference by the Chinese, ten Indian Air Force squadrons were retained in the eastern sector.

The offensive came on September 1, with Pakistan launching an all-out attack at 0930 hrs in the Chhamb sector with two regiments of armour and corps artillery supporting Pakistan's 7 Infantry Div. Clearance to the Chief of Air Staff (CAS) for the IAF to carry out attacks against enemy ground forces was given by the defence minister only at 1650 hrs; by 1719 hrs (barely 29 minutes

10. Air Mshl Bharat Kumar, *The Duels of the Himalayan Eagles* (Gurgaon: IMR Media Pvt Ltd.), pp. 35-45.

later), the first formation was airborne. Three missions of Vampires (four aircraft in each mission) were launched, followed by four missions of Mysteres (total of 14 Mystere aircraft) to blunt the Pakistani armoured thrust. The strikes by the IAF aircraft destroyed 12 tanks, two field guns and 62 vehicles, although the loss of aircraft was high – three Vampires (of the second formation) lost to Sabres, and one from the first formation possibly being shot down by ground fire. The Vampire was a first generation aircraft of 1940s' vintage that had been launched keeping in mind the criticality of the ground situation

which required that all available air assets be pressed into service in support of the Indian Army. The strikes by these IAF aircraft broke the momentum of the Pakistani advance and prevented the fall of the vital town of Akhnoor. Throughout the 22-day war, there were many such instances where close support was provided to the army in accordance with the broad strategy spelt out by the government for utilisation of the IAF; the air force, consequently, met more than 90 percent of the air effort indented by the Indian Army – a fact that seems to have been lost sight of in the post-war period.¹¹ **The IAF was also restricted from attacking PAF airfields unless attacked.**¹² This restriction prevented the IAF from carrying out the planned preemptive strike¹³ against the PAF, while the PAF had no hesitation in carrying out a preemptive strike against IAF bases. It was only after the PAF first attacked IAF bases on September 6, that the IAF was given permission to retaliate. The IAF suffered losses of aircraft on the ground as a result of these attacks by the PAF.

A huge lesson for the political and military leadership: unless own military is given a free hand in the conduct of military operations, especially when hostilities are imminent – in this case, Pakistan had already crossed the Line of Control (LoC) in the Chhamb-Jaurian sector as early as September 1, 1965 – own military will always be at a disadvantage.

11. Ibid., p. 51.

12. Ibid.

13. A 'preemptive strike' has the advantage of catching the enemy by surprise and can seriously affect the conduct of air operations by the enemy, as his airfields that are targeted can be kept non-operational for extended periods of time through repeat attacks.

This, then, is a huge lesson for the political and military leadership: unless own military is given a free hand in the conduct of military operations , especially when hostilities are imminent – in this case, Pakistan had already crossed the Line of Control (LoC) in the Chhamb-Jaurian sector as early as September 1, 1965 – own military will always be at a disadvantage if the initiative is allowed to pass to the adversary. Giving own military the freedom to launch a preemptive strike could have possibly prevented such huge losses on the ground as were faced by the IAF on September 6, 1965; the IAF would have seized the initiative and put the PAF on the defensive from Day-1 itself.

The 1965 War saw the emergence of the IAF as a bruised but effective fighting force that traded punches with the better trained and equipped PAF, yet achieved greater success in the air battles that ensued. The diminutive Gnat earned the sobriquet ‘Sabre slayer’.

THE 1971 INDIA-PAKISTAN WAR

On November 22, 1971, when four F-86 Sabres attempted to enter the Indian air space from East Pakistan in support of the Pakistan Army that was fighting the Mukti Bahini, the IAF Gnats were scrambled from Dum Dum airport (Calcutta) to intercept the intruding aircraft. In the ensuing combat, three Sabres were shot down by the IAF Gnats.

Pakistan launched a preemptive strike against IAF bases in the west at last light on December 3.

The 1971 India-Pakistan War had begun.

The PAF was not able to cause any serious damage during these strikes as IAF aircraft had now been dispersed in hardened aircraft shelters (unlike in 1965).

The IAF responded with counter-air strikes, both in the east and the west. While air dominance was achieved in the east within the first three days, the PAF was forced to go on the defensive in the western sector, thereby permitting greater freedom of operations to the Indian Army, unhindered by enemy air in both sectors. Blunting of a Pakistan armoured thrust by the IAF’s Hunter aircraft at the lightly held – yet resolutely defended – Indian

Army outpost at Longewala, was a classic example of Counter-Surface Force Operations (CSFO) carried out by the IAF in direct support of the army. It also highlighted the vulnerability of armour to air attack while on the offensive and caught in the open. Lack of air cover by the PAF rendered the tanks defenceless. The Hunters cut them to size and destroyed almost 40 tanks.

The IAF also successfully prevented a major armoured thrust planned by the Pakistan Army in the Suleimanke headworks region through round-the-clock attacks on the Pakistani armour reinforcements and fuel dumps in the Changa Manga forest, besides providing close support to the Indian Army. The IAF helped check the further advance of the Pakistani armour beyond the Sabuna drain (in Indian territory).¹⁴ Effective interdiction by the IAF destroyed trains carrying tanks¹⁵ and fuel to the area (between Okara and Montgomery). The Changa Manga forest was singled out for attacks at night by the Canberras and also the An-12s.¹⁶ The An-12s were also utilised successfully by night to ‘carpet bomb’ an area that was being used by the enemy artillery to target Poonch. They dropped 40 tons of bombs and silenced the guns effectively.

In all the above operations, it was the core competency of the IAF that was on display, as also its ingenuity in the optimum utilisation of its resources. The *mantra* for the IAF throughout the conduct of air operations in the western sector appeared to be: “You tell us what the target is; leave the rest to us to figure out how to destroy it”. The impact was felt in the battlefield by the Pakistan Army; the planned grand offensive by Lt Gen Tikka Khan did not materialise.¹⁷

The average time for the IAF to respond to a demand for close support was between one to one and a half hours in the western sector; this was a vast improvement over the time that it took for demands to materialise during

14. Air Chief Marshal PC Lal, *My Years with the IAF* (Lancer International), p. 262.

15. “A train carrying 50-odd tanks was destroyed by Mystere interdiction strikes between Okara and Sahiwal (old Montgomery)”, Singh, n.7, p. 159.

16. Lal, n. 14, p. 264.

17. Singh, n.7, p. 161.

Valuable lessons in jointmanship were learnt during the operations in the east, born out of the necessity to assist the army in crossing the various natural obstacles – rivers – in its advance towards Dacca. Air dominance was established by December 6.

the 1965 War¹⁸. The procedure for providing support to the army had also been streamlined by providing Tactical Air Centres (TACs) along with each of the Corps Headquarters (HQ), besides an Advance HQ of the air force alongside each Command HQ of the army. Forward Air Controllers (FAC) had been **trained** during exercises conducted in the western sector before war broke out on December 3. The Army Commander, Western Command, Lt Gen KP Candeth, commenting on the support provided by the IAF in the western theatre, said, "Except during the first four days in Chhamb, the PAF never really made their presence felt. Further, they never were able to prevent or even hinder our moves or the execution of any operations."¹⁹

Valuable lessons in **jointmanship** were learnt during the operations in the east, born out of the necessity to assist the army in crossing the various natural obstacles – rivers – in its advance towards Dacca. Air dominance was established by December 6 with the bombing of Tezgaon airfield, the operating base for the F-86s. The bombing was carried out by MiG-21s²⁰ of 28 Squadron operating from Gauhati; the squadron had earned the sobriquet "The Runway Busters" by the end of the war. From the very next day, i.e. by December 7, IAF helicopters began carrying army troops and equipment across the rivers in an innovative and unprecedented heli-bridging operation that proved extremely successful. In anticipation of the likelihood of achieving air dominance in the eastern theatre within seven days (it was actually achieved within three), paradrop of a battalion group was planned. The **joint planning** for the paradrop was carried out

18. Lal, n. 14, p. 176.

19. Lt Gen KP Candeth, *The Western Front: The Indo-Pakistan War 1971* (New Delhi: Allied Publishers, 1984), p. 158.

20. This was yet another example of 'flexibility' of air power – an essentially air defence aircraft was utilised in the bombing role using 2x500 kg free fall bombs (with a high explosive charge) for runway denial missions. The results were outstanding.

by forming a Joint Coordinating HQ at the Advance HQ of the Eastern Air Command (EAC) working under the Director of Operations (Transport) at Air HQ. It functioned alongside the Army Eastern Command at Calcutta. An Integrated Air Transport Group was also established for effective execution of plans²¹. Paratroopers not familiar with jumping from Dakotas were given practice jumps in the build-up phase. The different types of aircraft practised the formations to be flown for the final drop. As a result, the paradrop near Tangail was near copy-book in terms of the time taken for the battalion group to be dropped as well as the accuracy of the drop. Training of paratroopers during the build-up phase paid rich dividends in a true display of jointmanship.

Close support for the advancing Indian Army was provided wherever pockets of resistance were observed; thus, facilitating the progress of the army. Procedures for close support had been streamlined and proved successful during the operations in the eastern sector.

On December 14, an intelligence report was received at HQ Eastern Command (at 0930hrs) that the Governor of East Pakistan, Dr AM Malik was to have a Cabinet meeting at 1200hrs in the Government House. This was promptly conveyed to Air HQ as well as to Eastern Air Command. The MiG-21 squadron based at Gauhati was tasked for the mission. Although there were no maps of the target area with the squadron, a tourist map was located with Indian Oil Corporation at the air base at Gauhati ²²(from where the squadron was operating during the operations) and planning for the mission was carried out using the same. The strike was carried out with pin-point accuracy by the MiG-21s of 28 Squadron with unguided 57 mm rockets. The Governor was so shaken up after the strike that he, along with his entire Cabinet, resigned. This action by the IAF precipitated the surrender of the Pakistan Army in the east. It is also a befitting example of the IAF effectively exploiting some of the important characteristics of air power, viz. '**precision**', '**flexibility**' (using an essentially air defence aircraft in the air-to-ground strike role) and '**lethality**' (the impact that the precision strike had

21. Lal, n.14, p. 219.

22. Singh, n.7, p. 168.

on the psyche of the leadership). The core competency of the IAF was never more aptly demonstrated as during the bombing of the runways in East Pakistan – that grounded the PAF – as well as the attack on the Government House; all carried out by that true multi-role aircraft of the IAF: the MiG-21.

THE KARGIL WAR, 1999

The infiltration by the Pakistani forces was detected only on May 3, 1999, by the Indian Army when it moved to reoccupy the posts it had vacated during the previous winter. Initially, it was seen as a minor incursion by militants which the army felt confident of neutralising in a few days. When it was realised that the threat appeared to be more serious, the Indian Army sought attack helicopters from the IAF on May 11, to dislodge the infiltrators. The CAS agreed to this demand from the army but first sought political clearance for employing the air force. Use of the air force was viewed as being escalatory and the government did not want the conflict to spread to other areas; the Indian government, thus, refused utilisation of the IAF on May 18, during the Cabinet Committee on Security (CCS) meeting.

A Canberra carrying out reconnaissance on own side of the Line of Control (LoC) was hit by a Stinger Surface-to-Air Missile (SAM) on May 21. The aircraft recovered safely. The 'go-ahead' by the government to use the IAF was finally given on May 25, with the proviso that the LoC was not to be crossed under any circumstances. The mountainous terrain, with targets at heights ranging from 12,000-18,000 ft amsl posed a challenge that had to be overcome; no air force in the world had ever faced the challenge of attacking dug-in troops at such heights before. The restricted manoeuvring space for the fighters – in view of the government's diktat of not crossing the LoC – coupled with the threat from shoulder-fired SAMs, only increased the degree of difficulty that needed to be overcome by the IAF. Although some training had been carried out at the Toshe Maidan high altitude air-to-ground range near Srinagar just before the IAF was inducted, the challenges over the area of operations were entirely different, mainly relating to target acquisition. On May 27, a MiG-21 aircraft flown by Sqn Ldr Ajay Ahuja was shot down on own side of the LoC with a Stinger missile. Although he ejected safely, he was killed by the

Pakistani soldiers on landing. On May 28, a Mi-17 helicopter was shot down – again by Stinger missiles – while on an operational mission in the region. All on board were killed. These two losses necessitated a change in tactics that would keep fighter aircraft outside the lethal envelope of the shoulder-fired SAMs. Further helicopter offensive support missions were stopped. Mirage-2000 aircraft were inducted and this made a significant difference in the accuracy of the strikes. Interdiction of supply camps at Muntho Dhalo resulted in serious degradation of the enemy's ability to sustain the war effort. All possible aircraft in the sector – including the MiG-21s – were utilised to carry out round-the-clock bombing of the enemy. This was aimed at breaking his will to fight; it proved successful. Use of air power was a significant factor in reducing own casualties. The enemy air was kept at bay with air defence escorts being provided for every strike mission that proceeded to the target area. Own air defence aircraft were armed with Beyond Visual Range (BVR) missiles – something that the PAF lacked at that time. As a consequence of the Kargil conflict, the PAF realised this operational shortcoming and has since obtained BVR missiles for its fighter aircraft. **'Flexibility' and 'adaptability' were the hallmarks of IAF operations during the Kargil conflict.**

Finally, the biggest compliment to the IAF was symbolised in the message received from HQ XV Corps, which read, "You guys have done a wonderful job. Your Mirage boys with their precision guided bombs targeted an enemy Battalion HQ in Tiger Hill area with tremendous success. Five Pakistani officers reported killed and their Command and Control broke down – *as a result of which our troops have literally walked over the entire Tiger Hills area*. The enemy is on the run. They are on the run in other sectors also. At this rate, the end of the conflict may come soon"²³ (emphasis added).

One of the most important takeaways from the Kargil conflict was the high degree of army-air cooperation (at the functional level) that marked every phase of the operation.²⁴ The sheer grit of the young army officers and the men they personally led into battle is the stuff legends are made of – their

23. AVM (then Gp Capt) DN Ganesh, *Indian Air Force in Action*, in Jasjit Singh, ed., *Kargil 1999: Pakistan's Fourth War for Kashmir* (New Delhi: Knowledge World, October 1999), p. 184.

24. *Ibid.*, p. 186.

If the complexity of peace-time exercises can be increased to a level that 'almost' replicates the 'real thing', pilots would be better prepared to face the uncertainties brought about by the 'fog of war' – when the bullets, the Anti-Aircraft Artillery (AAA), Surface-to-Air Missiles (SAMs) and Air-to-Air Missiles (AAMs) start flying around.

close interaction with the air force helped evict the Pakistani intruders from Indian soil.

COMBAT TRAINING IN THE IAF

You Fight Like You Train

The Chief of Staff, USAF, Gen David L. Goldfein, while addressing the Air Force Association in 2016, was recounting his experiences during the Gulf War wherein he emphasised the importance of training under realistic conditions. Red Flag – the USAF's keystone exercise

– prepares aircrew for operations just short of war, and this facet of the experience (gained by him and as recounted by the General) was the saving grace for pilots in the opening rounds of conflicts. From experiences during the Korean War and Vietnam War, it had been established that if a pilot survived the first ten missions of a conflict, the chances of him surviving the war were very high.²⁵ Realistic training, therefore, has no substitute. If the complexity of peace-time exercises can be increased to a level that 'almost' replicates the 'real thing', pilots would be better prepared to face the uncertainties brought about by the 'fog of war' – when the bullets, the Anti-Aircraft Artillery (AAA), Surface-to-Air Missiles (SAMs) and Air-to-Air Missiles (AAMs) start flying around.

Without trying to sound pompous – or parochial – it is to the credit of the IAF that it pursues a rigorous training programme at its Tactics and Air Combat Development Establishment (TACDE) that is as challenging as the one carried out during Red Flag. It is no wonder, then, that the IAF aircrew have repeatedly performed exceptionally well during various international

25. "An Air Force analysis known as Project Red Baron II showed that a pilot's chances of survival in combat dramatically increased after he had completed 10 combat missions"; Exercise Red Flag; From Wikipedia, the free encyclopedia; https://en.wikipedia.org/wiki/Exercise_Red_Flag. Accessed on April 27, 2017.

exercises, be it Red Flag in the US/Alaska, Cope India (between the USAF and IAF in India), Ex Garuda (between the IAF and the French Air Force), Ex Indradhanush (between the Royal Air Force and IAF), etc. These exercises prepare IAF pilots for complex air combat scenarios, and provide them the opportunity to lead and participate in missions involving large force employment. With the introduction of the composite graduate course concept at TACDE, transport and helicopter aircrew are also inducted into the course, besides fighter controllers (both on ground-based radars as well as on AWACS), Surface-to-Air Guided Weapons (SAGWs) crew, Garuds, et al. Emphasis is placed on realistic Electronic Warfare (EW) training as well. Core competencies are achieved after the churn in the crucible of such exercises, not only abroad but also within the country; this is, however, equally applicable to the other Services as they follow Service-specific exercises/training regimens. **No attempt should, therefore, be made to undermine the other's capabilities in their areas of expertise at any stage. The emphasis should be on using the Service most suited to best achieve the operational objective in pursuance of national aims.** At this stage, I cannot help but recount a famous quote by one of my seminar-mates at the Air War College (USA) in 1997-98. While discussing joint operations he said: **"Jointness is like golf; you only have to use the right club!"**

COMBAT TRAINING IN THE PAF

The PAF has a Combat Commanders School (CCS) – akin to TACDE of the IAF – where its pilots get trained in realistic air combat scenarios. The CCS is located at PAF Base, Mushaf (earlier, PAF Base, Sargodha).

The PAF has a Combat Commanders School (CCS) – akin to TACDE of the IAF – where its pilots get trained in realistic air combat scenarios. The CCS is located at PAF Base, Mushaf (earlier, PAF Base, Sargodha). The centre is believed to be a world class facility for conducting multinational exercises as well as training PAF personnel at every level.

The PAF has also participated in the Red Flag Exercise held at Nellis AFB, Nevada, USA, in 2010 and 2016. It also participates in the annual exercise conducted by Turkey – Ex Anatolian Eagle. During the 2016 version of the exercise, emphasis was placed on dynamic and time-sensitive targeting, as well as close air support missions. Besides the Turkish Air Force (TuAF) and the PAF, the Italian Air Force and the Royal Saudi Air Force also participated in the exercise. The PAF first participated in the exercise in 2004 and has been participating in this Red Flag type of exercise occasionally thereafter. In February 2016, the PAF CAS was the chief guest at an earth-breaking ceremony for an air warfare training facility called the Airpower Centre of Excellence (ACE) at PAF Base Mushaf (Sargodha). The centre is believed to be a world class facility for conducting multinational exercises as well as training PAF personnel at every level. It was operationalised in October 2017 when an international exercise ‘ACES Meet 2017’ involving eight air forces was conducted there.

Earlier, in May 2017, the PAF had activated its PAF Base Qadri in the Gilgit-Baltistan region and carried out exercises there. The Intelligence, Surveillance and Reconnaissance (ISR) assets of the PAF, including precision targeting equipment – ‘Sniper’ Advanced Targeting Pods (ATPs) – were believed to have been used for the conduct of time-sensitive Counter-Insurgency (COIN) operations (as part of Operation Zarb-e-Azb against militants) in the mountainous regions of Waziristan [a part of the Federally Administered Tribal Areas (FATA) bordering Afghanistan].²⁶ The Sniper pods have a day/ night capability and could be used for Suppression of Enemy Air Defence/ Destruction of Enemy Air Defence (SEAD/DEAD) missions besides accurate targeting using Laser Guided Bombs (LGBs), including in the mountains.

26. “Sniper ATP provides pilots high-resolution imagery for precision targeting, surveillance and reconnaissance missions. Sniper ATP detects, identifies, automatically tracks and laser designates small tactical targets at long ranges. It also supports employment of all laser and GPS-guided weapons against multiple fixed and moving targets”; “Pakistan Expands Lockheed Martin Sniper Advanced Targeting Pod Fleet”, Lockheed Martin release, July 14, 2015; <http://www.lockheedmartin.com/us/news/press-releases/2015/july/mfc-071415-pakistan-expands-lockheed-martin-sniper-advanced-targeting-pod-fleet.html>. Accessed on April 27, 2017

More recently, the air exercise 'Saffron Bandit' was held at the Air Warfare School, Mushaf, in Sargodha, and concluded on August 17, 2018.

COMBAT TRAINING IN THE PLAAF

Fighting and winning local wars under conditions of informatisation had been the cornerstone of China's military doctrine since 1993 as much as it had been the rationale for its systematic military modernisation. This has now expanded to include President Xi's simple directive, "The Central Military Commission (CMC) should strengthen the troops' sense of crisis and war, work hard at combat readiness, and lead our military to be able to fight and win wars".²⁷

What has the PLAAF done in recent years to improve its state of training, which till the 1990s was considered archaic?

A Flight Test and Training Centre (FTTC) had been set up in 1987 at Cang Zhou, near Beijing, tasked with developing combat tactics, flight techniques (standard operating procedures/combat evaluation manuals/flight operating instructions), training programmes for new aircraft and certification of new equipment (a combination of the roles performed by TACDE and ASTE²⁸ in the IAF). The best combat pilots are sent to the FTTC which is also tasked with defending Beijing. The base carries out 'aggressor' training for the benefit of visiting PLAAF Air Regiments. Presently, it houses three 'aggressor' Air Regiments (one each of the J-10, Su-30 MKK and J-7E). In 1992, Russian flight instructors found that the PLAAF was treating the newly inducted Su-27 like the MiG-21 and were not utilising all of the potential of the Su-27. After the initial setbacks to training caused by the myopic leadership who thought training was capitalistic, the real boost to PLAAF training was given in 2002 after Hu Jintao assumed the leadership. The FTTC was tasked to develop tactics and operational concepts based on lessons learnt from the first Gulf War (1991).

27. "President Xi's Directive to Military: Be Ready for War" *The Straits Times* / Asia News Network / 02:46 PM November 6, 2017. <http://globalnation.inquirer.net/161495/president-xis-directive-military-ready-war#ixzz5PY1a9idc> Follow us: @inquirerdotnet on Twitter | inquirerdotnet on Facebook. Accessed on August 29, 2018.

28. ASTE –Aircraft and Systems Testing Establishment.

In 1998, a new Air Force Test Training Base was established at Dingxin (north-central China) and by 2005, Red Flag type of exercises (Red Sword/Blue Sword) began to be practised by the PLAAF at the base. Different war scenarios are now practised by the participating forces, the complexity increasing every year. Weaknesses in training are identified and standardisation of air regiments carried out. In January 2018, the J-20 is believed to have carried out BVR engagement exercises against the J-16 and J-10C, possibly at Dingxin.²⁹

The facilities at Dingxin cater for integrated training of fighter/transport/helicopter pilots, fighter controllers, SAM/AAA crew, and operational crew manning various command and control centres, including Airborne Warning and Control System (AWACS)/Airborne Early Warning (AEW) aircraft. Realistic Electronic Warfare (EW) training is imparted at the integrated EW range in a dense electromagnetic environment. Over 100 aircraft of different types participate at a time in the Red Sword/Blue Sword series of exercises that include CAS, SEAD and OCA³⁰ missions. Live weapons, including Precision Guided Munitions (PGMs) (air-to-ground) are used during the exercises. Most PLAAF Regiments have completed training at Dingxin. Those squadrons (from among the second/third generation aircraft) that perform well during the exercise are 'rewarded' by gaining a conversion to a new type of aircraft.

To overcome the handicap of exposure to Western tactics, the PLAAF has exercised with the PAF and Turkish Air Force during 2010 and later with the PAF in 2011, 2013, 2014, 2015, 2016 and 2017 during the Shaheen series of exercises between the PAF and PLAAF. The Shaheen series of exercises have been held alternately in Pakistan and China. Reports on the performance of PLAAF aircrew during the exercise with the Turkish Air Force indicate that the PLAAF crew were very weak in the application and understanding of complex manoeuvres involved in large force engagements; their standards are likely to have improved over the years due to their exposure to the

29. Gabriel Dominguez, "PLAAF Inducts J-20 into Combat Units," *IHS Jane's Defence Weekly* February 12, 2018; <https://www.janes.com/article/77794/plaaf-inducts-j-20-into-combat-units>. Accessed on September 3, 2018.

30. CAS – Close Air Support; SEAD – Suppression of Enemy Air Defence; OCA – Offensive Counter. Air.

Shaheen series of exercises with the PAF and their participation (since 2014) at the Aviadarts Military Games at Lipetsk AFB, in Russia. The Aviadarts competition pits selected pilots from various countries (Russia, China, Belarus, Azerbaijan, etc.) in a gunnery meet-cum-aerobatics competition where pilot skills in navigation, reconnaissance and evasion of ground-based air defence systems—including the feared S-300 surface-to-air missile system – are also tested. On conclusion of the Aviadarts 2017 in China in August 2017, Commander of the Russian Aerospace Forces Col Gen Viktor Bondarev said, “Our team came first in the contest. It was a close fight, the Chinese pilots proved to be worthy opponents, but our pilots were unparalleled.”³¹

As early as 2015 when the US Department of Defence (DoD) tabled its report to Congress on “Military and Security Developments involving the People’s Republic of China”, the PLAAF has been credited with “rapidly closing the (technology) gap with Western air forces across a broad spectrum of capabilities from aircraft, C2, to jammers, to Electronic Warfare (EW), to datalinks;”³² this has been reiterated in its 2018 report to Congress as well.³³

Closer home, of late, the PLAAF has been carrying out joint training drills in the Tibetan Autonomous Region (TAR) which are aimed at creating a favourable air situation for unhindered operations of the PLA. These exercises involve the use of helicopters to drop highly mobile units of the PLA whose main objective would be to capture and hold mountain passes and Advanced Landing Grounds (ALGs), and neutralise the IAF’s ‘gap-filler’ radar units. Attention is also being placed on providing greater air defence coverage to PLAAF airfields in the TAR in an ‘Integrated Air Defence System’ (IADS) through induction of radars and air defence weapons – Medium Range Surface-to-Air Missile (MRSAMs), Short Range Surface-to-Air Missile (SRSAMs) and point defence weapons in the form of anti-aircraft-artillery

31. “Russian Crew Wins Aviadarts 2017 Int’l Air Contest in China” © Sputnik / Evgeny Biyatov, WORLD064710.08.2017GetshortURL:<https://sputniknews.com/world/201708101056338077-russian-crew-aviadarts-china/>. Accessed on August 29, 2018.

32. Pentagon 2015 Report to Congress on China’s Military Power, May 8, 2015; USNI News; <https://news.usni.org/2015/05/08/document-pentagon-2015-report-to-congress-on-chinas-military-power>. Accessed on September 1, 2018

33. DoD Annual Report to Congress: Military and Security Developments Involving the People’s Republic of China 2018; <https://media.defense.gov/2018/Aug/16/2001955282/-1/-1/1/2018-CHINA-MILITARY-POWER-REPORT.PDF>. Accessed on September 2, 2018.

that has a very high rate of fire. Attention is also being given to ground-based LIMAN jammers.³⁴ Civil-military integration is also being assessed to ensure sustenance of the military in a long duration war without the need for a long logistics chain,³⁵ possibly the PLA fears that this 'tail' would be interdicted by the IAF. This 'fear' resulted in their abrupt pull-out from the regions they had advanced to (till Misamari, near Tezpur) during the concluding phases of the 1962 India-China War.

From the above, it is clear that the PLA is 'gearing up' for a possible conflict in the future; the capability is being developed, the intent (to wage a war) could possibly depend on geopolitical compulsions as might arise in the future.

The message for us is clear – we need to stay prepared 24x7 to counter this threat.

THREATS IN THE FUTURE

Many armchair strategists feel that in the future, the chances of classic force-on-force kinetic warfare – that is currently driving the acquisition of military hardware – would be low. However, militaries, being the traditional last bastion to ensure national security, always follow a conservative approach and prepare for the final onslaught, wherein, once all options of unrestricted war fail to meet the desired ends, conventional war-fighting, as the final option, might be resorted to by the enemy. Their apprehension is that conventional military asymmetry at such times could prove disastrous,

34.. The LIMAN is designed to protect ground targets against aircraft attacks by means of jamming hostile aircraft navigation and radio communications links with airborne or ground support platforms. The LIMAN automatically searches and intercepts radio communication and navigation-aid signals, whether fixed or frequency-hopping. It can jam a specific frequency or can be used to barrage jamming across a large portion of frequency band to deal with frequency-hopping (HAVE QUICK) systems. The maximum jamming range is 450 km; "The Ground Mobile Air Defense Electronic Countermeasure (ADEC) System which Received Designator LIMAN," UKROBORONSERVICE; <https://en.uos.ua/produktsiya/sistemi-zashchiti/47-nazemniy-mobilniy-kompleks-radiopodavleniya-liniy-navedeniya-aviatsii-liman>. Also see <https://media.defense.gov/2018/Aug/16/2001955282/-1/-1/1/2018-china-military-power-report.pdf>

35. "Chinese Military Holds Drill in Tibet to Test Factors that Influenced 1962 War with India", *Hindustan Times*, June 30, 2018; <https://www.hindustantimes.com/world-news/chinese-military-holds-drill-in-tibet-to-test-logistics-weapon-support-civilian-integration/story-MJwjXeTxfDAJ0l5ZZEEwBl.html>. Accessed on September 2, 2018.

paving the way for defeat at the hands of the more powerful aggressor; it could end up in conceding to the 'unfair' demands of the enemy. Accretion of military arms in a focussed manner, keeping the (purely conventional) military threats in the future in mind cannot, therefore, be ignored.

The type of conflict that has been ongoing in Ukraine since 2014 has been referred to variously as Russia's New Generation Warfare or Seventh Generation Warfare.

Obviously, the West – read the US and North Atlantic Treaty Organisation (NATO) – had been so engrossed in their own affairs that their lack of commitment to provide timely help virtually resulted in an abandonment of Ukraine. Russia could not have timed its intervention better, and it succeeded in annexing Crimea without a whimper from the world – the usual resolutions from the UN condemning the act notwithstanding!

What do we need to learn from this? Is the age of anarchy back? Has the world forgotten the Treaty of Westphalia, signed as far back as 1648?

Hitler, of course, rescinded the Peace of Westphalia once his conquest of Europe began. Now, is it Russia's turn to repeat the feat? And, of course, if Russia does something, can China be far behind?

We have already seen the beginnings of the 'creeping invasion' of territories in the South China Sea (SCS) by China. The world is still trying to decide how to deal with a China that is growing stronger, by the day, militarily and economically – enough to question the US' likely intervention in the SCS for providing assistance to its allies in the region, viz. Japan, South Korea and Taiwan (the Republic of China). Towards this, China has not only built up its Anti-Access/Area Denial (A2/AD) capability by operationalising anti-ship ballistic missiles like the the DF-21D, but has also built runways on islands in the Spratlys (Fiery Reef, Mischief Reef and Subi Reef) and the Paracel group of islands (at Woody Island). Use of these runways and infrastructure – that can accommodate up to 100 Gen 4+/Gen 5 aircraft – for coercion and area denial in operations that will remain below the threshold of all-out war is likely to be the *modus operandi* of the Chinese in the future. There are already signs of the 'Little Blue Men' – the Chinese Coast Guard and the maritime militia – who are operating in the grey zone (at levels

China has demonstrated its ability to transmit secure data (including video calls) at distances as large as 6,800 km with the launch of the quantum communications satellite – Micius – in August 2016. It has already set up five ground stations across the country from where secure communications can be exchanged.

below all-out war) and continuing to harass and intimidate fishermen and militaries of regional nations in the SCS region; no solution appears to be in sight to challenge the ‘new normal’ and the hybrid warfare set in motion by the Chinese in the region.

With the creation of a cyber army, China’s emphasis on electronic warfare [using High Altitude Long Endurance (HALE) Unmanned Aerial Vehicles (UAVs) as platforms], and with the continued development of directed energy weapons, China has made clear its intentions of the likely form of warfare it would resort to in

its next major military engagement: *“information operations (IO) – including cyber, electronic, and psychological warfare – (that would be) integral to conducting modern warfare.”*³⁶ In an attempt to expand its influence beyond the First Island Chain, China has begun to exercise its long range bombers – the H-6K – in the Western Pacific. Armed with Air Launched Cruise Missiles (ALCMs), these bombers pose an existential threat to US air assets based in Guam. This is in consonance with China’s efforts at ‘breaking out’ from the confines of the Taiwan Straits to areas further afield. The H-6K bombers were escorted by Su-35 fighters that undertook air-to-air refuelling for the mission flown on May 11, 2018. The demonstration was aimed at projecting China’s ability – in the future – to undertake *“informatized local wars” – regional conflicts defined by real-time, data-networked command and control, and precision strike.*³⁷

China has demonstrated its ability to transmit secure data (including video calls) at distances as large as 6,800 km with the launch of the quantum communications satellite – Micius – in August 2016, and the first long distance quantum secured video call between researchers in China and

36. n. 34, p. 73.

37. Colin Clark, “China ‘Likely’ Training Bomber Pilots To Hit US, Allied Targets,” *Breaking Defence*, August 17, 2018; <https://breakingdefense.com/tag/second-island-chain/>. Accessed on September 2, 2018.

Austria in December 2017³⁸ that lasted 75 minutes (with a total of approximately two GB data being transmitted securely). It has already set up five ground stations across the country from where secure communications can be exchanged.³⁹ That some of these ground stations are in the TAR indicates the military intent of the (almost certain) use of this capability in the future to protect its command and control system in the region.

The CONOPS (Concept of Operations) that are likely to be favoured by nations possessing such capabilities would be to try and control the electromagnetic spectrum before the fighting breaks out. This would include an attempt to degrade/neutralise the enemy's command and control structure through cyber attacks (as part of information operations) and carry out jamming of communication and radar systems and GPS satellites of the adversary. Protection of own assets would be an integral part of such operations. China is focusing on information, cyber, space and counter-space operations.

NEED FOR JOINT TRAINING (TO TACKLE FUTURE THREATS)

It is only through a joint approach to warfare that the synergies of the core competencies of the individual Services can be realised. Today, each Service

It is only through a joint approach to warfare that the synergies of the core competencies of the individual Services can be realised. Today, each Service has capability in the cyber realm as well as the EW domain. Synchronisation of the efforts in these areas to not only protect own systems but also launch a strong cyber and EW attack on the enemy's C2 nodes would prove to be the game changer.

38. Emily Conover, "A Quantum Communications Satellite Proved its Potential in 2017, Intercontinental Video Call Sets Distance Record for Cryptography via Entangled Photons, December 13, 2017, *ScienceNews*; <https://www.sciencenews.org/article/global-quantum-communication-top-science-stories-2017-yir>. Accessed on August 31, 2018.

39. These are located in Xinglong (near Beijing), Nanshan (near Urumqi), Delingha (37°22'44.43"N, 97°43'37.01"E), Lijiang (26°41'38.15"N, 100°1'45.55"E), and Ngari in Tibet (32°19'30.07"N, 80°1'34.18"E); "Real-World Intercontinental Quantum Communications Enabled by the Micius Satellite," January 19, 2018, University of Science and Technology of China; <https://phys.org/news/2018-01-real-world-intercontinental-quantum-enabled-micius.html#jCp>. Accessed on August 31, 2018.

has capability in the cyber realm as well as the EW domain. Synchronisation of the efforts in these areas to not only protect own systems but also launch a strong cyber and EW attack on the enemy's C2 nodes would prove to be the game changer. Psychological operations and information operations are other areas where synchronisation of efforts would pay greater dividends. Interaction with the civil intelligence agencies would need to be maintained – and encouraged – to adopt a 'whole of nation' approach to tackle a future Doklam type grey zone incident that almost turned ugly; it had the makings of the 1962 conflict as the Chinese had begun calling India's action (at Doklam) an "intrusion".

How can Headquarters Integrated Defence Staff (HQ IDS) help the Services to synergise their efforts in keeping with its motto: "*Victory through Jointmanship*"?

The training calendar for the three Services should be coordinated by HQ IDS so that the synergy required for fighting today's high-tech wars can be achieved through joint training. Although one cannot train for all contingencies that are likely to be faced during war, once interoperability issues are resolved during intense peace-time training, the few cases which have not been practised, could be tackled by the intrinsic flexibility and adaptability among own warriors.

Interoperability issues among the three Services need to be ironed out during peace-time, realistic exercises like the recently concluded IAF's Exercise Gagan Shakti 2018.

IS A CHANGE IN THE HIGHER DEFENCE ORGANISATION OF INDIA NECESSARY?

The stellar role played by the Indian armed forces in winning all the wars fought since Independence – except in 1962 when the air force was not utilised – appears to have been all but forgotten by the recent proponents of Integrated Theatre Commands. They seem to have forgotten the individual core competency of each Service that was on display throughout the conduct of these wars. Jointness too played an important role, as we have seen earlier in the paper.

There were, however, instances during the 1965 India-Pak conflict when air power, although available, was not utilised in support of own ground forces. This was as a result of the procedures for seeking immediate air support not being streamlined and, in some cases, not being cleared by the controlling formations.⁴⁰ Lack of reliable secure communications between the Tactical Air Centres (at Corps HQ) and controlling Air Force Wings (where fighter aircraft were based) was another deficiency in providing timely air support to the army.⁴¹ These deficiencies were made good by the time the next war came along and the degree of close support in the 1971 War was exemplary.

Whenever joint training was carried out prior to the conduct of the operation(s), the results were exceptional (e.g. the Tangail airdrop). The blunting of the Pakistani armoured thrust in the Longewala sector by IAF Hunters is a testimony of the close support provided by the IAF to the beleaguered Indian Army troops in the area; in the process, the IAF prevented what would have been a major embarrassment to the Indian armed forces had the Pakistan Army been successful at Longewala. All the actions by the IAF to gain air dominance in East Pakistan in early December 1971 prepared the ground for the Indian Army to continue its operations against Lt Gen Niazi's forces unhindered by enemy air; an Army on the move is certainly an easy target for air forces, as opposed to a dug-in, defensive army.

Sheer grit and outstanding leadership of the young officers and jawans of the army was on display while evicting the intruders from the Kargil heights against defying odds and against a well entrenched enemy who occupied the dominating heights and had a veritable storehouse of ammunition and weapons – including shoulder-fired SAMs (Stingers). Here too, the IAF, once inducted (on May 26, 1999), provided full support to the army to 'soften' the positions being occupied by the intruders; most operations were well coordinated through joint planning at the Corps HQ. Eventually, through a round-the-clock bombing effort and interdiction of supply dumps,

40. Indian Army's 15 Div was launched on a major highway towards Lahore without informing the IAF. On being attacked by the PAF, close support was requested by 15 Div. the request was forwarded to the Corps HQ, but was not authorised by the Corps HQ. Singh, n.7, pp. 129-131.

41. *Ibid.*, p. 131.

the enemy's will to continue was broken. The Indian Army carried out a commendable job to evict the intruders from the heights they had wrongfully occupied.

Does such an outstanding performance by any military in winning its nation's wars in the past then require the armed forces to move away from the established organisational set-up that has served the nation well so far? Does it really require a change in the higher defence organisation either?

The reluctance of the Services in the US to operate as an integral joint force and the continued parochialism that existed led to several operational blunders. Also, there were serious differences within the Services when it came to prioritising defence acquisitions; each wanted a greater piece of the pie. This led to the introduction of the Goldwater-Nichols Act (GNA) in 1986 – a reform in the higher defence organisation of the US.

However, thirty years down the road, and with the more technologically advanced nations posing as peer competitors to the US military, "*getting better technology into the hands of the war-fighter faster is an imperative*" as outlined in a report by the Naval Postgraduate School of the US.⁴² The report recommends a review of the GNA 1986 to shorten the acquisition cycle even further if the US military is to stay ahead of the competition "to defend the country".⁴³

With a concept of bipartisan budget support – as outlined in the Bipartisan Budget Act 2018 of the US – certain defence spending is authorised to the government that is in office.⁴⁴ Political machinations by opposition parties in India, on the other hand, opposing induction of critically needed weapon systems/technologies have mostly had a deleterious effect on acquisitions that impact national defence. This is one area that needs to be addressed urgently while considering 'structural reforms' in the higher defence organisation.

42. Dale P. Bond, Scott M. Davis, Aaron D. Pearsall, *The Goldwater-Nichols Act of 1986: 30 Years of Acquisition Reform* (California: Naval Postgraduate School, Monterey, December 2016), p86; <http://www.dtic.mil/dtic/tr/fulltext/u2/1030707.pdf>. Accessed on September 3, 2018.

43. *Ibid.*, p. 86.

44. Seamus P Daniels and Todd Harrison, "Making Sense of the Bipartisan Budget Act of 2018 and What It Means for Defense", February 20, 2018; CSIS; by <https://www.csis.org/analysis/making-sense-bipartisan-budget-act-2018-and-what-it-means-defense>. Accessed on September 3, 2018.

The post of the Chief of Integrated Defence Staff to the Chairman of the Chiefs of Staff Committee (CISC) was created in 2001 as a result of the proposals made by the Group of Ministers, based on the recommendations of the Kargil Review Committee to fulfil the pressing need for an institutional framework for higher management of defence. The Integrated Defence Staff was expected – on lines similar to those set out by the GNA 1986 – to bring about a modicum of rationality to the defence acquisition procedure. Also, it was expected to play a pivotal role in coordinating joint operational planning among the three Services. However, this has not happened despite 17 years having passed since its formation. To be fair to the institution of the IDS, although great effort has been expended to streamline the acquisition process, the final clearances by the apex body – the CCS – have, however, been beyond the control of IDS.

At the sharp end of the stick, it has been found that the Services always deliver a war-winning strategy when the chips are down. This does not mean that no reform is required; on the contrary, certain realignment in the overall functioning of the Chief of Staff Committee (COSC) – duly supported by HQ IDS – is considered inescapable. Some suggestions are discussed below:

- **Joint training** among the various Services, to increase interoperability, to be given the highest priority. The COSC needs to designate HQ IDS as the nodal agency to drive this training. Cyber, electronic warfare, information operations to be given the highest priority during such joint training. For time-sensitive targeting, greater emphasis to be placed on coordination of resources of all the Services and agencies for accurate Intelligence, Surveillance, Reconnaissance (ISR) inputs. The special forces of all three Services also need to train jointly for tasks that could require each other's core competencies for success.
- The COSC to ensure **joint planning** for operations – in consonance with the Raksha Mantri's (RM's) Op Directive, and also as 'war-gamed' by the Directorate of Net Assessment (part of HQ IDS) – by inviting representatives from all three Services.
- While the role of each Service cannot be ignored in joint war-fighting, assignment of priorities for the CONOPs to be followed to achieve

national aims – and consequent **outlining of roles and missions for individual Services** – need to be carried out by the COSC.

- Greater emphasis to be placed on **cross-training of officers** at the middle seniority levels – preferably after having completed a command tenure – to better appreciate the nuances of the other Services more comprehensively; exposure to each other’s CONOPs would have already been achieved earlier during joint Service exercises.

Presently, the Service chief who has been longest in the chair is appointed as the chairman of the COSC. Besides looking after his own Service, the chairman also administers the Strategic Forces Command (SFC) as well as the Andaman and Nicobar Command. This requires the chairman COSC to devote time and effort to understand the nuances of the critical aspects of the SFC as he is an important functionary in the Nuclear Command Authority chain of command. This additional responsibility, therefore, would impact his primary responsibility as a Service chief. Appointment of a Permanent Chairman COSC (PC COSC), as recommended by the Naresh Chandra Committee, would free the chairman COSC of this responsibility as there would now be a ‘full time PC COSC’ to look after this responsibility. This, then, is an urgent requirement in restructuring the higher defence organisation.

IS A THEATRE COMMAND STRUCTURE RELEVANT FOR INDIA?

During World War II, North Africa and England constituted one air theatre, while Europe was considered another theatre.⁴⁵ Geographically, the North African theatre is more than three times the area of India, yet it was considered one air theatre. All US air forces were placed under one air theatre commander – Gen Carl Spaatz. However, when Spaatz was asked by Gen Eisenhower, the Commander-in-Chief (C-in-C) of all US forces in North Africa, to stand down the US Eighth Air Force from carrying out its operations in the European theatre to support the air effort against

45. Col F. Randall Starbuck, *Air Power In North Africa, 1942-43: An Additional Perspective* (United States Air Force; US Army War College Class of 1992), p. 6; <http://www.dtic.mil/dtic/tr/fulltext/u2/a251886.pdf>. Accessed on September 3, 2018.

Rommel in North Africa, he successfully resisted this and emphasised that the strategic bombing effort of the Eighth against Germany should not be stopped. Eisenhower conceded to this and resolved the issue by creating another numbered air force – the 12th Air Force – for supporting the US' ground offensive in North Africa.

That Gen Carl Spaatz was able to resist the arm-twisting 'proposal' of his superior – Gen Eisenhower – is a rarity and a 'risk' not many senior officers would be willing to take today if placed 'under command'. It also showed the lack of air sense in the top military leader in the North African theatre who was fixated on achieving his tactical aim at the cost of the larger, strategic aim of winning the war.

The above situation arose at a time when the radius of action (roa) of fighter aircraft was only a few hundred kilometres; they depended on nearby bases for providing close support to the army. The bombers, on the other hand, could engage targets at further ranges but could not be provided fighter escort at all times due to the range limitations of fighter aircraft; most bombing raids were, therefore, undertaken by night. Today, when the roa of most Gen 4/Gen 4+ multi-role aircraft is in excess of 1,500 km – and which can be enhanced by more than three times that figure with in-flight refuelling – confining such aircraft to only a limited theatre would be sub-optimal utilisation of costly strategic assets. They should not be 'parcelled' away to theatres where their utilisation for strategic tasks would not be under the control of the 'air theatre commander' – the Chief of Air Staff (CAS) of the IAF.

This ability of fighter aircraft to operate across the country was amply demonstrated during Ex Gagan Shakti 2018 held in April 2018 when Su-30 aircraft, operating from Kalaikunda Air Force Base in Eastern Air Command 'engaged' targets in the Arabian Sea near Lakshadweep before recovering at Thanjavur air base in southern India – covering more than 4,000 km and refuelling in the air several times during the mission.⁴⁶

46. Jugal Purohit, "Wargame Gaganshakti: What Is The IAF Saying?" Salute, May-June 2018; <https://salute.co.in/wargame-gaganshakti-what-is-the-iaf-saying/>. Accessed on September 3, 2018.

The Flight Refuelling Aircraft (FRA) and the Airborne Warning and Control System (AWACS) aircraft are force multipliers that are few in number because of their high acquisition cost. Their utilisation is centrally controlled by Air HQ for specific missions. Unity of command – particularly for control of strategic air assets – is a tenet that needs to be respected while considering utilisation of scant resources for strategic tasks.

Creation of Theatre Commands in India, merely to assuage the need for ‘on call’ air effort – to be used at the whims of the commander – is decidedly not the most intelligent way of utilising the strategic assets of the IAF.

In view of the above, this author is of the opinion that Theatre Commands do not merit consideration in the Indian context. What is more important is to energise the **joint training** regimen among the three Services to improve interoperability and prepare them for various likely scenarios where joint operations are envisaged.

CONCLUSION

The performance of the IAF in all the wars fought so far has proved decisive. **Joint operations** have been, and always will remain, the *mantra* for IAF operations in the future also. This, however, needs dedicated effort during peace-time, realistic training to iron out interoperability issues before the bullets start flying around. **Joint planning** for operations will prove decisive as the nature of warfare in the future would require greater synergy between the Services to partake – and share – their core competencies in the conduct of information operations, cyber, electronic warfare, space and counter-space operations and special forces operations. Creation of a PC COSC towards restructuring of the higher defence organisation is recommended. Integrated Theatre Commands are not a viable proposition for a country the size of India, having air assets that can be flexibly deployed across its length and breadth, as required.

Joint training has been the icing on the cake during past wars which has provided results far greater than can be achieved by a single Service alone. Its paramountcy for the conduct of future wars will remain.

BABUR-3—PAKISTAN’S SLCM: CAPABILITY AND LIMITATIONS

RAJARAM NAGAPPA, AVINASH P AND RIFFATH KHAJI

On January 9, 2017, Pakistan carried out the flight test of a 450-km range Submarine Launched Cruise Missile (SLCM), the Babur-3. This was followed by another test on March 29, 2018. Apart from claiming advanced technical features, reports appearing in the Pakistani media claimed that with the launch of the Babur-3, Pakistan had achieved second strike capability. Based on the publicly available materials, the capability of the missile has been examined and the assessment shows that the missile range is shorter than the claimed one, and is about 250 km. This paper looks into the implications of the fielding of the Babur-3 on strategic stability and deterrence. The paper also reflects on the future direction that Pakistan may take to reinforce its second strike capability.

INTRODUCTION

The 2017-18 period has seen new advances in the Pakistani missile development scenario. The missile developments broke new ground with the introduction of the Multiple Independently Targeted Reentry Vehicle (MIRV) capable Ababeel, the submarine launched cruise missile Babur-3, and the improved short-range ballistic missile Nasr. The press releases

Rajaram Nagappa is the Head of the International Strategic and Security Studies Programme (ISSSP), National Institute of Advanced Studies (NIAS), Bengaluru.

Avinash P is a Junior Research Fellow in ISSSP, NIAS.

Riffath Khaji is a Senior Research Fellow in ISSSP, NIAS.

Babur-3 is aimed towards providing Pakistan with second-strike capability, and to quote from the ISPR press release, “it is a manifestation of the strategy of measured response to nuclear strategies and postures being adopted in Pakistan’s neighbourhood”.

accompanying these launches indicate a shift from credible deterrence to full spectrum deterrence in the Pakistani military circles. The Babur-3, according to the Inter-Services Public Relations (ISPR) press release, is aimed towards providing Pakistan with second-strike capability, and to quote from the press release, “it is a manifestation of the strategy of measured response to nuclear strategies and postures being adopted in Pakistan’s neighbourhood”. The paper attempts to gauge the technical capabilities of the

Babur-3 submarine launched cruise missile and the strategic implications of fielding this system.

BABUR-3 FLIGHT TESTS

Two flight tests of the Babur-3 have been reported: one in January 2017, and the second in March 2018. The Babur-3 was claimed to be a variant of the ground launched Babur-2, which has a range of 700 km. The claimed range of the Babur-3 is 450 km and summary details from media reports are provided in Table 1.

Table 1: Babur-3 Missile Tests

Missile	Launch Date	Performance	Remarks
Babur-3	January 9, 2017	Range: 450 km	Submarine launched cruise missile ¹
Babur-3	March 29, 2018	Range: 450 km	Launched from underwater dynamic platform ²

1. ISPR Press Release Number PR- NO-10/2017, <https://www.ispr.gov.pk/press-release-detail.php?id=3672>. Accessed in May 2018.
 2. ISPR Press Release Number PR-NO-125/2018 <https://www.ispr.gov.pk/press-release-detail.php?id=4660>. Accessed in May 2018.

TECHNICAL PARAMETERS OF THE MISSILES

Only limited open source information is available on the Babur-3 cruise missile. The images available also are not clear and distinct to derive meaningful information relating to the missile's features and dimensions. An attempt is, however, made using the available information, ISPR press release, and imagery, along with some standard features of torpedo tube launched weapons to obtain an understanding of the missile system.

The Babur-3 is a submarine launched subsonic cruise missile, launched from the torpedo tube of the Agosta-90B (Khalid class) submarine in service with the Pakistan Navy. Fig 1 (reproduced from the ISPR press release) depicts the missile in flight after emerging from under water.

The Pakistan Navy possesses two Agosta 70 (Hashmat class) and three Agosta 90B (Khalid class) submarines. The former are equipped with the UGM-84 Harpoon, while the latter field the French SM-39 Exocet anti-ship missiles. Pakistan has, therefore, adequate experience with torpedo tube launched cruise missiles.

Fig 1: Babur-3



The Pakistan Navy possesses two Agosta 70 (Hashmat class) and three Agosta 90B (Khalid class) submarines. The former are equipped with the UGM-84 Harpoon, while the latter field the French SM-39 Exocet anti-ship missiles. Pakistan has, therefore, adequate experience with torpedo tube launched cruise missiles and the emergence of the Babur-3 from this consideration should not be surprising.

The press release³ issued by the ISPR in connection with the Babur-3 launches as well as the related video provide some details. And as the missile is launched from the submarine torpedo tube, some inferences can be drawn from the study of the Exocet SM-39 missile, launched in a similar manner. According to the ISPR press release, in the January 2017 launch, the missile was fired from an underwater mobile platform, while for the March 2018 launch, the missile was fired from an underwater dynamic platform.

It would appear that the mobile platform refers to a pontoon launch, wherein the pontoon can be towed to the required location and submerged to the required depth and the missile launched in the simulated torpedo tube environment. The underwater dynamic platform could also signify a pontoon or an actual submarine. All the development tests need to be done using the pontoon to demonstrate the safety and reliability of the system before it can be integrated with the submarine.

Some technical parameters of the Babur-3, based on ISPR information, are explained in Table 2.

Table 2: Babur-3 Technologies

Extract from ISPR Press Release	Explanation/Comment
Missile range is 450 km	
Missile was fired from an underwater mobile platform	Pontoon/Khalid class submarine.

3. n.1.

<p>The Babur-3 is a sea-based variant of the Babur-2 ground launched cruise missile</p>	<p>Modifications of the Babur-2⁴ for sea-basing will involve reduction in diameter to house inside the torpedo tube and wrapping of the fins around the missile body. The length of the missile will also be constrained by the dimensions of the torpedo tube. The same turbojet/turbofan engine could power both the Babur-2 and Babur-3.</p>
<p>Incorporates underwater controlled propulsion.</p>	<p>The missile may incorporate a propelled and guided underwater vehicle similar to the one used with the Exocet. This, however, would take up space and have a bearing on the onboard fuel quantity and, hence, the range. Alternately, the missile could be floated to the surface, where a surface sensor will command the ignition of the booster</p>
<p>Other technologies include global navigation augmented guidance and navigation, terrain and scene matching, terrain hugging, sea-skimming and stealth technologies.</p>	<p>These technologies are common and relevant for any cruise missile.</p>

For expelling a torpedo from the submarine tube, three methods are in vogue, as explained below:

- ‘Swim out’, in which the torpedo propels under its own power.
- Gas/air ejection, which requires a dedicated system to vent the exhaust air inboard, to avoid detection of the bubble on the surface, leading to compromise of the submarines position.
- Hydraulic or mechanical ram, which is silent and effective, and gives the exact momentum required.

4. In an earlier National Institute of Advanced Studies (NIAS) study, the Babur cruise missile diameter was estimated as 560 mm. See Rajaram Nagappa and S Chandrashekar, “Assessment of Pakistan’s Babur-Hatf-7 Cruise Missile”, NIAS Report number R5-07, NIAS, Bangalore, 2007.

The *swim out* and the *gas/air ejection* methods require extra length of the torpedo tube to provide speed and stability to the torpedo as it exits the tube. The torpedo expulsion in the Agosta 90B works on the ram principle. The Exocet underwater propulsion module, *Véhicule Sous Marin (VSM)*⁵ is not a missile performance augmentation unit, though it does provide a velocity of 20 m/second to the VSM. Its function includes obfuscation of the submarine platform location. For this purpose, the VSM can manoeuvre⁶ underwater at up to 90° on either side of the launch direction with a turning radius of 100 m; further underwater manoeuvres can be carried out using electromagnetic deflectors in the rocket motor nozzle. Pakistan manufactures the Agosta 90B submarine under licence and possesses operational experience. Pakistan can, therefore, be expected to possess the competency to replicate an appropriate system for the Babur-3.

MISSILE DIMENSIONS AND PERFORMANCE

One could arrive at the dimensions of the missile if a good image is available. The images and the video currently available in the public domain cannot be used for determining the missile dimensions. In the absence of a good image, an attempt is made to obtain the dimensions through other means. The dimensions of the submarine torpedo tube would be one useful source. The Agosta 90B submarine employs the standard 533 mm diameter torpedo tube and further, it is seen from the literature⁷ that the submarine fields the ECAN F17 Mod 2 torpedo, which is 5.62 m long. The Mod 1 version of the torpedo used against surface ships was 5.9 m long and the actual length of the torpedo tube can be expected to be longer by 1m, i.e. 6.9 m. In essence, the maximum length of the Babur-3 cruise missile + booster + VSM should be ≤ 6.9 m. The standard practice is to encapsulate submarine launched cruise missiles in an encapsulating shell, which will protect the missile from sea water as also the water pressure at operating depths.

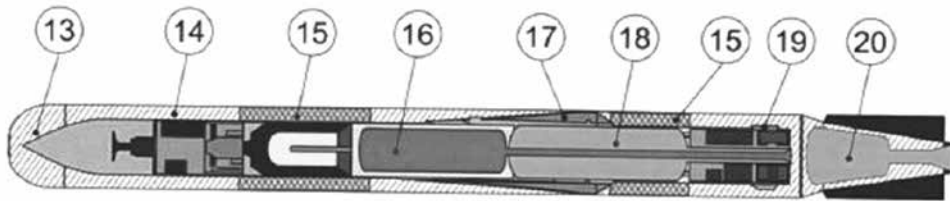
5. "Exocet Anti-Ship Missile", see <http://docfoualier.free.fr/exocet.pdf>. Accessed on April 19, 2018.

6. "Surface-to-Surface Missiles", France, *Jane's Naval Weapon Systems*, <http://www.vif2ne.org/nvk/forum/arhprint/417564>. Accessed on June 12, 2018.

7. "F-17 Torpedo", Archived 5/2003, https://www.forecastinternational.com/archive/disp_old_pdf.cfm?ARC_ID=1731. Accessed on April 15, 2018.

Making allowance for the encapsulation shell housing, release mechanism and clearance between the shell and the missile, the maximum length for the missile that can be housed in the torpedo tube will be 6,650 mm. The cross-sectional scaled sketch of the Exocet SM-39, shown in Fig 2⁸ along with missile's dimensional details provided in the company literature, permit us to determine the length occupied by VSM and the permissible diameter for the Babur-3.

Fig 2: Inner arrangement of Exocet



Legend:

13: VSM Cover 14: VSM Body 15: Launcher Shoes 16: Lift/Cruising Engine
 17: Folded Wings 18: Acceleration Motor 19: Folded Fins 20: VSM Motor

The following information is derived on the basis of Fig 2:

- Encapsulation shell inner diameter 516 mm
- Encapsulation shell outer diameter 533 mm
- Shell thickness 8.25 mm
- Encapsulation shell length 4,920 mm
- VSM length 968 mm

Assuming that Pakistan's design of the VSM is similar to that of the Exocet, it will be 968 mm long. This dimension can be rounded off to 970 mm—that leaves a length of 5,680 mm for the solid booster and cruise part of the missile. The encapsulation shell is designed to withstand the external pressure exerted by water at the operational depths of the

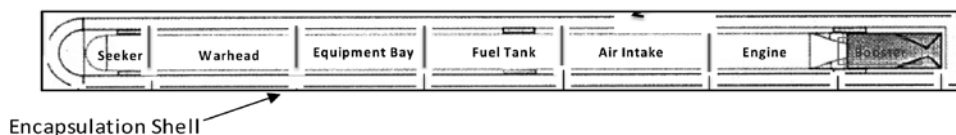
8. "Exocet Anti-ship Missile", Details reproduced from <http://sistemasdearmas.com.br/asv/exocet1historia.html> . Accessed on July 16, 2018.

submarine. It can, therefore, be assumed that the encapsulation shell for the Babur-3 will have the same thickness of 8.25 mm, as the one used with the Exocet. The wings, fins and the air intake are deployed in flight for the Babur-3. The main wings and the air intake are stowed inside the airframe till deployment. The fins are movable and control the missile in flight. While in the ground launched version of the Babur, the fins need not be stowed, for the submarine version, the fins need to fit into the encapsulation shell and have, therefore, to be folded or wrapped around the airframe. Keeping the thickness of the fin and its folding/wrapping requirement in mind, the maximum diameter of the Babur-3 can be expected to be 510 mm.

Rough measurement from the Babur-3 video indicates that the solid booster length is about 1/6 of the total (booster + cruise) length, which approximates to 1 m. A booster configured within this dimension is able to provide 5-6 g type of acceleration. If we take off another 300 mm for accommodating the separation system and fin actuation system, we will have a length of 4,380 mm for the cruise missile sub-systems.

The essential sub-systems of a cruise missile are shown in Fig 3. Based on the data of cruise missiles, engine manufacturer's catalogue and domain knowledge, the length and mass of the sub-sections can be estimated and are depicted in the figure.

Fig 3: Inner Details of Typical Cruise Missile



The warhead, equipment bay, power plant and the air intake occupy a good percentage of the space and there is little scope for minimising their volume. The seeker can be dispensed with for the strategic land attack roles; consequently, the fuel tank has to be accommodated in the remaining length. This will dictate the quantity of fuel onboard and, hence, the range of the

missile. The sub-system length arrived at for the Babur-3 in this fashion is shown in Table 3.

Table 3: Babur-3 Estimated Sub-system Length and Mass

Sub-system	Length, m	Mass, kg	Remarks
Equipment bay	0.8	76	The length and mass are computed for land attack mode, thus, dispensing with the need of a seeker (the corresponding numbers with a seeker will be 1.1 m length and 105 kg mass)
Warhead	1.0	400	
Airframe		260	
Air intake	1.0	50	
Fuel	0.68	100	With seeker included, the tank length and fuel mass reduce to 0.38 m and 57 kg respectively
Cruise engine	0.9	100	
Cruise-booster interface	0.3	–	Included in the airframe mass
Cruise missile	4.68	986	
Booster Propellant		240	
Motor hardware	1.00	20	
Total Babur-3	5.68	1,246	
Total at launch		1,966	

In this apportionment, the tank length is limited to 0.68 m and the consequent fuel mass is only 100 kg. The mass of the 6.9-m-long encapsulation shell is estimated to be 720 kg. From the video⁹ released by ISPR for the March 29, 2018 launch, the encapsulation shell is seen to separate at approximately 1.2

9. "Surface-to-Surface Missiles", France, *Jane's Naval Weapon Systems*, 36, posted November 29, 2001. Available at <http://www.vif2ne.org/nvk/forum/arhprint/417564>. Accessed on January 29, 2018.

The choice for Pakistan will be between longer missile range and platform survivability. Common sense suggests platform survivability as the primary choice and this necessitates the use of VSM. From this consideration, it can be concluded that the range of the Babur-3 is of the order of 250 km only.

seconds after emerging at the sea surface. This timing compares quite well with the VSM separation height of 20 m, which is equivalent to 1 second for the Exocet missile. The paint markings on the airframe indicate that the missile is spinning at about 5 revolutions per second (RPS). The spin will help in stabilising the missile in this phase of flight.

The missile range is estimated using engineering judgement values of missile velocity and engine specific fuel consumption. With fuel mass of 100 kg, it is found that the missile range is limited to 250 km. This range is in line with most of the operational Anti-

Ship Cruise Missiles (ASCMs) as shown in Appendix 1. For ground attack purposes, there will be further erosion in the direct range value as the missile flight path will be programmed to avoid air defence and radar installations. The only way the range of 450 km becomes feasible, is to increase the length of the fuel tank by sacrificing the need for VSM. The choice for Pakistan will be between longer missile range and platform survivability. Common sense suggests platform survivability as the primary choice and this necessitates the use of VSM. From this consideration, it can be concluded that the range of the Babur-3 is of the order of 250 km only. The non-availability of the notice to mariners/airmen pertaining to the launch dates precludes a separate estimate of the missile range.

SECOND STRIKE PERSPECTIVE

After the first test of the Babur-3 on January 9, 2017, the ISPR¹⁰ release stated, "*Babur-3 SLCM in land-attack mode is capable of delivering various types of payloads and will provide Pakistan with a Credible Second Strike Capability, augmenting deterrence. While the pursuit and now the successful attainment of a second-strike capability by Pakistan represents a major scientific milestone, it*

10. n.1.

is manifestation of the strategy of measured response to nuclear strategies and postures being adopted in Pakistan's neighbourhood".

The press release¹¹ after the second test of the Babur on March 29, 2018, is more forthright and connects the test to the nuclearisation of the Indian Ocean Region (IOR). The relevant extract from the press statement reads, *"SLCM Babur provides Pakistan Credible Second-Strike Capability, augmenting the existing deterrence regime. Development of this capability also reflects Pakistan's response to provocative nuclear strategies and posture being pursued in the neighbourhood through induction of nuclear submarines and ship-borne nuclear missiles; leading to nuclearization of the Indian Ocean Region. Pakistan eyes this landmark development as a step towards reinforcing the policy of Credible Minimum Deterrence through indigenization and self-reliance"*.

It is evident that Pakistan aims for a credible second strike capability, however relevant or otherwise its reasons to attain this capability are. As early as 2015, retired Gen Khalid Kidwai, in an event¹² organised by the Carnegie Endowment for International Peace, is said to have stated that "assured second strike capability comes from being sea-based". Pakistan has in, the past, suggested that the Indian Ocean be declared a nuclear free zone. The Pakistani reasoning, in the present context, for the introduction of the Babur-3 as a response to "happenings in the neighbourhood leading to nuclearization of the Indian Ocean" is hollow – the US, in all probability has stationed nuclear weapons in Diego Garcia¹³ for years; in recent times, Chinese nuclear

Pakistan, no doubt, realises that a credible second-strike capability comes from long-range submarine launched ballistic missiles. The answer lies in possessing submarines equipped with vertical launch systems and capable of launching the Shaheen-2 class of ballistic missiles. It is to be expected that Pakistan would be working towards acquiring such a capability.

11. n.2.

12. "A Conversation with Gen. Khalid Kidwai", Carnegie Endowment for International Peace, 23 March 2015. See <http://carnegieendowment.org/files/03-230315carnegieKIDWAI.pdf>. Accessed May 17, 2018 .

13. "Diego Garcia: A Thorn in the Side of Africa's Nuclear-Weapon-Free-Zone", <https://thebulletin.org/diego-garcia-thorn-side-africas-nuclear-weapon-free-zone>. Accessed on May 30, 2018.

submarines have been active in the IOR, ostensibly on anti-piracy patrols; and further, a Chinese Type 093 Shang class nuclear-powered attack submarine (SSBN) was at Karachi for a prolonged period during 2016-17.

Pakistan, no doubt, realises that a credible second-strike capability comes from long-range submarine launched ballistic missiles. The answer lies in possessing submarines equipped with vertical launch systems and capable of launching the Shaheen-2 class of ballistic missiles. It is to be expected that Pakistan would be working towards acquiring such a capability. There are reports that Pakistan may be negotiating with China for the lease of a Han class attack submarine. On the other hand, the NDTV¹⁴ report of January 10, 2017, speculates that Pakistani naval officers were taken aboard the Shang class SSBN, which docked in Karachi, and Pakistan may be in discussions with China for the leasing of this class of submarine. China, however, will weigh its options seriously prior to leasing the SSBN to Pakistan, even for training purposes. Such a gesture is certain to raise an intense international reaction due to considerations of proliferation and Pakistan's rather poor proliferation history.

Riaz Haq's blogsite¹⁵ as early as February 2012, had claimed that Pakistan was working on the indigenous development of a nuclear powered submarine. It is difficult to gauge the progress on Pakistan's indigenous nuclear submarine programme, but in view of the technological challenges, financial constraints, safety/reliability issues and acquisition priorities of the Pakistan Navy, it would be fair to assume that this is, at best, a distant goal.

Consequently, as Manpreet Sethi states, Pakistan is stuck with a *jugaad*¹⁶ solution to building sea-based deterrence, as reflected in the limited capability nuclear-tipped Babur-3 employment in the Agosta 90B/Khalid class diesel submarines of the Pakistan Navy. Sethi goes on to say, "Pakistan is seeking notional survivability through an essentially non-survivable platform". Pakistan would, therefore, be trying for a better than *jugaad* solution; with the SSBN

14. Vishnu Som, "Pakistan Likely to Acquire Chinese Nuclear Attack Submarines: NDTV Exclusive", NDTV, January 10. Accessed on June 27, 2018 <https://www.ndtv.com/world-news/pakistan-likely-to-acquire-chinese-nuclear-attack-submarines-ndtv-exclusive-1647370>

15. Riaz Haq, "Pakistan to Build Nuclear Submarines?" <http://www.riazhaq.com/2012/02/pakistan-to-build-nuclear-submarines.html>. Accessed on June 15, 2018.

16. Manpreet Sethi, "Pakistan's Jugaad at Building Sea Based Deterrence", Expert View, Centre for Air Power Studies, May 5, 2018.

option out of the reckoning at this time, Pakistan may explore other options; and the Chinese diesel electric submarines may offer a slightly better prospect. Pakistan has ordered and committed funds for the acquisition of eight Chinese submarines. The China State Shipbuilding Industrial Corporation (CSIC) is the principal contractor for the boats. Media reports indicate that the Type 039 /Type 041 Yuan class diesel electric attack submarines¹⁷ (SSK) have been finalised. The Yuan class submarines are believed to be the quietest in the People's Liberation Army Navy (PLAN) fleet and are fitted with state-of-the-art MTU manufactured 396SE84 diesel engines¹⁸. The submarine hulls of this class are supposed to be clad with anechoic tiles to minimise return echoes. The acquisition cost is speculated to be in the region \$ 4-5 billion. Four of the boats are expected to be delivered by CSIC by the end of 2023, while the remaining four will be produced at the Karachi Shipbuilding and Engineering Works Ltd, for delivery by 2028. These submarines will be equipped with the Air Independent Propulsion (AIP) system, which will enable them to stay submerged for longer durations. According to *The Diplomat*,¹⁸ it is speculated that some of the Chinese submarines of the Yuan class may be fitted with the Vertical Launch System (VLS) and employ newer YJ-18 anti-ship cruise missiles. Is it possible that Pakistan may opt for VLS for the boats it is purchasing and modify it for the Babur-3 launch? At this stage, it is difficult to guess if the contract with CSIC allows for this change and the implication on cost and the delivery schedule. Based on available dimensions of the Yuan class submarines, a VLS system may allow an increase in length of 0.5 m and consequent increase in range of the order of 450 km.

WEAPON SYSTEM: NUMBERS AND RELIABILITY

Pakistan claims to have miniaturised the weapon systems to fit into smaller delivery vehicles comprising cruise missiles, tactical nuclear missiles and potential MIRVs. In an earlier study, one of the authors¹⁹ had estimated a

17. "China Resumes Production of its Quietest Attack Submarine", report in *The Diplomat*, January 6, 2017. See <https://thediplomat.com/2017/01/china-resumes-production-of-its-quietest-attack-submarine/>. Accessed on June 1, 2018.

18. Ibid.

19. Rajaram Nagappa, Arun Vishwanathan and Aditi Malhotra, "Hatf-IX/NASR – Pakistan's Tactical Nuclear Weapon: Implications for Indo-Pak Deterrence", NIAS Report No. R17-2013, July 2013.

Pakistan would have stockpiled 138 kg of plutonium by 2013. This quantity was estimated to be sufficient for 23 miniaturised weapons, and annually 5-6 weapons could be added to the inventory. At this rate, by the end of 2017, Pakistan would have accumulated 45-50 miniaturised weapon systems.

requirement of 6 kg of plutonium for a miniaturised weapon and the annual production of such miniaturised warheads. The assessment in the report was based on the known annual uranium production of 40 tonnes per annum in Pakistan and assumed that progressively all the uranium was used for conversion to plutonium. With this assumption, Pakistan would have stockpiled 138 kg of plutonium by 2013. This quantity was estimated to be sufficient for 23 miniaturised weapons, and annually 5-6 weapons could be

added to the inventory. At this rate, by the end of 2017, Pakistan would have accumulated 45-50 miniaturised weapon systems. The question is: how is Pakistan going to apportion this small number among its delivery platforms?

The number of weapons available and the number of platforms available are mismatched and equipping all the platforms with nuclear weapons will be sub-critical. Pakistan will have to prioritise the platforms which will be equipped with nuclear weapons. It is logical to assume that the operational systems will be the current priority; the priority may change as other missiles graduate from development to operational status. The platforms needing miniaturised weapons are listed in Table 4.

Table 4: Pakistan Miniaturised Weapon Carrying Missiles

Name	Type	Status
Babur-2	Land attack cruise missile	Operational
Ra'ad	Air launched cruise missile	Operational
Hatf-9/NASR	Tactical nuclear weapon	Operational
Babur-3	Submarine launched cruise missile	Development
Ababeel	Multiple independently targeted reentry vehicle	Development

The Khalid class submarines have four bow-mounted torpedo tubes. The weapons complement will include torpedoes, Exocet SM-39 missiles and Babur-3 cruise missiles. As the mixed weapon load of torpedoes and missiles for the submarine is 16, it is surmised that four Babur-3 cruise missiles with nuclear warheads may find a place in each submarine. The level of reliability of the missile system for employment on a submarine is high and would call for a large number of proving and qualification tests before integration with the submarine. Even when a demonstrated reliability number for the missile may be available, the reliability of the nuclear warhead, with no record of testing, is open to question.

If major hostilities break out, the Indian Navy will endeavour to confine the Pakistani surface and sub-surface platforms to the Pakistani territorial waters. From these confines, the 250 km range of the Babur-3 is hardly of any consequence, as all major Indian cities will fall out of its range.

STRATEGIC BALANCE

Does the Babur-3 change the strategic balance? One can accept that a sea-based strike capability should add to the strategic stability. However, the Babur-3 falls short of this objective from the following considerations:

- Indian surveillance capabilities can keep track of submarines in port and their ingress and egress from port.
- If major hostilities break out, the Indian Navy will endeavour to confine the Pakistani surface and sub-surface platforms to the Pakistani territorial waters.
- From these confines, the 250 km range of the Babur-3 is hardly of any consequence, as all major Indian cities will fall out of its range.
- The short range will again prove to be of little consequence, even if the submarines venture out of the territorial waters.
- Even if Pakistan manages to increase the range of the cruise missile to 450 km, major cities of western India like Ahmedabad and Mumbai will be out of the reach of a missile fired from within the Pakistani coastal

waters. The issues mentioned in the previous bullet points hold good for the longer range missiles too.

- The exception to this will be the endurance of the Agosta (Khalid) class submarines which may permit crossover to India's east coast and bring more Indian cities within strike range. This will involve a long transit time as well as long task durations, requiring major skills and resources in avoiding Indian surveillance and defence strategies.
- The Pakistani ambiguity as to whether the submarines are carrying conventional weapons or strategic weapons will prompt the Indian Navy to prey on any submarine lurking in the conflict zones
- Besides the sub-criticality in the weapon assignment against many platforms mentioned in the previous section, it must be kept in mind that both Pakistan and India have carried out only a few nuclear tests. In the case of Pakistan, a further constraint is the absence of the test of any plutonium-based weapon. The safety and reliability requirements for weapon systems to be deployed on submarines are very demanding and serious compromises may have to be struck for fielding untested nuclear weapons on the Pakistani submarines.
- There could be a reduction in the compromises if technical help from China was available, but then, it is open to question why China would be interested in providing such technical assistance of a critical nature.
- For communication with submarines, Very Low Frequency (VLF) and Extremely Low Frequency (ELF) systems are used. VLF allows communication to the submarine in shallow waters to a depth of 10 m, while ELF allows greater depth penetration but at lower data rates. Pakistan is known to possess a VLF station at its naval base, PNS *Hameed*, in Sind province. The VLF array, quite visible from the air and space, will be an inviting target, to be neutralised at an early stage of hostility.
- Command and control issues come with their own challenges. The question of keeping the vehicle and warhead in a demated condition, which could be the practice with land-based weapons, is clearly impractical within the narrow confines of a submarine. It is understood

that Pakistan has underscored that nuclear weapons will remain under centralised control. However, in view of the communication challenges that are faced by most nations that adopt nuclear weapons as part of their triad, Pakistan may also be compelled to pre-delegate the authority for use of the nuclear weapon to the submarine commander, with some control enforced through the 'two-man rule'. There will be associated risks.

The points made above show that there are many vulnerabilities with the Babur-3 system and the weapon does not provide second strike capability of any significance to Pakistan. Nuclear weapons onboard submarines have associated challenges, and maintaining the safety and the readiness of the weapons at all time will be a demanding task. Pakistan faces major risks with the deployment of the Babur-3 on its communication and sub-surface assets from the Indian Navy. In the process, Pakistan has raised the risks for itself on a higher scale than the risks posed to India.

CONCLUSION

Pakistan has made a beginning with a sea-based deterrence using the torpedo tube launched cruise missile Babur-3. The missile does not meet the basic requirement of a second strike weapon, as its safety, stealth and survivability are no better than those of conventional submarines. More importantly, it has a limited targeting capability with the short range it possesses.

Pakistan can be expected to progress towards overcoming this shortcoming and work for a nuclear-powered submarine fielding long range ballistic missiles. The technology and financial needs towards this goal are challenging and involve long lead times.

APPENDIX 1

LIST OF SUBMARINE LAUNCHED CRUISE MISSILES IN THE WORLD

Name	Country	Propulsion	Weight (kg)	Warhead (kg)	Range (km)	Speed (km/hr)
Harpoon	USA	Turbojet	691	221	280	864
Exocet	France	Turbojet (Block3)	670	165	180	1,134
BGM-109B Tomahawk	USA	Turbofan	1,200	450	450	880
YJ-18B	China	Not available		140-300	220-540	Cruise: .8M, Terminal: 2.5-3 M
3M-54E1 Klub (SS-N-27 SIZZLER)	Russia	Turbojet	1,780	400	300	Cruise: 0.8M Terminal: 2.5/2.9M

Acknowledgement Note from the Authors:

Vice Admiral RN Ganesh (Retd) took the trouble of going through the draft and provided insightful observations. The authors are indebted to him for his suggestion, which has enhanced the quality of the paper. The authors would like to thank Prof. Lalitha Sundaresan, Visiting Professor, NIAS and Prof. Srikumar Pullat, Visiting Professor, NIAS for their valuable inputs. The authors would also like to thank Dr Shailesh Nayak, Director, NIAS for his interest and constant encouragement.

UAV SWARMS: CHINA'S LEAP IN CUTTING-EDGE TECHNOLOGIES

RK NARANG

INTRODUCTION

China's President Xi Jinping has vowed to transform its industry from "mass production" to "mass production with quality" by achieving excellence in science and technology, innovations and military technologies. China's experimentation with niche technologies and its rising innovation index indicate its rising potential to take the lead in futuristic technologies in the military domain. It demonstrated its ability to develop a variety of Unmanned Aerial Vehicles (UAVs) in the last decade or so and simultaneously pursued the development of Artificial Intelligence (AI). Its focus had shifted towards integrating these two capabilities to develop intelligent UAV swarms about a decade ago; however, its UAV swarm programme came into the limelight only when it released a video of its UAV swarm during the Zhuhai Air Show in November 2016.¹ China has made significant progress in UAV swarms since then, which has enormous potential for military and civil applications. China has accorded high-level priority to AI, speech recognition, self-driving cars and other cutting-edge technologies that would enable it to keep pace with the US. It successfully demonstrated

Group Captain **RK Narang** is Senior Fellow, Centre for Air Power Studies, New Delhi.

1. Jeffrey Lin and P.W. Singer, "China's New Fleet of Drones: Airshow Displays the Future of Chinese Warbots and Swarms", *Popular Science*, November 4, 2016, <https://www.popsci.com/chinas-new-fleet-drones-zhuhai-2016-airshow-displays-future-chinese-warbots-and-swarms>. Accessed on August 8, 2018.

China has accorded high-level priority to AI, speech recognition, self-driving cars and other cutting-edge technologies that would enable it to keep pace with the US. It successfully demonstrated the world's largest fixed-wing as well as quadcopter UAV swarms in 2017 and 2018.

the world's largest fixed-wing as well as quadcopter UAV swarms in 2017 and 2018 respectively. The potential of UAV swarms to transform warfare from "informatised" to "intelligencised" warfare was the key motivating factor for China in developing fixed-wing and multicopter UAV swarms.² *The Diplomat*, a current affairs magazine, in an article on February 3, 2018, observed that China has moved beyond the initial steps in progress and the UAV swarm demonstration has placed China ahead of the US in its swarm technology.³ Chinese

military scholars view the UAV swarm to be a 'disruptive technology' in modern war-fighting, which is likely to "change the rules of the game".⁴ A researcher at the National Security and Military Strategic Research Centre of the National University of Defence Technology (NUDT) of China observed that the employment of smaller, cheaper and reusable UAVs in a swarm for distributed attacks could lower combat costs and reduce casualties associated with the larger manned combat platforms and combatants.⁵ China's rise in the domain of futuristic technologies like the UAV swarm was viewed as the rise of a country which had developed aviation platforms through reverse engineering or by clandestine acquisition of technologies. However, development of emerging technologies like UAV swarms almost during the same timelines as the US could not have been achieved through imitation, espionage or reverse engineering alone.

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2. Elsa B. Kania, *Chinese Advances in Unmanned Systems and the Military Applications of Artificial Intelligence—the PLA's Trajectory towards Unmanned, "Intelligentized" Warfare*, Government Publishing Office, US, February 23, 2017, https://www.uscc.gov/sites/default/files/Kania_Testimony.pdf. Accessed on April 27, 2018.
 3. "Intel Breaks Drone Record with Olympics Display with a Promise of More to Come," *The Engineer*, February 12, 2018, <https://www.theengineer.co.uk/intel-drone-olympics/>. Accessed on June 19, 2018.
 4. Xiang Bo, "China Launches Record-Breaking Drone Swarm", *Xinhua Net*, June 11, 2017, http://www.xinhuanet.com/english/2017-06/11/c_136356850.htm. Accessed on June 28, 2018.
 5. Zhang Qiang, "Smart Drone Bee Swarm will Change the Rules of Battle", March 29, 2017, http://kepu.gmw.cn/2017-03/29/content_24084029.htm. Accessed on April 30, 2018.

The Chinese government's policies and initiatives for excellence in Science and Technology (S&T) and futuristic technologies like artificial intelligence, autonomy, robotics, etc. have contributed significantly to the development of UAV swarms. Also, its concerted effort in harnessing the potential of government laboratories, defence forces, private industry and academia have been key enablers for developing UAV swarms. The aspiration of the present Chinese leadership is much higher as it wants its military-civil industry to become a global leader in innovation by 2049.

China's UAV swarm programme has also been one of the biggest beneficiaries of the brain and technology drain from the US, which was stimulated by the Chinese strategy of leveraging its financial power and investments to acquire technology and talent. A study by the Defence Innovation Unit Experimental (DIUx) of the US Department of Defence (DoD) highlighted the large-scale brain drain from the US to China, singling out certain Chinese venture capital firms, which had been investing in the promising start-up companies of the US in Silicon Valley, taking over their managerial control and transferring some of these technologies to China. The UAV swarm is a domain in which China has exploited gaps in the US trade policies, and yet it has not significantly affected trade relations between these two nations.

China has often been accused by the US policy-makers of resorting to illegal and clandestine means to acquire cutting-edge technologies. However, the US government never imposed sanctions on China and China's clandestine activities did not impact the US-China engagement in aerospace and other high technology sectors. The only exceptions have been when the US Administration used its diplomatic leverage with Israel to block the sale of the Phalcon Airborne Warning and Control System (AWACS) to China in 2000 and thereafter, upgradation of the Harpy loitering drones in 2005. These blocking actions of

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the US government were due to the threat posed by these weapons to US forces supporting Taiwan in any confrontation.⁶ The response of the US to the acquisition of cutting-edge technology by China through various clandestine means, including coercion and espionage, has been rather subdued. This paper examines China's UAV swarm programme, the significance of its policy initiatives, Military-Civil Integration (MCI), the contribution of the academia, defence forces and private industry and technology acquisition strategy for achieving a leadership position in innovation and cutting-edge technologies.

CHINA'S UAV SWARM PROGRAMME

A UAV swarm essentially comprises simultaneous operations of multiple 'intelligent' UAVs by utilising the combined capability of the entire group. Some Chinese scholars have used the term 'clustered operations' for collaborative and swarm operations. The interest of military leaders in UAV swarms is increasing as multiple intelligent UAVs can perform various tasks simultaneously. Research on UAV swarms has been going on in the US since the 1990s and China was closely following these developments as well as aggressively pursuing similar projects at home, some of which are discussed below. The earliest indication of the Chinese UAV swarm development programme was seen when Tsinghua University launched a project in collaboration with the research institute of the Chinese Army for developing integrated control of electro-mechanical sensors dedicated to flying micro-engines in 1998 for which a patent was filed in 2011.⁷

Fixed-Wing Swarm: China's National Electric Corporation, a company of the large state-owned enterprise, the China Electronic Technology Corporation (CETC), displayed the largest swarm comprising 67 fixed-wing UAVs at the Zhuhai Air Show on November 1, 2016, beating the previous record held

6. Edward Cody, "China Scolds U.S. for Blocking Israeli Arms Sale", *Washington Post*, June 28, 2005, <http://www.washingtonpost.com/wp-dyn/content/article/2005/06/27/AR2005062700351.html?noredirect=on>. Accessed on July 31, 2018.

7. "Provides Drone Cluster Control Solution, Poisson Technology Wants to Deepen the Market", *Taibo.com*, November 11, 2016, <http://www.3snews.net/startup/246000044122.html>. Accessed on June 26, 2018.

by the US Navy of a swarm comprising 50 mini UAVs.⁸ These UAVs were seen carrying out networked manoeuvres to hunt for missile launchers in an urban area and then diving into missile launchers to destroy them.⁹ During this trial, CETC validated the creation of an ad-hoc communication network (dynamic non-centralised network) within the swarm, individual situational awareness, collision avoidance and autonomous control of the group.¹⁰

In June 2017, CETC tested an even bigger swarm of 119 catapult launched fixed-wing UAVs to improve its previous record of a swarm comprising 67 fixed-wing UAVs¹¹ as well as to break the world record of a swarm comprising 103 UAVs set by the US in January 2017.¹² The UAV swarm divided into different groups, with each group circling over its intended target and thereafter, manoeuvring as a group to ascertain the viability of carrying out coordinated reconnaissance, distributed surveillance and saturated strikes over ground targets.¹³ However, the major difference between the Chinese fixed-wing UAV swarm and the US fixed-wing UAV swarm was that the Chinese swarm was launched from ground-based catapult launchers while the US swarm had been launched from fighter aircraft. The technology gap between the US and Chinese UAV swarms was evident as the US had launched the Perdix UAVs from a fighter aircraft, which is technologically more challenging. China had realised this and the People's Liberation Army Air Force (PLAAF) had launched a UAV swarm challenge in late 2017 with the aim to bridge this gap, which is discussed later in the article.¹⁴

8. "China Tests 119 Drones, Makes Breakthrough in AI Systems", *Xinhua- Global Times*, <http://www.globaltimes.cn/content/1051123.shtml>. Accessed on July 19, 2018.

9. Jeffrey Lin and P.W. Singer, "China is Making 1,000-UAV Drone Swarms Now", *Popular Science*, January 9, 2018, <https://www.popsci.com/china-drone-swarms#page=3>. Accessed on June 19, 2018.

10. Henry Kenhmann, "CETC: Successful Test of a Swarm of 119 Fixed-Wing Drones", *East Pendulum*, June 12, 2017, <http://www.eastpendulum.com/cetc-test-reussi-dun-essaim-de-119-drones-a-voilure-fixe>. Accessed on June 26, 2018.

11. Xinhua, "China Launches Record-Breaking Drone Swarm," 2017-06-11, Accessed on March 13, 2018, URL: http://www.xinhuanet.com/english/2017-06/11/c_136356850.htm.

12. Chris Baraniuk, "US Military Tests Swarm of Mini-Drones Launched from Jets", *BBC News*, January 10, 2017, <https://www.bbc.com/news/technology-38569027>. Accessed on July 9, 2018.

13. Kenhmann, n.10.

14. Scott N. Romaniuk and Tobias Burgers, "China's Swarms of Smart Drones Have Enormous Military Potential", February 3, 2018, <https://thediplomat.com/2018/02/chinas-swarms-of-smart-drones-have-enormous-military-potential/>. Accessed on March 12, 2018.

Swarm of Quadcopter UAVs: The aspiration for developing larger quadcopter UAV swarms by the US and Chinese companies brought civil applications to the fore as well as indicated close competition between them for shaping the market sentiment and capturing its business potential. The competition between them commenced when the Chinese company Ehang demonstrated the biggest quadcopter UAV swarm comprising 1,000 Ehang Ghost Rider-2.0 mini UAVs on February 11, 2017 night.¹⁵ It broke the previous record of the 500 quadcopter UAVs swarm¹⁶ set by the Intel company in November 2016.¹⁷ Thereafter, Ehang demonstrated a swarm comprising 1,108 mini quadcopter UAVs in December 2017,¹⁸ which was surpassed when Intel demonstrated a larger swarm comprising 1,218 mini UAVs at Pyeongchang, South Korea, in February 2018.¹⁹ Intel became the first company to commercialise UAV swarms by becoming the official sponsor of the Olympics and was entrusted with organising UAV swarm displays as an environment friendly alternative to fireworks displays.²⁰ Ehang set another world record by flying a swarm comprising 1,374 mini quadcopter UAVs on April 29, 2018.²¹ The competition between Ehang and Intel for demonstrating bigger swarms indicated the rising capability for collaborative operations; however, some failures during the public displays also brought their vulnerabilities to the fore, which are discussed later.

POTENTIAL AND CHALLENGES

UAV swarms have the potential for civil and military applications; however, there are certain challenges, which are yet to be overcome. China, with the

15. Liu Yang, "Drone Swarming Technique May Change Combat Strategies: Expert," *Global Times*, February 13, 2017. Accessed March 13, 2018, URL: <http://www.globaltimes.cn/content/1032741.shtml>.
16. <http://www.guinnessworldrecords.com/news/2016/11/intel-launches-500-drones-into-sky-and-breaks-world-record-in-spectacular-style-449886>. Accessed on June 19, 2018.
17. "Ehang 1,000 Drone Light Show Refreshed World Record", Ehang, February 11, 2017, <http://www.ehang.com/news/249.html>. Accessed on June 19, 2018.
18. Romaniuk and Burgers, n.14.
19. "Intel Breaks Drone Record with Olympics Display with the Promise of More to Come", *The Engineer*, February 12, 2018, <https://www.theengineer.co.uk/intel-drone-olympics/>. Accessed on June 19, 2018.
20. Romaniuk and Burgers, n.14.
21. "Ehang Egret's 1374 Drones Dancing Over the City Wall of Xi'an, Achieving a Guinness World Records Title", April 29, 2018, <http://www.ehang.com/news/365.html>. Accessed on June 19, 2018.

development of fixed and rotary-wing UAV swarms, has demonstrated that the past phase of catching up in technology is over and it can develop innovative and futuristic technologies. Chinese military leaders believe that employability of a single platform in a future battlefield is limited and its survivability would be increasingly challenged.²² Therefore, UAV swarms are being seen as the future of unmanned aviation and UAVs are likely to witness a significant increase in the man-machine integration.²³ The challenge for operators would be to synergise the operation of multiple platforms and sensors, obtain inputs, build a holistic picture and provide information to multiple users in a simple manner and in real-time. A UAV swarm enhances the chances of success in combat operations since it is a self-healing group in which the functions of a defunct or disabled UAV can be taken over by other UAVs, which would enhance the probability of mission execution despite malfunctions or attrition. At present, missiles and air defence guns are employed for providing protection against conventional manned and unmanned aircraft. However, missiles would not be suitable for destroying a UAV swarm comprising tens and hundreds of mini UAVs. Similarly, small arms and anti-aircraft guns too would not be able to ensure destruction of the UAV swarm. Therefore, intensive research is being carried out to develop UAV swarm counter-measures.

China's UAV swarm programme, despite its successes, has faced certain challenges. The vulnerability of its UAV swarms came into the limelight soon after China created the world record for flying a swarm of 1,374 UAVs on April 29, 2018. The technical flaws were first noticed during the rehearsal for the UAV swarm display by Ehang to celebrate International Labour Day at Xi'an on May 1, 2018, when some UAVs malfunctioned and a few of them could not be recovered.²⁴ The public display of the UAV swarm formation on May 1 also did not go as planned as a total of 496 out of 1,373 UAVs deviated

22. "Airshow China Showcases the World's Largest Cluster of Drones", China Electronics Technology Group Corporation (CETC), November 01, 2016, <http://www.cetc.com.cn/zgdzjk/hzzt/wmgz/453128/index.html>. Accessed on June 18, 2018.

23. Ibid.

24. Echo Huang, "Watch: In the World's Largest Drone Performance, Some Machines Went Rogue", *Quartz*, May 3, 2018, <https://qz.com/1283452/a-cyber-resilient-enterprise-needs-a-cyber-committed-ceo-and-board/>. Accessed on June 19, 2018.

The challenge for the UAV swarm designers has been to develop a faster and secure datalink, which is capable of transmitting a greater volume of data.

from their intended path, which distorted the swarm formations. Also, some of the UAVs landed back abruptly during the display. These disruptions were attributed to targeted jamming of Global Positioning System (GPS) signals.²⁵

The PLA was anticipating an eventuality of GPS jamming and had invited proposals for research and development of self-organising network architecture, control, positioning and anti-jamming technologies for the Colony Drone Datalink Technology in August 2016.²⁶ It had also initiated a project to develop drone anti-jamming technology under a complex electromagnetic environment.²⁷ However, disruptions in the UAV swarm display on May 1, 2018, indicated that the Chinese military has either not succeeded in developing anti-jamming capability or not shared it with the private UAV operator (Ehang) involved in the display. UAVs normally use datalinks in the UHF, L, C, X and Ku bands.²⁸ The challenge for the UAV swarm designers has been to develop a faster and secure datalink, which is capable of transmitting a greater volume of data. The CETC developed a Ku-band UAV datalink for transmission of sensor data up to 300 megabits per second in 2016, which had greater bandwidth and accuracy and was resistant to interruptions and interference.²⁹ This is likely to enhance the capability of its datalinks to transmit a large amount of data at a much greater speed as well as provide protection against cyber attacks.

25. Gong Zhe, "Why Ehang's Record-Breaking 1,374-Drone Show Became a Disaster?", *CGTN*, May 7, 2018, https://news.cgtn.com/news/3d3d514d35676a4d77457a6333566d54/share_p.html. Accessed on June 19, 2018.

26. Fund - 61403110201 - Colony Drone Data Link Technology (Key), August 01, 2018, <http://www.weain.mil.cn/cgqx/yy/yjjsl/526969.html>. Accessed on June 23, 2018.

27. "Naval Pre-research, Drone Anti-Jamming Technology in the Complex Electromagnetic Environment," August 1, 2016, *Purchase Command, PLA*, <http://www.weain.mil.cn/cgqx/yy/yjjsl/526866.html>. Accessed on June 23, 2018.

28. İsmet Çuhadar and Mahir Dursun, "Unmanned Air Vehicle System's Data Links", Gazi University, Turkey, <http://www.joace.org/uploadfile/2015/1015/20151015021322106.pdf>. Accessed on August 20, 2018.

29. Liu Kun, "China's Latest UAV Data Link International Advanced is Extremely Difficult to be Cut Off", *Global Network Military*, November 2, 2016, <http://mil.huanqiu.com/china/2016-11/9624313.html>. Accessed on August 20, 2018.

Another limitation of the Chinese UAV swarm programme was its narrow scope as compared to that of the US. The US carried out trials of aerial launch and recovery of a UAV prototype in May 2018,³⁰ which China lacked. It has also launched the Gremlins project to develop operational UAV swarms that can undertake combat operations up to 300 nautical miles (NM) in GPS denied areas and be retrieved by an aircraft. The capability to recover UAVs in the air, and operation of UAV swarms in GPS denied areas are two crucial technologies whose success could significantly enhance the employability of the UAV swarms in combat operations. The US is aiming to utilise Gremlins in an Anti-Access/ Area Denial (A2/AD) environment.³¹

The capability to recover UAVs in the air, and operation of UAV swarms in GPS denied areas are two crucial technologies whose success could significantly enhance the employability of the UAV swarms in combat operations.

PLAAF Unmanned Swarm Challenge: To overcome some of the limitations of the Chinese UAV swarm programme, the PLAAF, in collaboration with the China Electronics Research Institute, Tsinghua University, Beijing Institute of Technology, Yuangwang think-tank and other organisations held the first “Unmanned Swarm Challenge or Smart UAV Cluster System Challenge” in 2018. The challenge indicated the key role of the PLAAF in the development of UAV swarms. It was meant to harness the potential available within the country for developing enabling technologies for UAV swarms and was open to military scientific research units, military units, Chinese Academy of Sciences related research institutes, universities, state-owned enterprises, private enterprises, UAV related teams and individuals who could participate with their fixed and rotary-wing electric UAVs weighing less than 7 kg. The challenge for autonomous UAVs was divided into two parts, i.e. open challenge and invitational challenge.

30. Aaron Gregg, “Pentagon Moves Closer to ‘Swarming Drones’ Capability with New Systems Test”, *The Washington Post*, May 6, 2018, https://www.washingtonpost.com/business/capitalbusiness/pentagon-moves-closer-to-swarming-drones-capability-with-new-systems-test/2018/05/04/61ec01d6-4fc8-11e8-af46-b1d6dc0d9bfe_story.html?noredirect=on&utm_term=.01a6e6175664. Accessed on August 20, 2018.

31. “Gremlins on Track for Demonstration Flights in 2019”, DARPA, May 9, 2018, <https://www.darpa.mil/news-events/2018-05-09>. Accessed on July 31, 2018.

The open challenge was aimed at developing wide-ranging UAV swarm capabilities, bridging technology gaps and facilitating their optimum exploitation for military applications. There were three competition topics: the first was the Intensive Formation Crossing Race (IFCR); the second competition was the Formation Cooperative Reconnaissance Attack (FCRA); and the third competition was the Self-Recovery and Aerial Docking (SRAD) on another UAV. In the IFCR, each team was to field at least four fully autonomous UAVs, which were required to pass through four door frames of the size of 7.32m x2.44 m and return to the landing zone. This would enable UAV swarms to autonomously navigate to a destination by avoiding obstacles. If we relate the development of the UAV swarm with the designing of the Ehang-184 unmanned passenger drone, China could integrate these two programmes and employ UAV swarms for logistics supply, troop insertion and extraction, and Combat Search and Rescue (CSAR) operations in obstacle prone areas. The FCRA competition, allowing participants to field 2-10 autonomous UAVs carrying out cluster search, identifying and locating true and false targets (two circular targets having diameters of 7m and 2m) and dropping sandbags on the target was aimed at assessing the capability of intelligent UAV swarms to undertake Intelligence, Surveillance, Reconnaissance (ISR) tasks, differentiate between dummy and actual targets, and strike them. The SRAD competition required teams to field 2-10 autonomous UAVs comprising both piloted and autonomous UAVs, in which autonomous UAVs were expected to dock with the piloted UAVs flying at specified speeds (fixed-wing flying at 70 km/h and rotary-wing flying at 20 km/h) and fly a route in a sequential manner. The focus of this competition was to bridge the gap in technology vis-à-vis the US and develop the capability for precise positioning of aerial vehicles and their docking on piloted UAVs. The decision of the PLAAF not to allow the use of differential GPS, differential Beidou and other differential positioning methods appeared to be aimed at developing inbuilt systems, which would increase the autonomy of UAV swarms and allow them to undertake operations in GPS denied areas.³²

32. "In June, the Air Force will Host the Unmanned Challenge Smart UAV Cluster System Challenge", <https://mp.weixin.qq.com/s/xfw3hZkCiPJa-gX3GExEcQ>. Accessed on June 24, 2018.

The second phase of the competition was the invitational challenge, which was a non-public competition in which the open competition winning team and the nominated invitational teams were to participate. The final phase involving competition among the invitational teams was planned to be held at the China Electronic Science and Technology Park at Hebei province in June 2018.³³ The results of these competitions have not been made public so far. However, development of the above technologies was important for China to transform its prototype UAV swarm into operational systems.

LEADERSHIP SUPPORT, POLICY INITIATIVES AND KEY PLAYERS

China had surprised the world when it created the world record by developing the largest UAV swarm in 2017. Reverse engineering and clandestine means were a part of its grand strategy to acquire elusive technologies and fill the technology gaps. The Western media gave greater credence to its clandestine activities while its industrial and aviation ecosystem did not receive due attention, though this played a significant role in its quest for technology development. The credit for its success in innovative technologies like the UAV swarm also goes to the support provided by its leadership and its consistent policy on excellence in science and technology, research and development, and innovation to achieve self-reliance in defence technologies. The Communist Party of China (CPC) has built the defence and aviation industry and academic institutions, and aggressively pursued indigenous development of military equipment since it came to power in 1949. The first significant boost to China's defence industry policy came when Deng Xiaoping introduced the principle of 'Four Modernisations' in 1978.³⁴ This principle placed the development of four key pillars comprising agriculture, industry, defence, science and technology³⁵ as central to making China a military and economic power. The three domains comprising science

33. Ibid.

34. The Central Committee of the CPC issued the "Opinions on Deepening the Reform of the Institutional Mechanism of Talent Development", Ministry of Science and Technology of the People's Republic of China, January 17, 2017, http://www.most.gov.cn/kjzc/gjkjzc/kjrc/201701/t20170117_130534.htm. Accessed on April 25, 2018

35. "Deng Xiaoping Theory", *China Daily*, September 15, 2010, http://www.chinadaily.com.cn/china/cpc2011/2010-09/15/content_12474319_8.htm. Accessed on April 25, 2018.

and technology, industry and defence were interrelated and critical for improving the quality of defence products, including defence aviation. To achieve this, China collaborated with leading civil aviation manufacturers to fill technology gaps and improve the quality of its products. Thereafter, Jiang Zemin brought another major reform in China's industrial policies, when he introduced the principle of "Three Represents" in 2000. He was responsible for changing the Party Constitution to allow participation of private entrepreneurs in the industry.³⁶ This strengthened its aviation eco-system further and new ideas contributed to China's endeavours in developing several advanced civil-military aviation platforms, including UAVs. The incumbent Chinese President Xi Jinping, aiming to take China to even greater heights, introduced the principle of "Four Comprehensives" in February 2015.³⁷ He emphasised on improving the technology by utilising talent and promoting innovation to develop world-class products. His policy aims to replace the idea of 'mass production' with 'mass production with quality and developing futuristic technologies'.

The articulation of the "Four Comprehensives" was soon followed by the Chinese Ministry of Science and Technology (MOST) launching the "Technology Innovation -2030- Major Projects" programme under the 13th Five-Year Plan in February 2016, which is aimed at initiating projects that indicate the strategic intention of the country. A total of 16 major projects in the high technology domains, including one on Artificial Intelligence (AI-2.0), were shortlisted under this scheme.³⁸ The "Strategic Plan AI-2.0" plan covering the period up to the year 2030 was formulated in September 2016. The AI-2.0 is aimed at exploring several AI verticals, including big data artificial intelligence, swarm intelligence, perception and cross-media reasoning, hybrid intelligence, autonomous unmanned systems and

36. "Three Represents", Communist Party of China, June 23, 2006, <http://english.cpc.people.com.cn/66739/4521344.html>. Accessed on April 25, 2018.

37. Song Wei, "Four Comprehensives Light up the Future", *China Daily*, July 10, 2017, http://www.chinadaily.com.cn/opinion/2017-07/10/content_30050292.htm. Accessed on April 25, 2018.

38. China's "Science and Technology Innovation 2030 – Major Projects will add Artificial Intelligence 2.0", Ministry of Science and Technology of the People's Republic of China, February 16, 2017, http://www.most.gov.cn/ztlz/lhzt/lhzt2017/hkjlhzt2017/hkj_fbh02/201702/t20170228_131502.htm. Accessed on March 14, 2018.

innovative applications.³⁹ Thereafter, China issued the “New Generation Artificial Intelligence Development Plan” in July 2017 to implement AI-2.0, which is focussed on man-machine collaboration, cross-media collaborative processing, self-control and autonomous intelligence systems.⁴⁰ The capabilities proposed to be developed under the AI-2.0 project are significant for the development of UAV swarms and their exploitation during combat operations.

DEFENCE INNOVATION

Xi’s vision is not restricted to civil technologies alone as he had called for “focusing on seizing the commanding height of military competition in the future” in January 2016.⁴¹ This statement indicated the Chinese leadership’s aspirations to develop cutting-edge military technologies in similar timeframes as those of the US and other leaders of military technology, and become a leader in some of the futuristic technologies. In May 2016, President Xi Jinping had set the target for China to become the most innovative country by 2020, a leading innovator by 2030, and a leading global power in Science and Technology (S&T) by 2049.⁴² China’s policy pronouncements for innovation have been supported with the development of infrastructure, formulation of regulations and provision of other enabling capabilities within the country. China’s earmarked innovation and comprehensive testing zone at Zhongguancun, East Lake, Zhangjiang and Hehe⁴³ and special high technology Research and Development (R&D), intellectual property and certification policies of the

39. Dean Feng Jianfeng was appointed as the expert group of the “China Artificial Intelligence 2.0 Project”, Institute of Science and Technology for Brain Inspired Intelligence, Fudan University, September 1, 2016, <http://istbi.fudan.edu.cn/zh/feng-jianfeng-president-of-the-china-artificial-intelligence-2-plan-the-preparation-of-the-group-of-experts/>. Accessed on April 28, 2018.

40. New Generation Artificial Intelligence Development Planning Notice No. 35 [2017], The State Council, The People’s Republic of China, July 08, 2017, http://www.gov.cn/zhengce/content/2017-07/20/content_5211996.htm. Accessed on June 24, 2018.

41. Xiaotian Liang, “Follow the Trend of Military Reform and Hold the Initiative of Reform”, *PLA Daily*, May 01, 2016, http://jz.chinamil.com.cn/n2014/tp/content_6843416.htm. Accessed on March 6, 2018.

42. “Xi Sets Targets for China’s Science, Technology Progress”, *Xinhua*, May 30, 2016, http://www.xinhuanet.com/english/2016-05/30/c_135399655.htm. Accessed on June 20, 2018.

43. “Science and Technology Policy”, Ministry of Science and Technology of the People’s Republic of China, <http://www.most.gov.cn/kjzc/gjsdkjzc/>. Accessed on April 25, 2018.

central government⁴⁴ and regulations and policies of provincial governments⁴⁵ are initiatives aimed at providing funds, nurturing of talent and harnessing their innovation potential to let an idea or an innovation pass through the process of prototype development and transform into a viable product.

President Xi, during his visit to the Academy of Military Sciences in 2018 had highlighted the need to intensify innovation in military theory, defence technology and the organisation model of the military scientific research to facilitate military reforms. He urged the Chinese military to pursue "Military Scientific Research Innovation" at full speed.⁴⁶ The Chinese military took measures to revitalise the military through science and technology, accelerate the development of modern military science and increase the pace of innovation to usher in a new era of military scientific research.⁴⁷ These measures would encourage greater involvement of the Chinese military in scientific research and harness innovations for developing futuristic military technologies.

CIVIL-MILITARY INTEGRATION

Implementing the strategy of military-civilian integration is a prerequisite for building integrated national strategies and strategic capabilities and for realising the Party's goal of building a strong military in the new era.

— Xi Jinping
March 12, 2018⁴⁸

Over the last few years, China has shown willingness to involve private sector companies in manufacturing dual use cutting-edge aviation systems. Ehang, a company founded at Guangzhou, China, in May 2014, is one

44. Ibid.

45. Ibid.

46. Zing Liming, "Department of Defense: Launching the Military Research Innovation Engine at Full Speed", Department of Defence Network, June 1, 2018, http://jz.chinamil.com.cn/n2014/tp/content_8047553.htm. Accessed on June 25, 2018.

47. Ibid.

48. Li Jiayao, "Xi Calls for Deepened Military-Civilian Integration", Xinhuanet, March 12, 2018, http://eng.chinamil.com.cn/view/2018-03/12/content_7969428.htm. Accessed on June 30, 2018.

of the beneficiaries of the military-civil collaboration.⁴⁹ The company had earlier created a sensation by unveiling the world's first low-altitude autonomous passenger UAV in January 2016 at Las Vegas within two years of its formation. It could not have achieved such technological feats without the help of the Chinese public sector defence industry, considering its humble background and having commenced its UAV business with the development of the Ghostrider 1.0 mini UAV in 2014.⁵⁰ In another case of civil-military integration, the Institute of Electrical Engineering of the China Electronics Technology Corporation (CETC) collaborated with Poisson Technology,⁵¹ a start-up company⁵² to develop the world's largest fixed-wing UAV swarm.⁵³

Military-Civil Integration (MCI) has been one of the thrust areas of the present Chinese government. The Chinese Military Strategy White Paper had called for in-depth MCI in 2015. This integration was proposed to establish uniform military and civilian standards for infrastructure, key technologies and industries.⁵⁴ The White Paper was soon followed by the publication of a catalogue for MCI in December 2016, which identified six high technology areas, including new materials, smart manufacturing,

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49. "The Military and Civil Integration Development Committee set up a Military Plate to Welcome the Pounds and Bullies", January 23, 2017, http://www.xinhuanet.com/finance/2017-01/23/c_129458492.htm. Accessed on April 28, 2018.

50. <http://www.ehang.com/history/>. Accessed on June 19, 2018.

51. "Airshow China Showcases the World's Largest Cluster of Drones", China Electronics Technology Group Corporation (CETC), November 01, 2016, <http://www.cetc.com.cn/zgdzkj/hzzt/wmgz/453128/index.html>. Accessed on June 18, 2018.

52. Henry Kenhmann, "CETC: Successful Test of a Swarm of 119 Fixed-Wing Drones", *East Pendulum*, June 12, 2017, <http://www.eastpendulum.com/cetc-test-reussi-dun-essaim-de-119-drones-a-voilure-fixe>. Accessed on June 26, 2018.

53. n.7.

54. "China's Military Strategy", The State Council, People's Republic of China, May 27, 2015, http://english.gov.cn/archive/white_paper/2015/05/27/content_281475115610833.htm. Accessed on May 7, 2018.

electronic information, new generation information technology, high-end equipment, new energy, and environmental protection. However, it appears that MCI was facing resistance or was not able to achieve the desired level of integration between the civil and military industry. The Political Bureau of the CPC Central Committee then established a high level “Central Military and Civil Integration Development Committee” under President Xi Jinping on January 22, 2017, to overcome the hurdles faced in achieving military-civil integration. As part of the pilot project for military-civil industry integration, four public sector units had been identified for implementing the mixed ownership, which is expected to act as an example for the defence industry sector.⁵⁵

According to Elsa B Kania, an expert on China, military-civil integration has been the pillar of China's growth trajectory and she attributes the development of AI and UAV swarms by China to increasing coordination between several military-civil institutes, including CETC's 54th Research Institute, China Aerospace Science & Industry Corporation's (CASIC's) Third Institute's UAV Research Institute (302 Institute), Harbin Institute of Technology's National Key Laboratory of Robotic Systems and Engineering, Tsinghua University's Department of Automation, Beijing University of Aeronautics and Astronautics (BUAA), and Northwestern Polytechnic University (NPU).⁵⁶

These reforms have similarities with the initiative of the then US Secretary of Defence, Mr Ash Carter in setting up the Strategic Capability Office (SCO) in 2012 and DIUx in 2015 for achieving military-civil integration.⁵⁷ Chinese planners appear to have closely studied the US model of technology development in which complementary capabilities of the public and private

55. n.49.

56. Elsa B. Kania, “Testimony before the U.S.-China Economic and Security Review Commission: Chinese Advances in Unmanned Systems and the Military Applications of Artificial Intelligence—the PLA's Trajectory towards Unmanned, Intelligentized Warfare”, February 23, 2017, https://www.uscc.gov/sites/default/files/Kania_Testimony.pdf. Accessed on March 15, 2018.

57. Remarks on “The Path to an Innovative Future for Defense” (CSIS Third Offset Strategy Conference), US Department of Defence, October 26, 2016, <https://www.defense.gov/News/Speeches/Speech-View/Article/990315/remarks-on-the-path-to-an-innovative-future-for-defense-csis-third-offset-strat/>. Accessed on Jul 10, 2018.

sector entities [including the Defence Advanced Research Project Agency (DARPA)], SCO, DIUx and private industry are optimally exploited to develop, manufacture and export advanced military-civil equipment. China's MCI programme appears to be aimed at emulating the mixed ownership model of the US, in which Raj Shah, a former military pilot and an entrepreneur, was made the head of the Pentagon's DIUx Silicon Valley office in 2016.⁵⁸

CONTRIBUTION OF PLA

The PLA and its research institutes have made significant contributions in developing futuristic technologies, including UAV swarms. At the apex level, the Central Military Commission (CMC), Joint Staff Department (JSD) and Equipment Development Department (EDD) [earlier known as General Staff Department (GSD) and General Armament Department (GAD)] play important roles in formulating UAV requirements and R&D policies. The National Institute of Defence Science and Technology of the National University of Defence Technology (NUDT) of China, 60th and 61st Research Institutes of the Equipment Development Department (EDD) of the PLA have been actively involved in strategic research, innovation and development of cutting-edge technologies, including artificial intelligence, autonomous and unmanned UAVs. The short, medium and long-term research objectives of NUDT were aligned with the Chinese government's targets for modernisation of its armed forces by 2020, 2035 and 2050 respectively.⁵⁹ As part of the research in UAV swarms, the UAV System Innovation Team of the NUDT carried out cold weather performance testing of autonomous flight and detection of fixed-wing UAV clusters in December 2017. The NUDT team has achieved significant breakthroughs in autonomous navigation, precision guidance and intelligent collaborative strikes.⁶⁰

58. Jane Edwards, "Reports: DIUx Head Raj Shah Steps Down", *ExecutiveGov*, February 27, 2018, <http://www.executivegov.com/2018/02/reports-diux-head-raj-shah-steps-down/>. accessed on August 12, 2018.

59. "Chinese University Flies a Swarm of Fixed-Wing Drones", *UAV Vision*, January 19, 2018, <https://www.uasvision.com/2018/01/19/chinese-university-flies-a-swarm-of-fixed-wing-drones/>. Accessed on June 26, 2018.

60. Wang Jianwen and Zhang Yulong, "Pioneering Pioneering Military Intelligence in the New era," China Military Net Defence Department, December 5, 2017, http://www.81.cn/jfjbmap/content/2017-12/05/content_193525.htm. Accessed on June 26, 2018.

CONTRIBUTION OF ACADEMIA

China's academic institutions not only act as its "eyes and ears" to keep abreast with the latest developments in the field of science and technology in the world but are also partners in the research, design and development of futuristic technologies. China utilises the knowledge base and expertise of academia to chart out its technology development roadmap as well as lay down modalities for its execution. As part of the Chinese government's drive to achieve excellence in futuristic technologies, the Ministry of Education had launched the "China Brain Project" under the "13th Five-Year Plan" in June 2016 to undertake studies on artificial intelligence, brain disease and cerebral protection and super brain functions. Accordingly, Fudan University and Shanghai Jiaotong University conducted a seminar with representatives of 60 universities to lay down the roadmap for the China Brain Project, which was aimed at developing advanced artificial intelligence capabilities, which can imitate the human brain. Chinese medical scientists have been advocating the development of the capability to "know the brain", "protect the brain" and "simulate the brain". Professor Feng Jianfeng of the Brain Research Institute of Fudan University, an expert of artificial intelligence and brain intelligence, was invited by the Chinese Academy of Engineering to join the expert group for laying down the "China Artificial Intelligence-2.0 (AI-2.0) Strategic Plan-2030" in September 2016.⁶¹ The contribution of academia in these projects is important because a higher level of artificial intelligence is essential for enhancing the autonomy of UAV swarms and their employability in military and industrial applications.⁶²

TECHNOLOGY AND TALENT ACQUISITION

Chinese scholars have closely studied the US UAV swarm projects and the contribution of private sector companies, including start-ups under the third offset strategy to draw their lessons. Articles published by Chinese scholars in the recent past had paid special attention towards studying the

61. n.3.

62. "China Brain Project Urgently Needs Direction, China Government Network", <http://www.stcsm.gov.cn/xwpt/kjdt/344990.htm>. Accessed on April 28, 2018.

advances made by the US in air launch and inflight recovery of UAVs. They deliberated in detail about the soft-capture system employing aerial refuelling hose type of equipment and the hard-capture system having a robotic arm jutting out of the mother aerial platform (C-130 transport aircraft) for recovering UAVs in the air and automatically placing recovered UAVs at the desired location in the mother aerial platform automatically.⁶³

Leveraging Venture Capital for Transfer of Technology: China has been aggressively investing through its venture capital companies⁶⁴ in the US (in start-up companies) to exploit its knowledge capital, infrastructure and an enabling environment for innovation to acquire Intellectual Property Rights (IPRs) in emerging technologies, and recruit talent. A study by the DIUx of the US DoD in January 2018 highlighted the adverse impact of Chinese investments on the technological edge enjoyed by the US, which is helping China in what it termed as “accessing the crown jewels of the US innovations”. China made a record investment of 10-16 percent (through Chinese and joint venture firms) during 2015-17 in the venture-backed start-ups of the US that were developing futuristic technologies like artificial intelligence, autonomous vehicles, augmented/ virtual reality, robotics and blockchain technology.

The report views venture capital to be a small part of the massive transfer of cutting-edge technologies from the US to China. Other factors contributing to the transfer of US technology are Chinese students undergoing higher academic education in the US, Chinese investment in the US technology companies, acquisition of start-up companies by Chinese entities, Chinese private equity for financing the US high technology companies, setting up of technology transfer companies in China, Chinese companies sponsoring US associations for recruiting talent in the US, cataloguing foreign innovations, industrial espionage, cyber attacks, and Chinese companies gaining technical expertise from US firms on how to do business deals. The Chinese companies Baidu, Alibaba, etc. being the investors in the US, became the medium for

63. Qiang, n.5.

64. Venture capital is a type of private equity or finances provided by large firms to start up companies during the initial stage while seeking equity or ownership stake in return.

China leveraged the presence of research laboratories of its major technology companies like Baidu, DJI, Huawei Technologies and Tencent Holdings in the Silicon Valley located in the US west coast to recruit talented scientists and innovators, and employ them to develop emerging and futuristic technologies.

acquiring talent and elusive technologies through legal means which appeared to have helped China in developing AI, UAV swarm and other emerging technologies.⁶⁵

China has exploited the innovation eco-system of the US to fill capability gaps for developing advanced AI related technologies, especially those related to UAV swarms. China leveraged the presence of research laboratories of its major technology companies like Baidu, DJI, Huawei Technologies and Tencent Holdings in the Silicon Valley located in the US west coast to recruit talented scientists and innovators, and employ them to develop emerging

and futuristic technologies. Also, its venture capital companies provided finance to promising US start-up companies, especially those dealing with AI to acquire ownership stakes. These were major sources for acquisition of AI-related technologies and their transfer to China. Another concern for the US has been Chinese companies poaching its key vendors as well as gaining stakes in those companies which have been partnering with the US R&D organisations and military—a case in point is the Chinese venture capital company, Haiyin Capital acquiring a minor stake in Neurala, an AI company having contracts with the National Aeronautics and Space Agency (NASA) and the US Air Force (USAF).⁶⁶ The US government is concerned that the ongoing technology transfer to China could adversely impact its technological superiority in the coming decades.⁶⁷

Reversing the Brain Drain: Chinese companies have collaborated with international technology leaders to learn and enhance indigenous capability

65. Michael Brown and Pavneet Singh, "China's Technology Transfer Strategy", Defence Innovation Unit Experimental (DIUX), January 2018, [https://admin.govexec.com/media/diux_chinatechnologytransferstudy_jan_2018_\(1\).pdf](https://admin.govexec.com/media/diux_chinatechnologytransferstudy_jan_2018_(1).pdf). Accessed on June 20, 2018.

66. <https://asia.nikkei.com/Features/Cover-story/China-gains-in-race-to-develop-AI-enabled-weapons>. Accessed on June 28, 2018.

67. Brown and Singh, n.65.

in Artificial Intelligence (AI), Internet of Things (IoT), Analysis of Things (AoT), Virtual Reality (VR), Augmented Reality (AR) and UAV swarms. As part of the Chinese industry's capability development endeavours, Baidu, the Chinese search giant, established the Deep Learning Lab in the US in 2014. This lab is headed by Andrew Ng, adjunct professor of Stanford University and an expert on machine learning and deep learning. This lab is actively pursuing the development of autonomous vehicles.⁶⁸ China has been making an all-out effort through its companies to woo Chinese expatriates as well as other experts to exploit

their potential for developing futuristic technologies. Baidu, in one such manoeuvre, appointed Qi Lu, a former vice president of Microsoft, as chief operations officer of its newly established laboratory on Augmented Reality (AR) in Beijing in January 2017. Dr Lu was important for China's ambition to enhance the automation of UAVs and for building UAV swarms.⁶⁹

CONCLUSION

China's success in demonstrating the largest UAV swarms ahead of many other aviation leaders indicates its leap in cutting-edge technologies. UAV swarm development is significant for China to establish itself as an

A scrutiny of China's progress in aviation indicates that China made concerted endeavours in establishing a robust aviation eco-system since 1949, which laid the foundation for its indigenous development programmes. In the beginning, it established aviation research and development centres, production factories, aerospace universities, provided funding and government support for indigenous manufacturing.

68. Phoenix Kwong, "Alphabet Soup is the Top Draw on China's 2017 Technology Menu, AI, IoT, AoT, AR and VR are the Must-Haves in China's 2017 Technology Portfolio," *South China Morning Post*, January 06, 2017, http://www.scmp.com/business/china-business/article/2059661/alphabet-soup-top-draw-chinas-2017-technology-menu?utm_source=MIT+TR+Newsletters&utm_campaign=cf4628adc3-The_Download&utm_medium=email&utm_term=0_997ed6f472-cf4628adc3-153925993. Accessed on March 15, 2018.

69. Jamie Condliffe, "In 2017, China is Doubling Down on AI", *MIT Technology Review*, January 17, 2017, <https://www.technologyreview.com/s/603378/in-2017-china-is-doubling-down-on-ai/>. Accessed on March 15, 2018.

innovator of cutting-edge technologies. This is also significant because it was viewed as a country which was manufacturing aviation platforms through reverse engineering or from clandestinely acquired technologies. A scrutiny of China's progress in aviation indicates that China made concerted endeavours in establishing a robust aviation eco-system since 1949, which laid the foundation for its indigenous development programmes. In the beginning, it established aviation research and development centres, production factories, aerospace universities, provided funding and government support for indigenous manufacturing; however, its isolation from the global community restricted its progress in aviation technologies. The easing of relations with the US enabled China to collaborate with global civil aviation manufacturers since the 1980s, which helped it in filling the technology and manufacturing quality gaps and consolidate its aviation eco-system. Another factor contributing to China's progress in aeronautics manufacturing is the staunch support of its leadership and consistent policy on indigenous development. The policy interventions by Deng Xiaoping in 1978, Jiang Zemin in 2000 and Xi Jinping in 2015 provided the necessary impetus for transforming China's aviation manufacturing industry into a modern industry. As a result, it started exploring innovative and futuristic designs and the development of the largest UAV swarm is a result of one such endeavour. On the other hand, the absence of a Chinese programme to develop an operational UAV swarm on the lines of the Gremlins programme of the US indicates its challenges in operationalising the UAV swarm. The launching of the Swarm Challenge by the PLAAF in late 2017 is an endeavour to bridge the technology gaps to develop operational UAV swarms.

The study of Chinese investments in the US indicates a new trend in the Chinese approach to technology acquisition in which Chinese venture capital companies funded high technology start-ups and defence manufacturing companies of the US to acquire IPRs of emerging technologies and innovations. China also explored other legal means for acquiring cutting-edge technology by recruiting the best talent and taking over promising start-ups in the US by exploiting loopholes in the US trade and investment policies. In its journey

for capability development in aviation, clandestine operations, cyber attacks and espionage were never a taboo for China. The acquisition of technology through venture capital funds and other investments has added a new dimension to its multifaceted approach to technology acquisition. China has also ensured systematic and persistent strengthening of its eco-system, which enabled it to achieve significant progress in manned platforms, AI, autonomous UAVs and UAV swarms. Therefore, there is a need to examine China's technology development initiatives in the correct perspective, by taking into account its policies, its establishment of an aviation eco-system, aviation development programmes, investments in science and technology, the role of key stakeholders, the strategy of leveraging trade relations and exploiting gaps in the economic and investment policies of other nations to bridge technology gaps.

The development of UAV swarms is an indicator of the gradual transformation of the Chinese industry in general and defence aviation industry in particular from the "reverse engineering approach" to "leading the innovation and development of cutting-edge defence technologies". China is expected to strive hard to transform its initial gains in the fixed-wing and multi-rotor UAV swarms into operationally deployable combat products in the coming decades. The reorientation of the Chinese defence industry from imitation and technology absorption to leading the cutting edge technology development through disruptive innovations is going to be the new norm and the US and other global powers are becoming increasingly aware, as well as concerned, about this change. China, on its part, is working hard to ensure that UAV swarms are operationalised at the earliest to demonstrate its ability to develop innovative and cutting-edge futuristic civil-military technologies, an essential ingredient for realising its long-term goal of establishing itself as the global leader in innovation by 2049.

CSFO LESSONS FROM MAJOR INTERNATIONAL WARS/ CAMPAIGNS

JPS BAINS

There are no secrets to success. It is the result of preparation, hard work, learning from failure.

— Colin Powell¹

The character of the air-land battle has changed with time. Counter-Surface Force Operations (CSFOs) have continued to play a major role in conflicts since World War II. Wars become de-facto testing grounds for the test of many concepts and the evolution of further ones. The character of air-land battles changes as per the situation, and adapts accordingly. An analysis of modern conflicts such as in Korea, Vietnam, Arab- Israel conflicts, Iraq, Kosovo and Afghanistan has brought out such trends, where differing local conditions and political restraints have had an enormous effect on how such battles were conducted and the degree to which they were successful. In Vietnam, for example, the strategic interdiction campaign known as Rolling Thunder (1965–68), was largely unsuccessful. The dense jungle terrain, poor intelligence on enemy movements, and political restrictions on targets made US air interdiction efforts largely futile. In contrast, coalition air

Group Captain **JPS Bains** is a serving IAF Officer, from the Fighter stream. He has extensive operational experience on varied aircraft of the IAF and has participated in Op Safed Sagar.

1. Colin Powell, Joseph E Persico, *My American Journey*, 1996. Accessed at https://www.goodreads.com/author/quotes/138507.Colin_Powell.

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interdiction efforts in the 1991 Gulf War were extremely successful in isolating frontline Iraqi units from their bases in the rear. Intelligence derived from space and airborne sensors gave an unusually clear picture of enemy locations and the open desert terrain similarly facilitated air interdiction operations.

This paper seeks to analyse the major international conflicts in the context of CSFOs in support of the air-land battle and draw relevant lessons from them.

The wars sought to be examined are those in which CSFO operations were extensively carried out. Only the wars post World War II are being examined, as these are more contemporary to the trends and concepts prevalent today, which can be related to the Indian Air Force (IAF) environment. These also bring out the evolution of relatable concepts and technological advancements which shaped the conduct of the air-land battle.

1973 ARAB-ISRAELI WAR

Narrative

The Yom Kippur War, Ramadan War, October War or the 1973 Arab-Israeli War, was a war fought by a coalition of Arab states led by Egypt and Syria against Israel from October 6 to 25, 1973. Egypt and Syria wanted to regain the Sinai and Golan Heights respectively, which had been captured by Israel in the 1967 Six-Day War and also avenge the humiliation inflicted as a consequence of the massive defeat suffered during that war. The war began after a sustained period of preparations and capability build-up, when the Arab coalition launched a joint surprise attack on Israeli positions on Yom Kippur, the holiest day in Judaism, which also occurred that year during the Muslim holy month of Ramadan. Both the

United States and the Soviet Union initiated massive resupply efforts to their respective allies during the war.

The war began with a massive and successful Egyptian crossing of the Suez Canal. After crossing the ceasefire lines, the Egyptian forces advanced virtually unopposed into the Sinai peninsula. After three days, Israel had mobilised most of its forces and managed to halt the Egyptian offensive, settling into a stalemate. Likewise, the Syrians coordinated their attack on the Golan Heights to coincide with the

Egyptian offensive and initially made threatening gains into Israeli-held territory. Within three days, however, the Israeli forces had managed to push the Syrians back to the pre-war ceasefire lines. They then launched a counter-offensive deep into Syria. Within a week, Israeli artillery began to shell the outskirts of Damascus. Likewise, the Israelis counter-attacked at the seam between the two Egyptian Armies, crossed the Suez Canal into Egypt and began slowly advancing southward and westward towards Suez, in over a week of heavy fighting that inflicted heavy casualties on both sides. Offensive air support and surface-to-air guided weapons played major roles in shaping the outcome of the war and also in large attrition of surface and air forces.

On October 22, a United Nations brokered ceasefire was initiated but it quickly unravelled, with each side blaming the other for the breach. By October 24, the Israelis had improved their positions considerably and completed their encirclement of Egypt's Third Army and the city of Suez. As a result, a second ceasefire was imposed cooperatively on October 25 to end the war.

The war had far-reaching implications. The Arab world, which had been humiliated by the lopsided rout of the Egyptian–Syrian–Jordanian alliance in the Six-Day War, felt psychologically vindicated by the early successes in the conflict. In Israel, despite impressive operational and

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tactical achievements on the battlefield, the war led to the realisation that there was no guarantee that it would always dominate the Arab states militarily². This war also exemplified and brought out a lot of lessons on the conduct of CSFO missions in a dense Air Defence (AD) environment and the emergence of the concept of Suppression of Enemy Air Defence/ Destruction of Enemy Air Defence (SEAD/ DEAD) operations as the prerequisite for the conduct of CSFO. The situation is similar to the current Indian scenario for both the northern and western fronts.

Inferences and Lessons

This war saw a maturity in the conduct of CSFO in a dense AD environment. It also brings out very valuable lessons *on the conduct of aerial warfare against well trained and well prepared forces*. The major inference and lessons pertaining to CSFO are the following:

- The close air support role was commenced from the eighth day onwards. Ground offensive and interdiction, however, started from day one.
- The campaign showed the vulnerability of aircraft to Surface-to-Air-Missiles (SAM), Anti-Aircraft Artillery (AAA) and enemy air. There were losses to the tune of 16-20 aircraft per day from each attacking side versus 04- 06 AD aircraft.
- The campaign showed the vulnerability of helicopters in the battlefield.
- The campaign showed that the air defence had to be neutralised prior to undertaking CSFO missions. CSFO could only progress fruitfully after air defence was neutralised and enemy air was put out of action.
- Towards neutralising the enemy AD, dedicated DEAD missions were carried out along with surface troops, to blast or create a corridor. Once an opening in the air defence corridor was created, ground and air action was progressed through that opening.
- Good, integral AD was a must for the ground troops. There was a lot of attrition suffered when the troops ventured out of the cover of integral SAMs.

2. "Yom Kippur War", (2015) Accessed from https://en.wikipedia.org/w/index.php?title=Yom_Kippur_War&oldid=683423898.

- The mobility and munition holdings of ground AD systems is limited. This aspect could be exploited by opening up more fronts and by saturation ingrained with decoys.
- The efficacy of cluster bombs fitted with varying time delays was seen, which disrupted a larger area for a longer period of time.
- Interdiction sorties were aimed at cutting off the resupply.
- The war saw innovative use of passive AD measures such as burning of tyres and barrels to create heat and for smoke generation to degrade thermal and TV pick-up of the air munitions.
- Multi-tiered and very high air defence density proved to be very effective in preventing enemy air action. Considerable delays and losses had to be suffered before overcoming AD.
- The SAMs could also extend their influence to cover the Tactical Battle Area (TBA) across the borders.
- There was fratricide to the tune of 40 aircraft, caused due to a lack of awareness and coordination with Army AD.
- The primacy of Counter-Air Operations (CAO) including SEAD/ DEAD as a facilitator for CSFO, was clearly established.
- Lack of night strike capabilities facilitated resupply and replenishments, allowing an opposing AD and surface force build-up.
- Efficacy of enemy AD was overcome through low altitude, high speed and single pass runs and also through terrain masking, where applicable.
- Deeper targets were found to be defenceless. Hence, air interdiction against deeper targets by routing through the created AD gaps proved to be very effective.
- There was a critical requirement of escort and SEAD aircraft to provide cover from air and ground threats to CSFO aircraft in the TBA.

1982 LEBANON WAR

Narrative

The 1982 Lebanon War by Israel began on June 6, 1982, when the Israeli Defence Forces (IDF) invaded southern Lebanon. This was after a period

which saw repeated attacks and counter-attacks between the Palestine Liberation Organisation (PLO) operating in southern Lebanon and the IDF, which caused civilian casualties on both sides of the border. The military operation was launched after PLO gunmen attempted to assassinate Israel's ambassador to the United Kingdom. This was treated as a *casus belli* for the invasion. Israel's publicly stated objective was to push the PLO forces back 40 km to the north. The Israeli forces pushed in from Southern Lebanon in a three-pronged offensive. They captured strategic positions throughout the country, with some of the fiercest fighting taking place at Beaufort Castle, Nabatieh and the Syrian-held town of Jezzine.

In an effort to establish air superiority and greater freedom of action, the Israeli Air Force launched the air operations with an intensive DEAD campaign. In the first attack on June 9, 1982, the Israeli Air Force destroyed 17 of the 19 Syrian SAM batteries and their radar sites as well as 29 Syrian Air Force (SAF) fighters, without any loss.³ During the course of the operation, the Israeli Air Force scored a dramatic victory over the Syrians, shooting down more than 80 Syrian planes and destroying 30 Syrian anti-aircraft missile batteries, with no air-to-air losses of its own. The Israeli Air Force thereafter conducted successful ground attack missions against Syrian and PLO targets in the battlefield as well as in urban areas. Israeli attack helicopters inflicted heavy losses on Syrian armour, including some of the modern Soviet T-72 main battle tanks and destroyed a majority of the Syrian anti-aircraft batteries stationed in Lebanon.

Inferences and Lessons

The major inference and lessons pertaining to CSFO operations are the following:

- The conflict brought out that the attainment of control of air was achieved through neutralising *both* the air and ground AD threats. This was achieved by carrying out dedicated DEAD and Counter-Air Operations (CAO) under intensive offensive Electronic Warfare (EW) cover.

3. Matthew M. Hurley, "BEKAA Valley Air Battle, June 1982: Lessons Mislearned?", *Airpower Journal*, Winter 1989.

- As a lesson learnt from the 1973 War, where ground AD systems reduced the effectiveness of CSFO, this campaign showed how the ground AD environment could be overwhelmed by employing superior tactics and decoys, to neutralise enemy Command and Control (C2) systems and technology concurrently through a dedicated DEAD campaign, prior to undertaking CSFO missions.
- Technology asymmetry played a major part in achieving control of the air in a swift manner.
- Attack helicopters were used effectively against tanks by employing anti-tank munitions.
- The Bekaa Valley battle was the first combat involving the use of modern Airborne Warning and Control System (AWACS) aircraft for vectoring fighters to their targets and managing the overall air battle situation.⁴
- The Israelis also demonstrated considerable technical prowess in efficiently managing own Command, Control and Communication (C3) systems while working to obstruct Syrian C3 systems.
- This war saw the emergence of the Remotely Piloted Vehicle (RPV) for extensive intelligence gathering for months preceding the invasion and as decoys to trick the Syrians into activating their SAM target acquisition and tracking radars.
- The war also introduced the overwhelming importance of winning the war in the fourth dimension (i.e. electronic warfare and C3) for undertaking successful air-land battles.
- The Bekaa Valley air battle also demonstrated the need for an effective doctrine, organisation and for an understanding of joint operations.

1991 GULF WAR

Narrative

The Gulf War, also known as the Persian Gulf War, First Gulf War, Gulf War I, Kuwait War, First Iraq War or Iraq War, was a war waged by coalition forces from 34 nations, led by the United States, against Iraq, in response

4. Ibid.

By the time the ground war began, the Iraqi ground forces had been hit by more than 40,000 attack sorties. Coalition air power caused the desertion of as many as 84,000 Iraqi personnel and destroyed 1,385 Iraqi tanks, 930 other armoured vehicles and 1,155 artillery pieces.

to Iraq's invasion and annexation of Kuwait in August 1990. An array of nations joined the coalition, the largest military alliance since World War II. The great majority of the coalition's military forces were from the US, with Saudi Arabia, the United Kingdom and Egypt as leading contributors, in that order. Air power played a critical role during the war. This was a war which was covered live and has seen voluminous literature on the conduct of the campaign and lessons.

It consisted of two major phases, namely, **Operation Desert Shield** from August 2, 1990 to January 17, 1991, for operations leading to the build-up of troops and defence of Saudi Arabia; and **Operation Desert Storm**, from January 17, 1991 to February 28, 1991, in its combat phase. During the five and half months of Operation Desert Shield, US and coalition forces poured into the theatre to deter further Iraqi aggression and to set the stage for offensive actions. During Operation Desert Storm, the combined attack on Iraq began in the early hours of January 17, 1991, with an independent air campaign and ended on February 28, 1991, after a four day combined forces ground and air assault. This was a decisive victory for the coalition forces, who drove the Iraqi military from Kuwait and advanced into Iraqi territory. The coalition ceased its advance and declared a ceasefire 100 hours after the ground campaign started. Aerial and ground combat was confined to Iraq, Kuwait and areas on Saudi Arabia's border.

At the opening of Desert Storm, coalition aircraft faced extensive Iraqi air defences incorporated into a complex and fully Integrated Air Defence System (IADS). In addition to formidable radar SAM batteries, the Iraqi military possessed a wide range of Infra-Red (IR) guided missiles and air defence artillery. By the time the ground war began, the Iraqi ground forces had been hit by more than 40,000 attack sorties. Coalition air power caused the desertion of as many as 84,000 Iraqi personnel and destroyed 1,385 Iraqi tanks, 930 other

armoured vehicles and 1,155 artillery pieces. They severely damaged Iraq's nuclear reactor facilities, three chemical and biological weapons production facilities, 11 storage facilities, 60 per cent of Iraq's major command centres, 70 per cent of its military communication, 125 ammunition storage revetments, 48 Iraqi naval vessels and 75 per cent of Iraq's electric power generating capability. It cut Iraq's flow of supplies to the theatre by up to 90 per cent. One Iraqi prisoner of war stated later that his brigade suffered more losses under 30 minutes of air attack, than it had during the entire Iran-Iraq War.⁵

The air campaign objectives that were formulated are given below:

- Isolate and incapacitate the Iraqi regime, namely, leadership command facilities, crucial aspects of electricity production facilities that power military and military-related industrial systems, telecommunications and C3 systems.
- Gain and maintain air supremacy to permit unhindered air operations by targeting strategic IADS assets, including radar sites, SAMs, IADS control centres, air forces and airfields.
- Destroy Nuclear, Biological, Chemical (NBC) warfare capability, namely, the known NBC research, production and storage facilities.
- Eliminate Iraq's offensive military capability by destroying major parts of key military production, infrastructure and power projection capabilities in the form of military production and storage sites, Scud missiles and launchers, production and storage facilities, oil refining and distribution facilities, naval forces and port facilities.
- Render the Iraqi Army and its mechanised equipment in Kuwait ineffective, causing its collapse by targeting railroads, bridges connecting the military forces to means of support, and army units to include the Republican Guard Forces in the Kuwaiti Theatre of Operations (KTO).

Based on these 5 objectives, 12 target sets were created. The target sets were interrelated and were not targeted individually. These are given below:

- Leadership Command Facilities.
- Electricity Production Facilities.

5. *US Congress Report on 1991 Gulf War, GW-7 Air Offensive*, October 15, 1994, p. 481.

- Telecommunications, Command, Control, and Communication Nodes.
- Strategic Integrated Air Defence System.
- Air Forces and Airfields.
- Nuclear, Biological and Chemical Weapons Research, Production, and Storage Facilities.
- Scud Missiles, Launchers, and their Production and Storage Facilities.
- Naval Forces and Port Facilities.
- Oil Refining and Distribution Facilities.
- Railroads and Bridges.
- Iraqi Army Units including Republican Guard Forces in the KTO.
- Military Storage and Production Sites.

The total air effort in terms of sorties and types of targets engaged is tabulated below:⁶

Table 1: UN Coalition Air Strikes by Mission during Desert Storm

Type of Mission or Target	Number of Strikes Flown	Percent of Total
Strategic - Largely Civilian		
Leadership	260	0.6
Electric Power	280	0.6
Oil/Refinery/Fuel	540	1.3
Telecoms/C ⁴	580	1.4
LOCs	<u>1,170</u>	<u>208</u>
Total	2,830	6.7
Strategic - Largely Military		
Military industry	970	2.3
Nue/Chem/Bio	990	2.3
Scuds	1,460	3.5
Naval Targets	<u>370</u>	<u>0.9</u>
Total	3,790	9.0
Counter-Air		
Airfields	2,990	7.0
Air Defence (KARI)	630	1.5
Surface-to-Air Missiles	<u>1,370</u>	<u>3.9</u>
Total	4,990	11.8
Against Iraqi Ground Forces	23,430	55.5
Total Categorised by Mission	35,040	82.3
Uncategorised (largely against ground forces)	35,040	82.3
Total	42,240	100%

6. Ibid., p.483.

Inferences and Lessons

The major CSFO inferences/ lessons that can be derived are given below:

- Detailed analysis and targeting of the Iraqi IADS was a key element to coalition success. Advanced technology drove the plan; precision weapons, stealth technology and computer driven command and control allowed coalition forces to dismantle Iraqi defences.
- The method for producing the daily attack plan involved synthesising many inputs, namely, Battle Damage Assessment (BDA) from previous attacks, detailed intelligence guidance, weather, target set priorities, new targets, intelligence, and the air campaign objectives. The available aircraft, Special Operations Forces (SOFs) and other assets were then assigned on the basis of ability and the most effective use of force.
- One of the most tragic lessons was that fratricide was still a problem on the modern battlefield.⁷ Of the 247 battle related deaths in Desert Storm, 35 of these casualties were the result of friendly fire despite measures such as markings on the top and sides of vehicles.
- Employing weapons in the midst of friendly ground forces requires pilot skills that must be practised on a continuing basis. The difficulty with multi-role strike aircraft is that they require pilot capabilities for a vast range of possible combat tasks.
- Despite the high technology and overwhelming air power, coalition forces never adequately controlled the low altitude environment below 10,000 ft due to the Man Portable Air Defence System (MANPADS).
- CSFO forces were still required to support ground manoeuvre units despite the relentless pounding of enemy positions prior to the ground war.
- Despite the success of air power, the introduction of ground troops was ultimately required to bring the war to a successful conclusion.
- The coalition flew a total of 1,170 strikes against Iraqi Lines of Communication (LOCs) during the Gulf War. Bridges were key targets in these attacks.

7. Leon E. Elsarelli, *From Desert Storm To 2025: Close Air Support in the 21st Century*, Research Report, Air Command and Staff College, USA, April 1998.

- Interdiction bombing severely damaged enemy's lines of communication; some forward deployed units had severe food problems; little maintenance took place and troops moved away from their equipment. Many of the units under heavy air attack, decided to surrender at the first opportunity.⁸
- A concept of demarcated kill box area was evolved to facilitate quick response, de-conflict and give responsibility amongst the coalition forces, once control of air was established. This comprised squares of 30 miles on each side. Each box was sub-divided into four quadrants and assigned to a flight for a given period of time. Forward Air Control (FAC) and attack squadrons were repeatedly assigned to specific kill boxes to improve their familiarity with an area.
- The surge in close air support and interdiction attacks before the land battle helped the coalition destroy or suppress much of Iraq's artillery in the forward area and to further weaken Iraqi forces in the path of the coalition advance.
- Aircraft were allocated according to "demand pull" in response to requests for air support from ground force commanders. It pushed forward sorties to support the ground force commanders at regular intervals based on the tactical situation. The air liaison officer in each ground corps would check in regularly with the ground commander.
- If a ground commander had targets, he would get air support. If not, the Airborne Battle Command and Control Centre (ABCCC) aircraft [AWACS, Joint Surveillance Target Attack Radar System (J-STARS)] could reassign the fighters to Advanced Tactical Fighter (ATF) based targets without wasting sorties. This system came to be called "flow Close Air Support (CAS)" and increased the responsiveness of air power to ground commanders.
- C-130s dropped BLU-82 15,000 pound bombs to create an overpressure that would detonate minefields and demoralise the Iraqi troops.
- The impact of the Gulf War in accelerating the transition to new offensive air technologies is an important lesson of the war.

8. n. 5.

- Post the war, a major effort was made to ensure that all aspects of the US Air Force (USAF), US Navy and US Marine Corps air, C4I/BM systems were fully interoperable, with quick-reacting communications, computer and intelligence support.
- Requirement of an effective and quicker BDA capability.
- Requirement of regular joint exercises to ensure familiarity and faster indoctrination during actual operations.
- Only 200 of the aircraft could attack with Precision Guided Munitions (PGMs) and only 7 per cent of all the munitions used were precision weapons.⁹
- Pertaining to weaponeering, there was a need to:
 - Develop methods of attack and delivery that are more accurate at altitudes about 10,000-15,000 ft.
 - Upgrade guidance systems on laser-guided bombs to increase their range and reliability.
 - Develop conventional deep shelter killing munitions that can be linked to the use of unattended ground sonars to “map” the shelter or underground facility before it is attacked to ensure an effective level of destruction.
 - Develop lethal and self-guiding sub-munitions.
 - Improve the fusing in many conventional bombs and sub-munitions.
 - Develop lower cost glide bomb conversions to provide cheap stand-off capability.¹⁰
- Precision weapons can only be effective if precise intelligence data is available.
- Aircrew need to have Air Tasking Orders (ATOs) at least six hours prior to take-off in order to plan interdiction missions properly.
- Attacks on Lines of Communications (LOCs) cannot be successful if limiting collateral damage is given a higher priority than effectiveness. Limiting collateral damage imposed additional constraints. There are problems in mixing politics with operational effectiveness.

9. *Ibid.*, p.488.

10. *Ibid.*, p.526.

Unlike the deserts of the Persian Gulf, Bosnia was a mountainous country with thick vegetation and rudimentary transportation infrastructure. Targets in Bosnia had the ability to hide in dense foliage, disperse in mountainous terrain and select from a variety of advantageous engagement areas.

- The war was marked by the introduction of live news broadcasts from the front lines of the battle, which brought in public and political opinions, which could be detrimental to, or influence, war-fighting.

KOSOVO WAR

Narrative

On the heels of Desert Storm, Bosnia-Herzegovina declared independence from Yugoslavia in 1992. The resulting civil and ethnic war resulted in 145,000 civilian casualties and an estimated two million refugees by mid-1995. Such widespread devastation prompted a U.S led coalition involvement in the crisis and eventual commitment of ground forces to stabilise a fragile peace agreement.

Unlike the deserts of the Persian Gulf, Bosnia was a mountainous country with thick vegetation and rudimentary transportation infrastructure. Targets in Bosnia had the ability to hide in dense foliage, disperse in mountainous terrain and select from a variety of advantageous engagement areas. In addition to radar guided SAMs, the Serb and Croat forces possessed a variety of IR guided SAM systems and a vast number of AAA pieces. These systems included the SA-6, -7, -9, -14 and -16 as well as air defence guns ranging in calibre from 20mm to 90mm. The planners of Desert Storm used the same target categories as in the previous wars.

Inferences and Lessons

This is an example of conducting aerial warfare using technology in mountainous regions. The CSFO inferences/ lessons are given below:

- As air defence systems (particularly surface-to-air missiles) have grown more sophisticated, SEAD has become the primary initial operation to be undertaken.

- Disabling the electric grid created a lot of effect in isolating the battlefield, communications and control.
- Lack of targeting data and target identification was the single greatest constraint on air operations.
- Coalition forces ran out of targets to be engaged by air.
- Targeting within Serbia was also limited by the reluctance of the North Atlantic Treaty Organisation (NATO) partners to inflict suffering on the civilian population.

The successful insertion of a small number of US SOF teams into Afghanistan after 11 days of bombing signalled the onset of a new use of air power in joint warfare, in which air force terminal attack controllers, working with SOF spotters positioned forward within line of sight of enemy force concentrations, directed precision air attacks against enemy ground troops who were not in direct contact with friendly forces.

OP ENDURING FREEDOM

Narrative

The attacks of September 11, 2001, thrust the United States into a no-notice war against Osama bin Laden, his Al Qaeda terrorist network and transnational terrorism across the board. The first round of this war was Operation Enduring Freedom, an air-dominated offensive conducted by the US Central Command (CENTCOM) against Al Qaeda forces in Afghanistan and against the Taliban theocracy that provided them safe havens. In less than a month and from a standing start, the United States commenced combat operations in a landlocked country half the world away.

The plan was to rely on air power and precision weapons, aided on the ground by US Special Operations Forces (SOFs), who would work alongside indigenous Afghan groups opposed to the Taliban and identify and validate targets for allied aircrew. On October 7, 2001, a joint war against Al Qaeda and the Taliban began at night with strikes against 31 targets, including early warning radars, ground forces, command and control facilities, Al Qaeda infrastructure and Taliban airfields. The successful insertion of a small number of US SOF teams into Afghanistan

after 11 days of bombing signalled the onset of a new use of air power in joint warfare, in which air force terminal attack controllers, working with SOF spotters positioned forward within line of sight of enemy force concentrations, directed precision air attacks against enemy ground troops who were not in direct contact with friendly forces. By December, many campaign goals had been achieved and the campaign moved to the high mountain caves at Tora Bora, where the dispersed Al Qaeda and Taliban fighters had fled.

Inferences and Lessons

This war is an example of evolving aerial warfare using technology in low intensity conflicts and terrorism. The CSFO inferences/ lessons are given below:

- This was the first time a country fought a war from land bases and aircraft carriers, positioned very far away from a combat zone, which is known as Out of Area Contingency (OOAC) operations. One B-2 mission lasted 44 hours from take-off to landing, becoming the longest air combat mission flown in history.
- The war saw a further improvement of some important trends that began during the Gulf War a decade earlier. Precision weapons accounted for nearly 70 percent of the munitions expended versus only 9 percent during Desert Storm.
- The war saw the first combat use of the new Global Hawk high-altitude, Unmanned Aerial Vehicle (UAV), the first operational use of Predator UAVs armed with Hellfire missiles and the first combat use of the highly accurate, all-weather Joint Direct Attack Munition (JDAM) by the B-1 and B-52 aircraft.
- For the first time in modern warfare, airborne and space-based sensors provided a constant flow of information about enemy force dispositions and activity.
- The greatest tactical innovation of the war was a unique air-land partnership that featured unprecedented mutual support between allied air power and ground-based SOF teams. Unlike traditional close air

support that entails concurrent air and ground schemes of manoeuvre, SOF units in Afghanistan enabled precision air strikes against enemy ground forces even when there were no friendly ground forces in direct contact.

- Global communications connectivity and common operating picture obtained by linking the inputs of UAVs and other sensors enabled a close partnership between airmen and SOF units and shortened the time from identification to successful target attacks. Such networked operations are now the cutting edge of CSFOs.¹¹
- Once the air component became fully engaged, the concentration of aircraft over the embattled area required unusually close coordination among the many participants and controlling elements.
- In a surprising and negative trend, despite the success of joint operations seen previously, the ground operations phase saw a single Service centralised planning and execution that yielded undesirable consequences. The ground-oriented nature of the ground battle plan meant that before D-Day, neither US ground nor air forces had engaged in the kind of close, careful cooperation and joint planning that normally would have been deemed necessary to mount a major CSFO operation from the onset of the battle. The airmen were left in the dark and were requisitioned on emergency when the ground forces were under attack.
- The war saw the dominance of fused information from platforms and munitions as the principal enabler of the campaign's success in the end. That new dynamic made possible all other major aspects of the war, including the integration of SOFs with precision-strike air power, the minimisation of target-location error, avoidance of collateral damage and command from the rear.
- The war saw the need to give flexibility to the 72-hour air-tasking cycle as also to shorten it.

11. Benjamin S. Lambet, *Air Power Against Terror: America's Conduct of Operation Enduring Freedom* (RAND Corporation, 2005).

PLAUSIBLE LESSONS FOR CONTEMPORARY OPERATIONS

Plausible lessons that can be derived are given below:

- The Close Air Support (CAS) role was commenced from a later stage. The ground offensive and interdiction, however, started from day one.
- CAS forces were still required to support ground manoeuvre units despite the relentless pounding of enemy positions prior to the ground war.
- The campaigns showed the vulnerability of aircraft to SAM, AAA and enemy air. There were losses to the tune of 16-20 aircraft per day from each attacking side versus 4-6 AD aircraft. Despite the high technology and overwhelming air power, coalition forces never adequately controlled the low altitude environment below 10,000 ft due to MANPADS.
- Good integral AD is a must for the ground troops. There was a lot of attrition suffered when the troops ventured out of the cover of integral SAMs.
- The campaigns showed that the air defence had to be neutralised prior to undertaking CSFO missions. It could only progress fruitfully after all the air defence was neutralised and enemy air was put out of action. As air defence systems (particularly surface-to-air missiles) have grown more sophisticated, SEAD has become the primary initial operation to be undertaken.
- The wars saw innovative use of passive AD measures such as burning of tyres and barrels to create heat and smoke to degrade thermal and TV pick-up of the air munitions.
- The efficacy of cluster bombs fitted with varying time delays was seen, which disrupted a larger area for a longer period of time.
- One of the most tragic lessons from recent combat experiences is that fratricide is still a problem on the modern battlefield.
- The campaigns showed the vulnerability of helicopters in the battlefield.
- The Bekaa Valley war saw the emergence of the remotely piloted vehicle for extensive intelligence gathering for months preceding the invasion and as decoys to trick the Syrians into activating their SAM target acquisition and tracking radars.

- The Bekaa Valley battle was the first combat involving the use of modern AWACS aircraft for vectoring fighters to their targets and managing the overall air battle situation.
- The war also introduced the overwhelming importance of winning the war in the fourth dimension (i.e., electronic warfare and C3) for undertaking successful air-land battles.
- The concepts of the demarcated box area, “demand pull” and “flow CAS” were evolved to facilitate quick response, de-conflict and give responsibility amongst the coalition forces during the Gulf War. These were effective but were enabled only once ‘control of the air’ was established.
- Concepts such as AWACS reassigning CSFO targets in flight as per situation or dropping of heavy calibre bombs to create overpressure and detonate minefields could be looked into.
- Aircrew need to have Air Tasking Orders (ATO) at least six hours prior to take-off in order to plan interdiction missions properly.
- There is a need to shorten the existing Command Air Tasking Orders (CATO) cycle as also make it more flexible.
- There is a need to invest more resolutely in unmanned platforms such as Global Hawk high-altitude UAV and Predator type of UAVs armed with Hellfire missiles. This is the possible future of CSFO missions.
- In a surprising and negative trend, despite the success of joint operations seen previously, the ground operations phase of Operations Anaconda, a part of Operation Enduring Freedom, saw a single Service centralised planning and execution that yielded undesirable consequences.
- The later wars saw the dominance of fused information from platforms and munitions as the principal enabler of the campaign’s success in the end.
- Precision weapons can be effective only if precise intelligence data is available. Lack of targeting data and target identification was the single greatest constraint on air operations.
- The method for producing the daily attack plan involved synthesising many inputs, namely, Battle Damage Assessment (BDA) from previous

A strategic group or an extra-government organisation like the Centre for Air Power Studies (CAPS) could be given the task of providing strategic long-term vision documents, White Papers and corresponding roadmaps.

attacks, detailed intelligence guidance, weather, target set priorities, new targets, intelligence, and the air campaign objectives. The available aircraft, SOFs and other assets then were assigned on the basis of ability and the most effective use of force.

- Net-centricity and ability to collate fused information in real-time from various platforms is the way forward. As seen from the recent wars, airborne and space-based sensors provided a constant flow of information about enemy force dispositions

and activity. This would also solve the persistent problem of attaining timely and correct intelligence.

- The contemporary wars were marked by the introduction of live news broadcasts from the front lines of the battle which brought in public and political opinions which could be detrimental to, or influence, war-fighting.
- It can be seen that the unconventional threats may not require large forces or capabilities. Therefore, certain units could be earmarked for the different threat scenarios over and above the conventional threat and additional capabilities in terms of equipment and weaponry could be built up accordingly. In creating such specialised units, the IAF as an organisation would thereby be able to handle a larger spectrum of threats.
- From the perspective of long-term procurement plans towards capability enhancement, the IAF needs to look out for technologies that could enhance its capabilities in the future and must have a plan and roadmap to absorb such technologies. This tasking could also be supplemented to extra-government organisations in addition to specialised in-service directorates.
- A strategic vision, periodical review for relevance, progress on roadmaps, continuity of conceptual thought processes, capability build-up, etc. are facets of strategic military thinking that need to be delinked from active

Service Directorates which get fully involved in daily/ routine functions, which would cloud this long-term vision. A strategic group or an extra-government organisation like the Centre for Air Power Studies (CAPS) could be given the task of providing strategic long-term vision documents, White Papers and corresponding roadmaps.

CONCLUSION

The contemporary global environment is characterised by change and the future is expected to be no different. Modern day wars are increasingly being affected by the fundamental changes taking place not only in the areas of technology, but also in the geopolitical environment. Political, social, economic and cultural factors are exerting an inordinate influence on the conduct of warfare. The role of military power has increased, as security concerns spread beyond national boundaries. By its nature, aerospace power is futuristic and increasingly utilitarian.¹² Air power, with its attributes of rapid mobility, reach and flexibility has, in the past, demonstrated the capability of being able to change the paradigm of warfare by ensuring that troops or marine vessels could be targeted regardless of their domains. The stunning effectiveness of offensive aerial operations has showcased air power as an increasingly powerful and flexible instrument for the pursuit of political objectives. In this dynamic environment, it is essential to have a clear understanding of the attributes, limitations and potential of air power to enable its optimum exploitation for furthering national objectives. The changing threat perception and military landscape of the future would,

The stunning effectiveness of offensive aerial operations has showcased air power as an increasingly powerful and flexible instrument for the pursuit of political objectives. In this dynamic environment, it is essential to have a clear understanding of the attributes, limitations and potential of air power to enable its optimum exploitation for furthering national objectives.

12. Fali H. Major, "Indian Air Force in the 21st Century: Challenges and Opportunities" (Institute for Defence Studies and Analysis), *Journal of Defence Studies*. vol 2, Summer 2008.

however, require a certain degree of adaptability for air power to optimise in the expected threat scenario. In that light, it becomes important to constantly reevaluate existing concepts and methodologies in vogue and update them where necessary in order to stay relevant.

US-NORTH KOREA NUCLEAR RELATIONS: REVISITING THE PAST TO FIND POINTERS FOR THE FUTURE

HINA PANDEY

On June 12, 2018, Singapore witnessed history. For the first time, the sitting heads of two adversarial states—the US and the Democratic People’s Republic of Korea (DPRK)—came face to face with each other to sign a mutually agreed framework for establishing a peaceful Korean peninsula, primarily aimed at preventing a future nuclear crisis in the region. Considering that the US-DPRK have always had a faceoff-standoff kind of dynamics, this development indeed marked a fresh note after the US-DPRK relations had touched new lows, and the threat of the cancellation of talks had loomed large. The Singapore Summit that finally took place appears to be a step in the right direction. It produced a joint declaration¹ that captured the essence of Presidents Trump’s and Kim’s meeting in four points in less than 100 words.

Both countries put forward five major commitments: (i) to establish new US-DPRK relations, (ii) to make joint efforts to build lasting peace in the Korean peninsula; (iii) affirmation to the Panmunjom Declaration of April 27, 2018; (iv) work towards denuclearisation of the Korean peninsula; and (v) a commitment to recover the Prisoners of War (POWs), including immediate

Hina Pandey is Associate Fellow, Centre for Air Power Studies, New Delhi.

1. “Full text of US-North Korea Joint Statement in Singapore”, June 12, 2018. Available at <https://mainichi.jp/english/articles/20180612/p2g/00m/0in/100000c>. Accessed on June 13, 2018.

Many experts have, however, expressed scepticism about whether this meeting would lead to anything substantial. Since the devil lies in the detail, it is suspected that a follow-up on these four broad commitments might end up tearing apart whatever mutual understanding the two countries have established.

repatriation. Though low on specifics, the document, nevertheless, makes a first step with valuable pledges.

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However, in the subsequent days, one can notice some follow-up on these pledges by both sides. For instance, the US-RoK (Republic of Korea) agreed to indefinitely suspend the military exercise Freedom Guardian, along with the delay of two Korean Marine Exchange Programme (KMEP) drills scheduled in the upcoming months. It is to be noted that these exercises were an annual routine in the US-RoK defence partnership. Last year's Guardian Freedom saw the participation of 17,500 American troops and more than 50,000 South Korean troops in the drills.² As a response to this, the DPRK has also signalled that it would cancel its annual "anti-US imperialism" rally,³ which is held every year in Pyongyang, commemorating the Korean War, usually utilised by the DPRK to signal its discontentment of the US. Additionally, it is reported that North Korea has also returned the remains of 200 US or allied Service members⁴ lost in the Korean War. It is noteworthy that both countries

2. "Pentagon Cancels Two More Military Exercises with South Korea", *Reuters*, June 23, 2018, Available at <https://www.theguardian.com/world/2018/jun/23/pentagon-cancels-two-more-military-exercises-with-south-korea>. Accessed on June 24, 2018.
3. Benjamin Hass, *Guardian*, June 26, 2018. Available at <https://www.theguardian.com/world/2018/jun/26/north-korea-cancels-anti-us-imperialism-rally-pompeo-denuclearisation>., Accessed on June 25, 2018.
4. Emily Birnbaum, "Trump Says Remains of 200 US Soldiers Have Been Returned from North Korea", *The Hill*, June 23, 2018. Available at <http://thehill.com/homenews/administration/393801-trump-remains-of-200-us-soldiers-have-been-returned-from-north-korea>. Accessed on June 26, 2018.

had agreed on this during the Singapore Summit.

While these developments can be viewed as an effort to promote goodwill and facilitate conditions for further positive engagement, those that closely observe US-DPRK interactions have often remarked that there is a pattern in US-DPRK relations. History has witnessed many occasions when both countries have agreed to be the facilitators of peace and stability in the region but have ended up in a devastating decay of their agreed commitments.

It is in their historical interactions that their mutual distrust of each other can be evidently viewed. This historical understanding of the US-DPRK relations can be utilised to assess what the near future might hold after the recent Singapore Summit. This becomes important in the light of the fact that the summit itself was cancelled once, and the run-up to the summit displayed a repeat of the pattern of their interactions. It is in this context that this paper delves deep into history to understand the recent fluctuations in the US-DPRK interactions, including the escalated nuclear war rhetoric on both sides that compelled some experts to label it as an escalating nuclear crisis.

SEPTEMBER 2017 NUCLEAR CRISIS

In September 2017, North Korea crossed an important nuclear threshold in its nuclear weapons programme.⁵ On September 3, 2017, Pyongyang conducted its sixth nuclear test which was claimed to be a hydrogen bomb test. However, experts differ on whether this test makes the North Korean nuclear threat potent and whether North Korea actually possesses the capability to build a hydrogen bomb. This test was reported as one of the

On September 3, 2017, Pyongyang conducted its sixth nuclear test which was claimed to be a hydrogen bomb test. However, experts differ on whether this test makes the North Korean nuclear threat potent and whether North Korea actually possesses the capability to build a hydrogen bomb.

5. David Santoro, "Three Futures for the Korean Peninsula", *Japan Review*, vol.1 no.3, Spring 2018, pp.73-78.

most powerful nuclear tests by the country, with a possible 100-kiloton yield. Interestingly, early in January 2017 itself, during his New Year's Day speech, Kim Jong-Un had announced that the country was in the last stage of preparations to test an Inter-continental Ballistic Missile (ICBM). Later, during May 2017, the leader also hinted at a strong resolve in going ahead with the weapons programme when he declared a willingness to risk the country's friendship with its closest ally, China, if it tried to limit the North Korean tests. It needs to be recalled that by this time, the country had already tested its 12th Pukguksong-II Medium Range Ballistic Missile (MRBM), conducted its largest military drill ever in order to commemorate the 85th anniversary of the Korean People's Army (KPA) and also conducted the flight test of its ICBM, Hwasong-14, that coincided with the American celebration of their independence.⁶ It is noteworthy that in 2017 alone, North Korea conducted 15 nuclear and missile tests in total, including that of a hydrogen bomb.

Some observers have asserted that with these recent tests, the DPRK has demonstrated a capability of reaching the continental United States, while some others contend that the country has acquired the capability of intercontinental ranges with its missiles. In fact, post the September 2017 nuclear test, tensions escalated between the US and North Korea to an extent that the war of words transcended from "Pyongyang would be met with *fire and fury like never before...*"⁷, to the sending of the B-2 bombers by the Americans. Some of the prominent nuclear experts even viewed the nuclear crisis as transcending from a *proliferation problem to a deterrence problem*. Scott Sagan, in his recent *Foreign Affairs* article, viewed the overall play of these factors as posing immediate dangers, wherein the possibility of an *accidental war due to miscalculation, a misperceived military action or a false warning was alarmingly high*. The situation, according to him, was compounded because of

6. Ashutosh Kumar, *2017 North Korea Crisis and International Security Problem* (Aarti Prakashan), pp.94-107.

7. "Trump Vows To Unleash 'Fire And Fury'", *BBC*, August 8, 2017. Available at <http://www.bbc.com/news/av/40857783/trump-north-korea-threats-will-be-met-with-fire-and-fury>., Accessed on October 30, 2017; and James Griffiths and Brad Lendon, "US Warns of N Korean 'Provocations' as it Sends Bombers, Carriers To Region, 2017." Available at <http://www.kabc.com/2017/10/30/us-warns-of-n-korean-provocations-as-it-sends-bombers-carriers-to-region/>

the presence of the *unpredictable and impulsive leadership on both sides*.⁸ Others viewed the Korean peninsula crisis as appearing to be “*the Cuban missile crisis in slow motion*”,⁹ with the presence of a relentless drive to assemble the nuclear arsenal, the propaganda and uncertainty surrounding the North Korean leadership, as well as hints of military action by the United States.

If one contextualises these observations with North Korean Minister Ri Su Yung’s response to President Trump’s United Nations General Assembly speech,¹⁰ one may discern the possibility of the crisis escalating into a larger military action, as the North Korean foreign minister clearly viewed President Trump’s speech as a “declaration of war on North Korea”.¹¹

The possibility of conflict on the Korean peninsula became very real, and it was perceived that it was US aggression that would bring about that conflict. Many in Seoul viewed this as being thrust directly into the line of fire by an ally.¹²

It is, indeed, true that tensions on the Korean peninsula in September 2017 had escalated to levels not anticipated, yet after almost six months of sabre-rattling, peace talks between the DPRK and ROK were held in April 2018 in order to resolve the crisis. Kim Jong-Un became the first North Korean leader to visit South Korea. This summit generated a lot of hope as it put the agenda of denuclearisation back on the negotiation table. Experts viewed it as the “start of a period of better relations between the two Koreas”.¹³

8. Scott Sagan, “The Korean Missile Crisis: Why Deterrence Is Still the Best Option”, *Foreign Affairs*, November -December 2017. Emphasis added.

9. David E. Sanger and William J. Broad, “The Cuban Missile Crisis in Slow Motion”, *The New York Times*. Available at <https://www.nytimes.com/2017/04/16/us/politics/north-korea-missile-crisis-slow-motion.html>. Accessed on January 9, 2018.

10. Kelly Swanson, “Trump’s Full Speech to the UN General Assembly”, “September 19, 2017. Available at <https://www.vox.com/policy-and-politics/2017/9/19/16333290/trump-full-speech-transcript-un-general-assembly>. Accessed on May 25, 2018

11. Hina Pandey, “Implications of North Korean Nuclear Exchange for South Asia: Hypothetical Reality and Possible Options”, *South Asian Voices*, November 27, 2017. Available at <https://southasianvoices.org/implications-north-korean-nuclear-exchange-south-asia-hypothetical-reality-india-options/>. Accessed on April 28, 2018.

12. Karl Friedhoff, “Why Trump’s Cancellation of the North Korea Summit May Undermine the US-South Korea Alliance”, *Bulletin of Atomic Scientists*, May 24, 2018. Available at <https://thebulletin.org/why-trumps-cancellation-north-korea-summit-may-undermine-us-south-korea-alliance11847>. Accessed on May 26, 2018.

13. Ramon Pacheco Pardo, “The Inter-Korean Summit: When Moon Met Kim”, *ISDP*. Available at <http://isdp.eu/expert-interview-the-inter-korean-summit-when-moon-met-kim/>. Accessed on May 17, 2018.

What was truly historic in all this was the establishment of a direct phone line¹⁴ between Presidents Moon and Kim. Other than that, Pyongyang had also offered direct talks with the US, as well as offered to halt its nuclear and missile tests as part of the understanding between the two Korean leaders.

PATTERN OF OSCILLATION BEFORE THE SINGAPORE TALKS

With everything in place to hold a US-DPRK Summit, a sudden halt came due to President Trump's announcement of the cancellation of the peace talks between the US president and North Korean leader Kim Jong Un. This dimmed the prospects of normalising of the nuclear dynamics of the US-DPRK. It was rather strange for President Trump to have called off¹⁵ the talks approximately two weeks before the scheduled date—more confusing was the fact that within hours of North Korea destroying its Punggye-ri nuclear test site,¹⁶ President Trump decided to cancel the upcoming summit. It is to be noted that in his letter to the North Korean leader, he expressed regret for cancelling the talks and justified it as based on the “tremendous anger and open hostility displayed”¹⁷ by Kim Jong Un in his recent statement.

Even before President Trump's cancellation on May 15, 2018, North Korea too, had threatened to cut off the talks with South Korea as well as the planned US-North Korea Summit, citing the upcoming military exercises between the United States and South Korea as the reason. Interestingly, a day later, the US-South Korea military exercise “Max Thunder” took place,¹⁸ involving some 100 warplanes, including a number of B-52 bombers and

14. Yi Whan-woo, “Moon, Kim Connected with Direct Hotline”, *The Korea Times*, April 20, 2018. Available at https://www.koreatimes.co.kr/www/nation/2018/04/103_247603.html. Accessed on May 20, 2018.

15. “President Donald Trump's Letter to Kim Jong Un Canceling the Summit”, May 24, 2018. Available at <https://edition.cnn.com/2018/05/24/politics/donald-trump-letter-kim-jong-un/index.html>. Accessed on May 24, 2018.

16. Choe Sang-Hun, “North Korea Said It Destroyed Nuclear Site, Hours Before Trump Canceled Meeting”, May 24, 2018. Available at <https://www.nytimes.com/2018/05/24/world/asia/north-korea-shuts-nuclear-test-site.html>. Accessed on May 24, 2018.

17. n.15..

18. “South Korea, US to Work Closely on Summit after Pyongyang's About-Face.” Available at <https://www.cnn.com/2018/05/20/south-korea-us-to-work-closely-on-summit-after-pyongyangs-about-face.html>. Accessed on May 22, 2018.

F-15K jets.¹⁹ It is puzzling as to why after the Kim-Moon talks that resulted in the Panmunjon Declaration, the US-RoK conducted military Exercise “Max Thunder”, especially with B-52 bombers and F-22 stealth fighters, that not only symbolised nuclear capability but demonstrated the US’ ability to decapitate North Korea. What was most interesting was that in the last year’s “Max Thunder” Exercise, these aircraft had not been included. The DPRK’s perception of this exercise was that it was a demonstration of President Trump’s “fire and fury”, and not a routine exercise. Fitzpatrick has argued that may be “Max Thunder” was a way of showing that maximum pressure was still in play. The purpose could have been to pressure North Korea to make concrete concessions in the meeting.²⁰ What unfolded before the resumption of the Singapore talks can be viewed as a pattern of oscillation in the attempt at reconciliation, brushed by mutual distrust. Historically, too, the attempts to resolve the nuclear crisis in the Korean peninsula have been marked by extreme possibilities of achieving a breakthrough on the stalemate, on the one hand, and a complete halt of the negotiations, on the other.

US-DPRK NUCLEAR INTERACTIONS GOVERNED BY AMERICAN NON-PROLIFERATION STRATEGY

At the outset, what lies at the very base of the US-DPRK interactions must be spelt out. The very foundations of US-DPRK interactions have been within the framework of negotiations during nuclear crises. The Americans’ approach in all these interactions was driven largely by their non-proliferation objective – that is, to prevent new states from acquiring nuclear weapons capability. Thus, when North Korea was suspected of moving towards such capability in the late 1980s and early 1990s, the Americans’ approach in their bilateral interaction was, indeed, very clear. Since the very beginning, the US non-proliferation strategy had dominated the US-DPRK interactions,

19. “N Korea Cancels Talks with South Korea and Warns US”, May 15, 2018. Available at <http://www.bbc.com/news/world-asia-44133308>. Accessed on May 18, 2018.

20. Mark Fitzpatrick, 2018, IISS, Available at <https://www.iiss.org/en/politics%20and%20strategy/blogsections/2018-4cda/may-ba86/on-again-off-again-korean-summit-3d0c>. Accessed on May 25, 2018.

It is ironical that most of the US-DPRK interactions occurred during the Clinton and Bush Administrations, and yet it was in these Administrations that their relations deteriorated the most. In both Administrations, the US missed the opportunity to reverse North Korea's nuclear pursuit.

broadly focussing on (a) preventing North Korea from acquiring nuclear capability; (b) preventing the spread of nuclear weapons technology to other nations; and (c) getting the country to remain within the nuclear Non-Proliferation Treaty (NPT) regime.

Broadly, the United States had two significant opportunities to accomplish these goals. The first was during the 1990s period, when the US and DPRK interacted during four nuclear crises that had engulfed the Korean peninsula in 1993. The second was in 2000 when China was able to initiate the Six-Party Talks (6PT). In both cases, the talks collapsed, leading to further deterioration of US-DPRK relations. It is ironical that most of the US-DPRK interactions occurred during the Clinton and Bush Administrations, and yet it was in these Administrations that their relations deteriorated the most. In both Administrations, the US missed the opportunity to reverse North Korea's nuclear pursuit.

Nuclear Weapons in the Region?

As mentioned earlier, the oscillation of talks and a similar pattern of bargaining and blaming had occurred between the US and DPRK in the period 1991-98, during which the Agreed Framework (AF) was negotiated, and once again, in 2003, when progress was made during the Six-Party Talks. Since the nuclear capability remained central to their interactions, a brief overview of how the nuclear variable entered the region is worthy of mention.

One can locate North Korea's decision to explore nuclear technology back to the days of the Korean War, when North Korea invaded South Korea in an attempt to unify the Korean peninsula by force. The war ended in a stalemate three years later, in 1953, with the signing of the Korean Armistice

Agreement (KAA) for 60 years. It is noteworthy that four years later, in 1957, the US NSC (National Security Council) began consideration of a proposal by Adm Radford concerning the introduction of nuclear weapons into South Korea. This was perceived by North Korea as a breach of paragraph 13(d) of the KAA that mandated both sides to not introduce new types of weapons and missiles. The unilateral American abrogation of the KAA occurred on June 21, 1957, when it notified the North Korean representative at the UN.

In August 1957, the NSC 5702/2 permitted the deployment of nuclear weapons in Korea. One year later, in January 1958, the nuclear armed Honest John missiles and 280 mm atomic cannons were deployed to South Korea. Thus, one can argue that it was, in fact, the US that introduced nuclear weapons into the region for the first time. The nuclear deployments by the US since 1957 continued in the Korean peninsula till 1993, simultaneously with the annual US-South Korean joint military exercises.

US: Nuclear Deployments in South Korea

During the Cold War, the United States deployed nuclear weapons in South Korea continuously for almost three decades, mainly from January 1958 to December 1993. Interestingly, the US rationale for such deployment was to deter aggression from North Korea, a country that did not have any nuclear capability, especially during the 1950s. The US deployment was also, to a great extent, to maintain its strategic presence against Russia and China. The Korean War, which lasted from 1950 to 1953, had set the stage for such a deployment. The first US nuclear weapons that were deployed in South Korea, arrived four-and-a-half years after the Korean War ended, and

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four years after forward deployment of nuclear weapons began in Europe. Over the years, the numbers and types deployed in South Korea changed frequently. At one point, in the mid-to-late 1960s, as many as eight different types were deployed at the same time, and the arsenal peaked at an all-time high of approximately 950 nuclear warheads in 1967. However, over the following quarter century, the US nuclear arsenal in South Korea gradually declined as weapon systems were withdrawn or retired and conventional capabilities improved. By the early 1980s, the arsenal had shrunk to between 200 and 300 weapons, and it declined to around 100 by 1990.²¹

A recent report of the *Bulletin of Atomic Scientists* shows a dramatic nuclearisation of the Korean peninsula shortly after the end of the Korean War. In fact, in 1958, the United States deployed four nuclear weapon systems, with approximately 150 warheads. The systems included the Honest John surface-to-surface missile, the Atomic Demolition Munition (ADM) nuclear landmine, and two nuclear artillery weapons, the 280-mm gun and the 8-inch (203-mm) howitzer. Nuclear bombs for fighter-bombers arrived next, in March 1958, followed by three surface-to-surface missile systems – the Lacrosse, Davy Crockett, and Sergeant – between July 1960 and September 1963. Within five years of the first deployment, the South Korea-based stockpile had ballooned to seven different nuclear weapon systems and 600 warheads in total. The dual-mission Nike Hercules anti-air and surface-to-surface missile arrived in January 1961, and, finally, the 155-mm howitzer arrived in October 1964. At the peak of this build-up, in 1967, eight weapon systems with a total of 950 nuclear warheads, were deployed in South Korea.²²

Four of the weapon types remained deployed only for a few years, while the others stayed for decades. The most enduring of them all was the 8-inch howitzer, the only nuclear weapon system deployed throughout the entire 33- year period. In 1974, for example, the US Air Force strapped nuclear bombs under the wings of four F-4D Phantom jets of the 8th Tactical Fighter Wing parked at the end of the Kunsan Air Base runway (US Pacific Command 1975, vol. 1, pp. 264–265). The jets were kept in a heightened state

21. Hans M. Kristensen and Robert S. Norris, "A History of US Nuclear Weapons In South Korea", *Bulletin of Atomic Scientists*, vol. 73, no. 6, pp. 349–357.

22. *Ibid.*

of readiness, known as quick reaction alert, less than 610 miles (1,000 km) from Beijing and Shanghai, and 550 miles (890 km) from the Soviet Pacific Fleet headquarters at Vladivostok. Additionally, in the late 1970s and early 1980s, for example, the US Navy suddenly began conducting port visits to South Korea with nuclear-powered ballistic missile submarines (SSBNs). It made just a few visits in 1976 and 1978, but the frequency increased significantly with more than a dozen visits in 1979 and 1980. Over the course of five years, there were 35 SSBN visits, all to Chinhae, with some vessels visiting several times each year. All the visits were by older Polaris submarines that only operated in the Pacific; each carried 16 missiles with up to 48 nuclear warheads²³

While historical facts point to the Americans' introduction of nuclear capability in the region, it is not known whether in 1957 or prior to that, North Korea was considering its pursuit of nuclear weapons. It must be reckoned that for the DPRK, the suspicions concerning its pursuit of nuclear weapons capability surfaced later in the 1980s to the 1990s. While the country did have a nuclear technology base with the help of Soviet Russia as early as in 1959, as this was the year Soviet Russia and the DPRK signed the first civilian nuclear cooperation, in reality, the nuclear reactor was only delivered in the year 1962. The Soviet and DPRK civilian nuclear cooperation treaty, albeit with Soviet reluctance, continued until 1991—however, till today, the Soviet position on the DPRK remains that it did not support the DPRK's nuclear weapons capability. In any case, the historical fact is that there is no evidence to suggest that the DPRK was thinking about acquiring nuclear weapons capability before the introduction of nuclear weapons in the region.

Fast Forward to 1990s

In February 1990, the DPRK signed the nuclear Non-Proliferation Treaty (NPT) based on the assumption that the US nuclear umbrella, the tactical nuclear weapons, would be removed in exchange for the DPRK's commitments to the International Atomic Energy Agency (IAEA). Since North Korea had newly signed the NPT, the IAEA inspections were to

23. Ibid.

follow. However, by 1993, Pyongyang had stopped cooperating with the IAEA, which resulted in its referral to the UN Security Council (UNSC).

It must be reckoned that by 1992, Soviet intelligence²⁴ had confirmed that North Korea had actually completed a bomb. One year later, by 1993, Pyongyang had also expressed its intention of withdrawing from the NPT. The reason from North Korea was simple: it accused the US of not fulfilling its promise of cancelling the joint military exercise called "Team Spirit", which according to Pyongyang, directly threatened its security interest. The second reason was the US not being able to establish a high level dialogue between the two countries. It is noteworthy that North Korea had opened its nuclear facility for the IAEA safeguards in exchange for these two demands.²⁵

It is to be noted that by this time, the US had already influenced the IAEA to conduct special investigations on the North Korean nuclear sites by showing the satellite imagery of a waste storage site next to the Yongbyon reprocessing facility; obviously, North Korea viewed this demand as unfair and rejected the IAEA's request. It is important to note that these two sites were undeclared by North Korea. Additionally, it perceived these demands of the special investigations as being motivated by the US influence. Pyongyang actually perceived that it could meet the same fate as Iraq. On the other hand, this refusal led to the suspicion that the DPRK was intending to preserve the mystery of its nuclear past. For the IAEA, these inspections were deemed as necessary for concluding whether North Korea had produced enough plutonium for nuclear weapons.

It was this demand of special inspections that further worsened the US-North Korean relations as the US insisted on them as a precondition for any high level talks with the DPRK. On the other hand, Pyongyang also remained unbending, and perceived the US motivated UN sanctions, which were a response to the DPRK's refusal, as a threat of war. However, in the subsequent months, bilateral talks began after the US dropped its precondition. This

24. Michael J. Mazarr, *North Korea and the Bomb: A Case Study in Non-Proliferation* (MacMillan Press, 1997).

25. James A. Bayer, "The North Korean Nuclear Crisis and the Agreed Framework: How not to Negotiate with The North Koreans", *Asian Perspective*, vol. 19, no. 2, Special Issue on Security and Cooperation in Northeast Asia, Fall-Winter 1995, pp. 191-222.

time, a range of political and economic issues were discussed, including the prospects of the DPRK replacing its graphite moderated nuclear reactor with the Light Water Reactor (LWR) which is proliferation resistant, and the DPRK suspending its withdrawal from the NPT. Some progress was also made on DPRK and South Korea discussions for the implementation of the de-nuclearisation accord, and the continuity of regular, not 'special', inspections by the IAEA of the DPRK's nuclear programme. In the next few months, however, the IAEA had to bear the frustration of not being able to continue its inspections as the DPRK only permitted customised pre-approved inspections. This issue was raised by the IAEA in the UN General Assembly (UNGA).²⁶

Unfortunately, in response to this, the DPRK cancelled all its inspections when the US further pressured the DPRK by siding with the IAEA's position, along with a possibility of further economic sanctions; Pyongyang not only reciprocated by breaking off the talks but also threatened to start off the war in the Korean peninsula. On the policy front, this had resulted in the US' deployment of the Patriot missile in the Korean peninsula. After a continued standoff for months, the talks began for the second time by reaching a resolution on February 25, 1994, that reestablished the tradeoffs of the 1993 interim agreement. This time, the US also agreed to suspend the "Team Spirit" Exercise as earlier asked by Pyonyang. Yet, for the third time, the accord collapsed. By March 1994, the Korean peninsula had entered a third nuclear crisis. This time, Washington had reversed its position on opening the high level talks and made them conditional on actual exchange of nuclear envoys between the two Koreas. The DPRK further responded by interfering with the IAEA inspections and prevented the IAEA inspectors from carrying out tests that could have determined whether nuclear materials were moved out from the 5MW nuclear research reactor to the reprocessing plant at Yongbyon.²⁷

Once again, in the year 1994, the Clinton Administration cancelled the talks and resumed the "Team Spirit" Exercise. This time, the US also pushed

26. Ibid.

27. Ibid.

The Clinton Administration resumed its talks with North Korea, but, only a few days later, the IAEA's parallel negotiations with North Korea on the 'fuel rods segregation', etc. failed. This actually meant that the DPRK was attempting to destroy all evidence of any nuclear weapons history.

for UNSC sanctions; however, upon China's veto, only a statement asking for North Korea's compliance with the IAEA was announced. Moreover, Japan, and South Korea too supported the Chinese approach of a UNSC statement, instead of implementation of severe sanctions. Surprisingly, the DPRK dismissed this UNSC statement as well as the repeated attempts by the IAEA for inspections. Some hope was created when the US further delayed its joint military exercise with South Korea in anticipation of engaging North Korea directly. But the crisis began

to unfold for the fourth time in the period from April-June 1994 when the DPRK expressed its intent to refuel its research reactor at Yongbyon. This decision by North Korea was viewed as a problem—the country's attempt to reprocess could harvest enough weapons grade plutonium by the end of 1994. However, subsequently, North Korea allowed the IAEA to conclude its pending investigations. What triggered the change of heart is unknown, but it is argued that the prospects for US concessions offered earlier may have worked. A breakthrough was finally reached when, in its inspection results, the IAEA concluded that no evidence had been found that suggested that the DPRK had reprocessed plutonium in the period after 1993.²⁸

The Clinton Administration resumed its talks with North Korea, but, only a few days later, the IAEA's parallel negotiations with North Korea on the 'fuel rods segregation', etc. failed. This actually meant that the DPRK was attempting to destroy all evidence of any nuclear weapons history. North Korea went ahead, nonetheless, ignoring the warning of the UNSC. It dumped the fuel rods that the IAEA was looking to inspect. The US responded by strengthening further the economic sanctions and also called for an embargo on the sale or purchase of weapons and oil, including all financial transactions

28. Ibid.

and the remittances sent to North Korea by Japan. The US also demanded the DPRK's suspension in all international organisations, including on the UN's technical aid to the country. The US wanted to appear tough on North Korea as it wanted to send a message to other potential violators of the NPT such as Libya, Iran, etc. At this point, officials in the US State Department believed that if not curtailed, the DPRK could produce 5 or 6 nuclear weapons from the rod extracted from the 5MW reactor. It would also make progress on other nuclear reactors and in the near future, could possibly produce enough material for 10 bombs per year.²⁹

The Agreed Framework was to be implemented over 10 years in three phases. On the North Korean part, it agreed to remain an NPT member, implement the IAEA inspections, freeze its nuclear programme and eventually dismantle its existing nuclear facilities.

Once again, the sanctions proposal was met with fervent opposition by China at the UNSC. Japan too expressed its opposition to the proposal of a ban on remittances. In order to save face, the US then sent former President Jimmy Carter to meet with Kim-Il Sung. After many ups and downs, once again, a breakthrough occurred, with both countries resuming the bilateral talks and the US giving up the sanctions policy while the negotiations were underway.³⁰ The sudden death of Kim-Il Sung further created doubts but the successor, Kim Jong-il, too remained committed to North Korea's negotiations strategy. Yet the talks were unable to reach a compromise as the US expressed that it was prohibited by law to provide technology to enemy states—the case in point was the LWR that the DPRK was looking for. On the other hand, South Korea which could have assisted in giving the LWRs too, attached a precondition that the DPRK was to open its two nuclear waste dump sites for IAEA investigations. After many rounds of pushback on both sides, the Geneva Agreed Framework (AF) was reached between the US and North Korea. It committed the US to arrange for the LWR and also compelled the US to provide for alternative energy supplies of oil to end

29. Ibid.

30. Ibid.

the country's diplomatic and economic isolation. The Agreed Framework was to be implemented over 10 years in three phases. On the North Korean part, it agreed to remain an NPT member, implement the IAEA inspections, freeze its nuclear programme and eventually dismantle its existing nuclear facilities.³¹

Observations

It is evident that the first phase of US-DPRK negotiations went through many ups and downs. One can argue from the US perspective, that while it was not clear whether the DPRK possessed a full scale nuclear cycle for a nuclear weapon, it remained undeniable that the DPRK's intention was well known. Jina Kim (2014) has argued that the DPRK's choice of reactor—50 MWe (graphite moderate, gas cooled)—that was to be completed by 1995 had the negotiations not taken place, had already raised suspicions. It was suspected that it could produce upto 55kg of plutonium per year. Similarly, the other reactor of 200MWe, that began operation in 1989 and was expected to be critical by 1996, was assumed to be able to produce approximately 220 kg of plutonium per year. Furthermore, it was also known by this time (1992) that since 1986, North Korea had established a reprocessing facility which was disguised as a radio-chemical laboratory. At this point, it should be added that in 1992, the Soviets had conveyed information to the Americans³² about the possible nuclear pursuit by North Korea. Additionally, it was also known to the US through its own intelligence taken by a satellite photograph that there might be a plutonium separation facility in operation in the DPRK. This intelligence was available in the year 1989 and was corroborated by the French and Japanese intelligence as well. To add to that, the DPRK's (then) ongoing missile production had further strengthened the circumstantial evidence, as well as assisted in raising doubts that the DPRK was being honest in its dealings with the IAEA. Thus, one can argue that the US was engaged in the negotiations with an already preconceived notion of mistrust.

31. Ibid.

32 Mazarr, n.24.

On the other hand, there were definite delays on the part of North Korea in the ratification of the IAEA safeguards which was supposed to take place within 18 months after the DPRK ratified the NPT in 1992. However, at this juncture, Jina Kim points towards the IAEA's mistake which provided a wrong document to the DPRK. By the time it was corrected, another 18 months had gone by. Additionally, when finally the IAEA inspections were concluded, post the acceptance of the Safeguards Agreement, the IAEA demanded more inspections in June 1992 as it had concluded that some parts of the DPRK's programme were still unclear. The discrepancy lay in the amount of plutonium produced by the DPRK. The declaration of plutonium produced by the DPRK did not tally with the IAEA analyses, which prompted the IAEA to request for special inspections. However, the very fact that these IAEA observations and its preliminary assessment were revealed to the public could be responsible for North Korea's non-cooperation. These findings received enough media attention and speculation about the DPRK's intention and its alleged weapons pursuit was flagged internationally that further contributed in forming a negative perception about the country. Finally, the Agreed Framework was signed but with these misconceptions in the background.

Bush Administration's Flip on Agreed Framework

While everything seemed to be in place with the progress of the Agreed Framework, the succeeding Bush Administration took a more hardline approach to North Korea and even suspended the fuel oil shipments agreed to under the Agreed Framework during the Clinton Presidency. By the end of 2002, North Korea ordered the IAEA inspectors out of the country. The Agreed Framework had collapsed. Their relationship hit a new low in 2003 when the DPRK officially withdrew from the NPT, and within months, it became evident that the DPRK had at least one nuclear weapon.³³

33. Priyanka Boghani, "The U.S. and North Korea on the Brink: A Timeline", *Frontline*, April 18, 2018. Available at <https://www.pbs.org/wgbh/frontline/article/the-u-s-and-north-korea-on-the-brink-a-timeline/>. Accessed on May 22, 2018; and George Moore, "America's Failed North Korea Nuclear Policy: A New Approach", *Asian Perspective*, vol. 32, no.4, 2008, pp.9-27.

The Bush Administration's reengagement of North Korea occurred in the form of the Six-Party Talks, which manifested in a joint statement in 2005 that committed North Korea to once again give up its nuclear weapons programme, accede to the NPT and allow IAEA inspections, while keeping its right to peaceful nuclear energy. Yet, in 2006, provoked by the US targeting of its financial assets and the pace of the LWR project, the DPRK broke its moratorium on testing medium- and long-range missiles. Since then, the country has consistently conducted its nuclear and missile tests to acquire a nuclear deterrent against the US. It is indeed true that the American approach to prevent North Korea from going nuclear had failed, the answer to which partially lies in a lack of understanding of North Korea during the missed opportunities.

Why the US' North Korea Policy Failed

Neoconservative Takeover: Michael J Mazzar has argued that the Bush Administration had crafted an extremely poor strategy in dealing with North Korea. The Bush Administration had entered the White House without a clear foreign policy doctrine and it failed to articulate a coherent policy. He argues that President Bush's view that "dictatorships are morally reprehensible and cannot be trusted" actually formed the core attitude in the Bush presidency. In fact, the North Korean strategy was not even debated at the senior levels of the US government, which resulted in a strategic muddle. President Bush had perceived that Kim Jong Il, the North Korean leader (then), was a loathsome tyrant who did not deserve to be in power. Additionally, this lack of understanding was compounded by the presence of the varied unfortunate influence of the hawkish group that reflected a strong consensus on North Korea. This group included senior officials in the Administration such as Undersecretary of State John Bolton, the NSC's Joseph, aides to Vice President Dick Cheney, senior Defence Department officials, including Secretary of Defence Donald Rumsfeld and the vice president himself. It is argued that all of them viewed the North Korean government as a brutal, Stalinist and tyrannical one, and believed that any economic and political engagement with Pyongyang implied prolonging

the life of a dangerous regime. It is to be recalled that it was the Bush Administration that had included North Korea in the axis of evil. Almost all these hardliners believed that since there were no prospects of North Korea giving up its nuclear weapons, negotiations meant a waste of time. Thus, they envisaged the preferred solution as a situation in which North Korea was to surrender its nuclear weapons and abide by the intrusive verification regime, without the US making any concessions.³⁴

Approach ABC: “Anything But Clinton”: Another reason for the failure of the US-DPRK talks also lies in the Bush Administration’s approach to the previous Administration, which George Moore has defined as “ABC: Anything But Clinton”. It is to be noted that President Bush felt that the Agreed Framework negotiated by the Clinton Administration was a terrible mistake and, thus, ought to be undermined. Hence, the Agreed Framework was always a non-starter in the Bush Administration. The first action he took was to review Clinton’s North Korea policy. He had serious doubts about its success and he wanted to undermine it. The only reasonable way to undermine the Agreed Framework was to impose more sanctions. Anything to strangle the North Korean economy and push it to the point of collapse was viewed as being in the long-term interest of the US vis-à-vis North Korea.

CONCLUDING OBSERVATIONS: POINTERS FOR THE FUTURE

Live up to the Commitment

The forty years of history and the recent declaration reveal that if history is to serve as any guide for the future, one lesson that is worth incorporating is that both sides should live up to their commitments. While the suspension of the military exercise³⁵ is a good start, one needs to take a long-term view of it. President Trump, in one of his statements, referred to the military exercise as “provocative” and “expensive”. This, in a way, brands these exercises as

34. Michael J Mazarr, “The Long Road to Pyongyang”, *Foreign Affairs*, September–October 2007. Available at <https://www.foreignaffairs.com/articles/asia/2007-09-01/long-road-pyongyang>. Accessed on May 4, 2018.

35. “S.Korea Says to Suspend August War Games with U.S.”, *Xinhuanet*, June 19, 2018. Available at http://www.xinhuanet.com/english/2018-06/19/c_137264433.htm. Accessed on June 26, 2018.

One can argue that the US commitment to the RoK and Japan may come in conflict with the US commitment to indefinitely suspend the military exercises. How then, will the US live up to its commitment?

unnecessary, however, this may not be the view in South Korea. Additionally, it is not clear as to what kind of military exercises would be suspended and that too, for how long? It is to be recognised that the US-South Korea exercises go beyond Freedom Guardian, the one which is suspended indefinitely. It is noteworthy to point out here that even a bigger military exercise known as Foal Eagle, that is a joint field training exercise, lasting up to two months, is said to have been delayed, not suspended. Some scholars³⁶

have viewed this suspension without much enthusiasm largely because in the long run, this might seriously affect the US-RoK alliance. Will this trigger the US allies—RoK and Japan—to question the future of the alliance? One can argue that the US commitment to the RoK and Japan may come in conflict with the US commitment to indefinitely suspend the military exercises. How then will the US live up to its commitment? The American pledge to suspend military exercises with South Korea as a quid-pro-quo for denuclearisation is the core of the recent summit and any progress has to be built around it. This is a significant concession and an excellent step that has the potential for denuclearisation, because it mitigates North Korea's threat perception from the US-RoK and, thus, negates the need for North Korea to possess nuclear weapons. It is to be noted, however, that this may not actually be realised. Interestingly, this huge concession that involves the security of an important US ally, was given without even consulting South Korea. Even if it is assumed that these military exercises will be cancelled, how will the US assure South Korea that it (the US) will be a responsible security ally is not clear. Let us assume that it will do so by strengthening military aid, but will that not further strengthen North Korea's threat perceptions and make it unsure of 'peace and stability of the Korean peninsula', the second most important goal in the Singapore Summit?

36. Matts Engman, "Consequences of Suspending U.S.-ROK Military Exercises, *ISDP*, June, 20 2018, Available at <http://isdpeu/consequences-suspending-u-s-rok-military-exercises/>. Accessed on June 26, 2018.

Additionally, for North Korea, one has to understand that as Kim Jong Un has declared his country's nuclear deterrent complete, this further raises questions on the possibility of 'denuclearisation'. Additionally, US Secretary of State Pompeo³⁷ has already stated that the Trump Administration would regularly assess the regime's seriousness about abandoning its nuclear programme. To start with, on the idea of 'denuclearisation', the Singapore Declaration has shied away from making any mention of the comprehensive (sometimes complete) verifiable, irreversible disarmament (dismantlement) of nuclear weapons. Caution should be exercised while hoping that this goal of denuclearisation will be met any sooner, even when the declaration has said so. The first, obvious question that comes to mind is, "When has any country, after testing its nuclear capability ever given up its nuclear weapons capability"? The answer is, "Never". While there is no harm in being hopeful in the North Korean case, the reality militates against it. In this context, two separate but related variables need to be connected. The first is the constitutional amendment by the DPRK in 2012 that legitimises its pursuit of nuclear weapons and officially makes the pursuit of nuclear weapons and economic development of the country a goal to be achieved simultaneously. The second is the North Korean principle of *Juche*, the core philosophy of the country, which implies self-reliance and autonomy. According to scholars who observe North Korea closely, "The North Korean government has worked to inspire the entire nation with the *Juche* ideology..."³⁸ It is a coherent body of thought that reflects the North Korean understanding

Washington continues to demand that Pyongyang relinquish the nuclear weapons it already has. The Trump Administration has pledged that the North Korean regime will never acquire a nuclear missile that can hit the United States.

37. Elise Labott, "Exclusive: Pompeo Says no Timeline on North Korea Negotiations", June 25, 2018. Available at <https://edition.cnn.com/2018/06/25/politics/pompeo-exclusive-north-korea/index.html>. Accessed on June 26, 2018.

38. Jina Kim, *The North Korean Nuclear Weapons Crisis: The Nuclear Taboo Revisited* (UK: Palgrave Mcmillian, 2014), p.42

of its dynamics of relations with other countries and also guides its perception of the international system. In this regard, it is important to ask the question, "By giving up nuclear weapons, a pursuit that was followed for more than three decades, how is the DPRK adhering to its *Juche* philosophy"?

Yet, Washington continues to demand that Pyongyang relinquish the nuclear weapons it already has. The Trump Administration has pledged that the North Korean regime will never acquire a nuclear missile that can hit the United States. Scholars such as Jervis view this as a more dangerous phase in the US-North Korean relationship. On the current scenarios, Jervis³⁹ is of the opinion that regardless of what manifests out of the diplomatic engagement, one can argue that the US is not likely to change the tools of engagement such as sanctions, deterrence, and even military force (or the show of it). It is important to ask at this point whether this will actually result in the normalisation of US-DPRK ties.

IAEA as an Honest Broker

The very day the Singapore Summit was concluded, a statement from the IAEA Director General Yukiya Amano welcomed this development. The head of the monitoring agency also remarked that the IAEA would be watching the negotiations further and is ready to undertake verification activities⁴⁰ that may be requested. Indeed, the role of the IAEA is significant. However, the history of their interactions suggests a mistrust for the IAEA by North Korea. For instance, in 1993, when the DPRK had warned about its NPT withdrawal, it announced it by sending a statement of notice in which it accused the "IAEA of violating its sovereignty and interfering in its internal affairs, attempting to stifle its socialism, and of being a 'lackey' of the United

39. Robert Jervis and Mira Repp Hopper, "Perceptions and Misperceptions on the Korean Peninsula: How Unwanted Wars Begin," *Foreign Affairs*, May-June 2018.

40. Yukiya Amano, "Statement by IAEA Director General Yukiya Amano", June 12, 2018. Available at <https://www.iaea.org/newscenter/statements/statement-by-iaea-director-general-yukiya-amano-on-dprk>. Accessed on June 27, 2017.

States".⁴¹ According to North Korea, the United States influenced the officials of the IAEA Secretariat and member states at the IAEA Board of Governors meeting on February 25, 1993, to adopt a resolution requiring North Korea to open its sites to inspections that were not nuclear-related.⁴² However, it is to be noted that one year ago, when the DPRK had newly ratified the IAEA safeguards agreement, in the subsequent days, as a requirement, it had provided the IAEA a 150-page report on its nuclear facilities and material, 25 days ahead of schedule. It also invited Hanx Blix and the IAEA's head, with the inspection team, to Yongbyon for a tour of any site, even if unlisted. The DPRK reported to the IAEA not only completed but under construction facilities as well. However, the IAEA's conclusion that highlighted the DPRK's nuclear programme needed more clarification. The IAEA alleged that the DPRK was involved in several reprocessing campaigns, contrary to what it had claimed. This generated a sense of suspicion that undeclared material had been hidden in a secret facility elsewhere. When the IAEA demanded special inspections, which, earlier, it had never done, the DPRK resisted. The North Korean response was reciprocated by the resumption of the US-ROK military exercise and the reduction of the US Force Korea (USFK) was put on hold. Additionally, the ministers of foreign affairs from as many as 13 states in the Asia-Pacific urged the DPRK to again agree to the special inspections. As mentioned above, this demand was viewed by the DPRK as a grave violation of its national sovereignty. These issues of distrust might surface again considering that denuclearisation is still on the table, and the IAEA will play an important role. The DPRK's perceptions of the IAEA as an impartial entity are necessary. However, it is not clear as to what these are at this stage.

41. IAEA News Centre, (2018). Available at <https://www.iaea.org/newscenter/focus/dprk/chronology-of-key-events>. Accessed on June 27, 2018. It should be noted that on June 11, one day before its notice of withdrawal from the NPT was due to take effect, the USA persuaded North Korea to suspend the "effectuation" of its withdrawal and to accept normal IAEA inspection of the seven sites it had declared in the Initial Report to the agency. However, it withdrew its membership of the IAEA on June 13, 1994.

42. Ibid.

Role of China

Any pointers to the future have to include the role of China, as it is the only country that enjoys such a significant influence over the DPRK. Many questions come to mind when North Korea's nuclear weapons are discussed.

Scholars have argued that for all China's assumed influence over the DPRK, it is still puzzling to observe why China has consistently been reluctant to play a substantive role in diffusing the DPRK's nuclear weapons issue, considering its own opposition to the DPRK's nuclear programme. In this context, it is important to ask: what is the real attitude of China towards North Korea? Professor Kerry Brown of Chinese Studies at Kings College has observed, "...To many Chinese, North Korea... figure as a brother, is clearly regarded as a delinquent, one they not only dislike, but look down on⁴³..." He argues that China believes North Korea to be a problem, delinquent nation, and the best strategy is to let it muddle through, as taking responsibility would not help. Most importantly, China views the issues as bilateral between the US and DPRK and has often urged both parties to talk directly. Additionally, one must ask: what are the gains that China would make if the DPRK's nuclear issue gets resolved? The very fact that by letting this issue simmer, China also gets to ensure its leverage on the US, compels one to assume that China may not be truly invested in the DPRK's denuclearisation, if at all, that is taking place. Additionally, while assessing China's role, it is also imperative to ask whether China's influence is significant enough to induce North Korea to give up its nuclear capability?

FINAL OBSERVATION

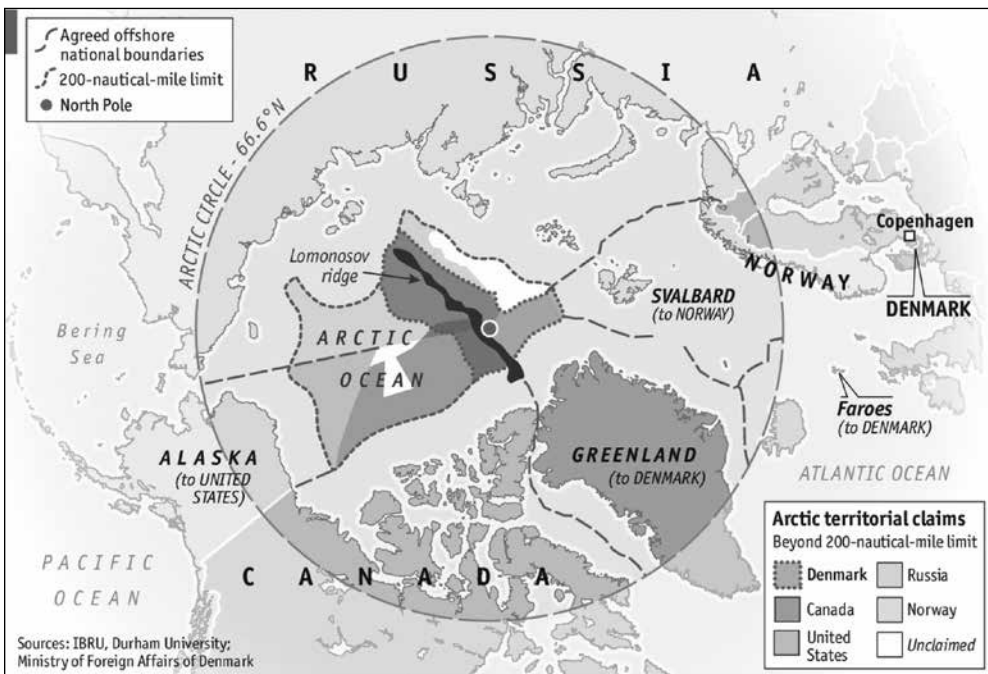
This brings another important variable as a pointer to the future, that is, mainstreaming North Korea into the international community, more in terms of the economy, can be a long-term solution. While the Singapore Summit has been able to diffuse the escalating nuclear rhetoric of

43. Kerry Brown, "What Does China Really Think of North Korea", *Diplomat*, May 25, 2018.

September 2017, there is still a long way to go. Thus, to conclude, one may argue that the summit was able to produce an ambitious, non-binding document that may not result in any tectonic shift in the dynamics of the security and stability of the Korean peninsula; after all, it is easy to reach an agreement when the pledges are vague, unbinding, without concrete timelines or a methodology for progress, promising a hypothetical peace scenario. This seems like an ‘up-cycled’ promise of some de-escalation of tension between the US and DPRK, without substantial consequences for the future of the peace promised to the people. Finally, both sides must realise that they both have the opportunity to create a historic pathway towards the generation of peace, by reducing the threat of the presence of nuclear weapons in the Korean peninsula. While the US may find it useful to learn that extreme pressure campaigns might not work; North Korea, too, might find it useful to refrain from its habit of issuing threats of cancelling the talks and signalling non-cooperation. Indeed, the Singapore Summit has released many pledges. However, these valuable pledges are just that—‘pledges’—on which a lot of ground work needs to be done by both sides if these are to be actualised. One can argue that the summit did not produce anything substantially different from the previous commitments in past agreements, that could be ‘life altering’ to either US-DPRK relations or DPRK-RoK relations and the larger goal of maintaining the security and stability of the Korean peninsula.

THE NEED FOR INDIA TO BRING AN 'ASIAN PERSPECTIVE' INTO THE ARCTIC

STUTI BANERJEE AND POOJA BHATT



This paper overviews the existing policies of the Arctic nations and explicates the need for India to develop its Arctic policy as an observer state of the Arctic Council. The Arctic becomes a crucial geostrategic location owing to the global

Dr. Stuti Banerjee is Research Fellow, Indian Council of World Affairs, New Delhi.

Ms. Pooja Bhatt is Research Associate, Centre for Air Power Studies, New Delhi. The views expressed are personal.

The Arctic becomes a crucial geostrategic location owing to the global warming and climate change that is affecting the landscape of this permafrost region. The melting ice presents opportunities as well as challenges to countries to evolve their policies and strategies.

warming and climate change that is affecting the landscape of this permafrost region. The melting ice presents opportunities as well as challenges to countries to evolve their policies and strategies in accordance with the same. In addition to member states, an observer state such as China has also produced its Arctic Policy in 2018. In the light of current developments, India, too, needs to constantly engage with several Arctic Council Working Groups as an active partner and stakeholder in the Arctic interests. The paper argues that even though India has participated in some of the Arctic projects, there is scope for more focussed and long-term policies by

bringing in an 'Asian perspective to the Arctic issues'.

INTRODUCTION

The Arctic is the polar region lying north of the Arctic Circle, including the icy North Pole and the Arctic Ocean, making it the northernmost region of the world. It covers an area of 14.5 million sq km and is surrounded by eight countries: Canada, Finland, Greenland, Iceland (Kingdom of Denmark), Norway, Sweden, and the USA. These eight countries have formed a high level inter-governmental organisation, the Arctic Council, for cooperation and coordination in Arctic-related issues. Apart from these permanent members, the Arctic Council was extended to non-Arctic members to engage and participate in, and contribute to, the Arctic Working Groups. Currently, there are 13 non-Arctic nations¹ that have been approved as observers to the Arctic Council; India became an observer in 2013.

The main driving force behind the emergence of the importance of the Arctic, over the past few years, has been the impact of climate change. The changing climate is leading to the melting of the sea ice in the Arctic Ocean

1. France, Germany, Italian Republic, Japan, the Netherlands, People's Republic of China, Poland, Republic of India, Republic of Korea, Republic of Singapore, Spain, Switzerland, and United Kingdom.

and the glaciers on land, and a thawing of the permafrost. The emergence of the 'New Arctic' is fast becoming geographically very important and cannot be ignored by the international community. Several opportunities have also emerged from the melting of the Arctic ice in the form of shipping routes, possible exploration of mineral wealth, and expansion of the fishing industry. One of the downsides of climate change is the changing topography of the world, with the possibility of invoking territorial and maritime sovereignty claims that eventually have geostrategic implications. A number of overlapping territorial claims in the Arctic might place strain on the existing international regimes leading to considerable power politics between the members of the Arctic Council. It has to be kept in mind that most members of the Arctic Council, apart from Russia, are allies of the United States, with some being members of the North Atlantic Treaty Organisation (NATO) as well.

One of the downsides of climate change is the changing topography of the world, with the possibility of invoking territorial and maritime sovereignty claims that eventually have geostrategic implications. A number of overlapping territorial claims in the Arctic might place strain on the existing international regimes.

The debate on the Arctic has been to balance the opportunities that the region provides as a result of the melting of the ice due to climate change, with targeted efforts to mitigate the harmful effects on the Arctic, and prevent it from melting further. A number of Asian nations are also looking towards the Arctic for the economic opportunities it may provide as well as the possibility of exploring new shipping routes to trade with Europe. Many have proposed that the Arctic be declared a 'global commons' or an asset of the 'common heritage of mankind', akin to the Antarctica continent.

THE ARCTIC COUNCIL NATIONS AND THEIR INTERESTS IN THE REGION

The Arctic Council is the leading inter-governmental forum promoting cooperation, coordination and interaction among the Arctic states, Arctic

indigenous communities and other Arctic inhabitants on common Arctic issues, in particular on issues of sustainable development and environmental protection in the Arctic. The Arctic Council is celebrating its 22 years of existence. The council was set up to work towards making the Arctic a zone of peace and stability. It was established on September 19, 1996, with the signing of the Ottawa Declaration.² In addition to eight permanent Arctic Council members, six organisations representing the Arctic indigenous peoples have status as permanent participants. The category of permanent participants was created to provide for active participation and full consultation with the Arctic indigenous peoples within the council. They include: the Aleut International Association, Arctic Athabaskan Council, Gwich'in Council International, Inuit Circumpolar Council, Russian Association of Indigenous Peoples of the North and Saami Council.

The Arctic Council has also helped to maintain the Arctic as a zone of peace and stability. In the 2013 "Vision for the Arctic", ministers of the Arctic states wrote: "We are confident that there is no problem that we cannot solve together through our cooperative relationships on the basis of existing international law and goodwill." This commitment is also affirmed by the Ministerial Declarations from Nuuk (2011), Kiruna (2013) and Iqaluit (2015), in each of which, ministers of the Arctic states recognised "the importance of maintaining peace, stability, and constructive cooperation in the Arctic."

The following is a brief look at the Arctic policy of the members of the council.

CANADA

"Canada's vision for the Arctic is a stable, rules-based region with clearly defined boundaries, dynamic economic growth and trade, vibrant northern communities, and healthy and productive ecosystems. The Arctic is fundamental to Canada's national identity. It is home to many Canadians, including indigenous peoples across the Yukon, the Northwest Territories and Nunavut, and the northern parts of many Canadian provinces. The

2. The text of the 'Declaration' can be found at: https://oarchive.arctic-council.org/bitstream/handle/11374/85/00_ottawa_decl_1996_signed%20%284%29.pdf?sequence=1&isAllowed=y

Arctic is embedded in Canadian history and culture, and in the Canadian soul. The Arctic also represents tremendous potential for Canada's future. Exercising sovereignty over Canada's north, as over the rest of Canada, is its number one Arctic foreign policy priority. Its vision for the Arctic is a stable, rules-based region with clearly defined boundaries, dynamic economic growth and trade, vibrant northern communities, and healthy and productive ecosystems.³

Canada's 'First Defence Strategy' as a comprehensive policy for the Canadian Forces, also focusses on the need to provide an increased presence in the Arctic. Through this strategy, Canada is investing in new patrol ships that will be capable of sustained operation in first-year ice to closely monitor the Arctic waters as they gradually open up and maritime activity increases. In order to support these and other Government of Canada vessels operating in the north, Canada is investing in a berthing and refuelling facility in Nanisivik. Canada is also expanding the size and capabilities of the Canadian Rangers, drawn primarily from indigenous communities, who provide a military presence and Canada's "eyes and ears" in remote parts of Canada. A new Canadian Forces Arctic Training Centre is also being established in Resolute Bay.

Canada is also investing significantly in mapping the energy and mineral potential of the north.⁴ It is taking a comprehensive approach to the protection of environmentally sensitive lands and waters in the north, ensuring that conservation keeps pace with development and that development decisions are based on sound scientific study and careful assessment. As part of this effort, the government has enhanced pollution prevention legislation in the Arctic waters and is taking steps to clean up abandoned mining sites across the north. Canada is already at the forefront of several international efforts to study the impacts on both the Arctic and Antarctic of a changing climate, and is investing to help the northerners adapt to these impacts.

3. Government of Canada, "Canada's Arctic Foreign Policy," http://international.gc.ca/world-monde/international_relations-relations_internationales/arctic-arctique/arctic_policy-canada-politique_arctique.aspx?lang=eng, Accessed on August 1, 2018.

4. *Ibid.*, pp. 11-15.

GREENLAND (KINGDOM OF DENMARK)

The kingdom's Arctic policy states, "The Arctic has to be managed internationally on the basis of international principles of law to ensure a peaceful, secure and collaborative Arctic."⁵ Though the area under Denmark is covered by the NATO treaty, the long-term political agreement on defence (Danish Defence Agreement 2010–14) involves a stronger focus on the tasks of the Danish armed forces in the Arctic. As part of its presence, the armed forces are building a habitual picture of activities in the waters around Greenland and the Faroe Islands.

In addition, the armed forces play an important role in the provision of a range of more civilian-related duties. The 2010-14 Danish Defence Agreement includes four overriding initiatives that must be viewed in the light of climate change and increased activity that would foreseeably result in an increase of tasks for the armed forces. Firstly, the armed forces' North Atlantic Command structure will be streamlined by the amalgamation of the Greenland Command and Faroe Command into a joint Service Arctic Command. Secondly, the ability of the armed forces to conduct operations in the Arctic environment will be strengthened. The forces will be anticipated to strengthen their enforcement of sovereignty and surveillance, for instance through military exercises. The force could also be deployed in other situations such as in assistance to the Greenlandic society. Thirdly, in conducting a risk analysis of the maritime environment. Fourthly, in 2014, a comprehensive analysis about the future tasks of the armed forces in the Arctic was carried out, including opportunities and potential for closer cooperation with partner countries in the Arctic. Tourism, second only to fisheries, is the most important export industry in the area, and has the potential for growth in the future. The vision is to exploit the mineral resources in the Arctic under the best international practices, and in continued close cooperation with the relevant authorities of the Danish realm and international partners.⁶ In cooperation with the international research and scientific community, Denmark has stated that it will strengthen the effort to

5. Kingdom of Denmark, Greenland and the Faroe Islands, "Kingdom of Denmark Strategy for the Arctic 2011–2020," file:///C:/Users/Lenovo/Downloads/Arctic%20strategy%20(2).pdf. Accessed on August 1, 2018, p. 1.

6. Ibid., pp. 23–25.

quantify the global and regional impacts of climate change in the Arctic, including knowledge about how Arctic ecosystems, sea ice and ice sheets respond to climate change. Such efforts include monitoring and research activities with the involvement of Greenland, Faroese and Danish research centres. Research and monitoring must reinforce the knowledge base on climate change impacts and their significance for the populations and communities within and outside the Arctic, as well as incorporating local and traditional knowledge. It will also assist in reinforcing the rights of the indigenous peoples in negotiations towards a new international climate agreement by promoting the visibility of indigenous peoples' situation and also ensuring that the principles of the UN Declaration on the Rights of Indigenous Peoples from 2007 are observed.⁷

FINLAND

Finland had identified four priority areas for the Arctic Council under its presidency for 2017-19. These are: environmental protection, connectivity, meteorological cooperation and education. They are an extension of its Arctic Policy formulated in 2013, updated in 2016 with a strategy document released in 2017. Finland sees the European Union (EU) as a key factor in the Arctic region and supports efforts to consolidate the EU's Arctic policy. Finnish expertise can be exploited in fields such as energy-efficient Arctic construction (including timber construction), sustainable energy solutions and functional community development. Finland can be profiled as a model country for a bio-based and circular economy.⁸ All this is significant from Finland's perspective as it seeks to lead the way in the sustainable development of the region. Actors planning to launch operations in the area must have the capacity to evaluate and manage the risks and potential outcomes of their activities. Finland's role in the transition that the Arctic region is currently undergoing is to promote sustainable development

7. Ibid., pp. 43-44.

8. Prime Minister's Office, Finland, "The Government's Strategy Session on March 27, 2017: Action Plan for the Update of the Arctic Strategy," https://vnk.fi/documents/10616/3474615/EN_Arktisen+strategian+toimenpidesuunnitelma/0a755d6e-4b36-4533-a93b-9a430d08a29e/EN_Arktisen+strategian+toimenpidesuunnitelma.pdf. Accessed on August 1, 2018, p. 3.

A circular economy aims at maximising recycling and minimising waste products.

Standing in stark contrast to some other members, Finland has no belligerent military policy towards the Arctic. The Finnish defence forces have excellent capabilities for the Arctic environment due to their cold climate expertise and the material suited for northern conditions.

and stability, both nationally and internationally.⁹

Standing in stark contrast to some other members, Finland has no belligerent military policy towards the Arctic. In Finland, preparedness is based on a comprehensive concept of security for the Arctic. The Finnish defence forces have excellent capabilities for the Arctic environment due to their cold climate expertise and the material suited for northern conditions. Additionally, Finland has extensive Arctic training and exercise areas in Rovajärvi, Sodankylä and Kajaani as

well as in sea areas on the Quark, the Gulf of Bothnia and the Gulf of Finland. The Finnish Air Force has experience in operating in Arctic cold-climate conditions. Finland has offered its Arctic exercise and training to its international partners, which also contributes to its own forces' interoperability.¹⁰ The opportunities for the commercialisation of Finnish Arctic expertise are mainly based on the large theme areas and drivers of the Arctic region: climate change mitigation and energy solutions, maritime safety, construction and functional infrastructure, and digital services and functional data transfer.

ICELAND

The Parliamentary Resolution on Iceland's Arctic Policy (2011) states twelve principles such as "promoting and strengthening the Arctic Council as the most important consultative forum on Arctic issues and working towards having international decisions on Arctic issues." The policy also secures Iceland's position as a coastal state within the Arctic region as regards influencing its development as well as international decisions on

9. Prime Minister's Office Publication, Prime Minister's Office, Finland, "Finland's Strategy for the Arctic Region 2013. Government Resolution on August 1, 2018," <http://vnk.fi/documents/10616/334509/Arktinen+strategia+2013+en.pdf/6b6fb723-40ec-4c17-b286-5b5910fbecf4>. Accessed on August 26, 2016, p. 8.

10. *Ibid.*, pp. 39-41.

regional issues on the basis of legal, economic, ecological and geographical arguments.¹¹ It also importantly states, “Supporting the rights of indigenous peoples in the Arctic in close cooperation with indigenous organisations and supporting their direct involvement in decisions on regional issues. And to use all available means to prevent human-induced climate change and its effects in order to improve the well-being of Arctic residents and their communities.”¹² Since the northern part of the Icelandic Exclusive Economic Zone (EEZ) falls within the Arctic and extends to the

Greenland Sea adjoining the Arctic Ocean, Iceland has both territory in, and rights to, sea areas north of the Arctic Circle. Iceland is developing further trade relations between states in the Arctic region, and thereby laying the groundwork for Icelanders to compete for the opportunities created as a result of increased economic activity in the Arctic region. It supports the need to resolve differences related to the Arctic on the basis of the United Nations Convention on the Law of the Sea. The convention establishes a legal framework for ocean affairs and contains, *inter alia*, provisions on navigation, fisheries, exploitation of oil, gas and other natural resources on the continental shelf, maritime delimitation, ocean pollution prevention, marine scientific research and dispute settlement applicable to all sea areas, including the Arctic region. Nonetheless, it wants to conduct all of these activities in a manner that will contribute to sustainable utilisation of resources and through responsible handling of the fragile ecosystem.

According to the government, it is essential that the Icelandic people are able to make full use of employment opportunities created by changes in

Iceland is developing further trade relations between states in the Arctic region, and thereby laying the groundwork for Icelanders to compete for the opportunities created as a result of increased economic activity in the Arctic region.

11. Government of Iceland, “A Parliamentary Resolution on Iceland’s Arctic Policy,” <https://www.government.is/media/utanrikisraduneyti-media/media/nordurlandaskrifstofa/A-Parliamentary-Resolution-on-ICE-Arctic-Policy-approved-by-Althingi.pdf>. Accessed on August 1, 2018, p.2.

12. *Ibid.*

the Arctic region. The Icelandic economy and institutions have knowledge, technology and experience that fit well with the social and environmental conditions in the region.¹³ Iceland has stated that it will concentrate its efforts fully on ensuring that increased economic activity in the Arctic region will contribute to sustainable utilisation of resources and observe responsible handling of the fragile ecosystem and the conservation of biota. Furthermore, contribute to the preservation of the unique culture and way of life of indigenous peoples that has developed in the Arctic region.¹⁴

NORWAY

The Norway government's vision is for the Arctic to be a peaceful, innovative and sustainable region. The government will give even higher priority to ensuring an integrated approach to the Arctic policy. Norway wants to achieve the three dimensions of sustainable development – social, economic and environmental – in the Arctic.¹⁵ The oil and gas industry is the largest contributor to the Norwegian economy, and provides major opportunities for increased employment and growth in northern Norway. The government wants to establish an ambitious oil and gas policy, which facilitates future development projects in the High North, including by offering attractive exploration areas. The government will also continue mineral mapping in northern Norway under the management of the Geological Survey of Norway. The other two industries that have generated interest are fishing and tourism.¹⁶ More than 80 per cent of all maritime traffic in the Arctic passes through Norwegian waters. Climate change and melting of ice have increased the importance of the Arctic, both to

13. Ministry of Foreign Affairs of Iceland, "A Parliamentary Resolution on Iceland's Arctic Policy (Approved by Althingi at the 139th legislative session March 28 2011)," <https://www.mfa.is/media/nordurlandaskrifstofa/A-Parliamentary-Resolution-on-ICE-Arctic-Policy-approved-by-Althingi.pdf>. Accessed on August 1, 2018.

14. Ibid.

15. Norwegian Ministries, "Norway's Arctic Strategy: Between Geopolitics and Social Development," <https://www.regjeringen.no/contentassets/fad46f0404e14b2a9b551ca7359c1000/arctic-strategy.pdf>. Accessed on August 1, 2018, pp.9-10..

16. Norwegian Ministry of Foreign Affairs, Government of Norway, "Norway's Arctic Policy," https://www.regjeringen.no/globalassets/departementene/ud/vedlegg/nord/nordkloden_en.pdf. Accessed on August 1, 2018, pp. 20–22.

sea transport and to oil and gas activities. The government policy wants to ensure preparedness for acute pollution and for preventive maritime safety in the Arctic.

Norway is an active driving force in establishing global safety and environmental rules for ships operating in the polar waters. Norway has led the working group in the UN Maritime Organisation (IMO) which is working to establish the so-called Polar Code. Norway is working to strengthen cooperation on comprehensive, ecosystem-based maritime management. These are a few of the steps that Norway has stated in its Arctic strategy to protect the environment and eco-system of the Arctic.¹⁷ Norway has a number of larger naval bases in its northern regions at Haakonsværn, Ramsund and Sortland.¹⁸

THE RUSSIAN FEDERATION

Russia, as the country with the longest coastline in the Arctic Ocean, has a central role in determining how the emerging new Arctic will develop. The country has a long tradition of operating in the Arctic, and has strong economic and security interests in the region.¹⁹ Russia, with its northern fleet, naval infantry, air force, coast guard and patrol vessels that support it, is by far the most forceful naval power in the Arctic. Besides its headquarters at Severomorsk, the fleet has four other large naval bases in the high north, each of which consists of multiple bays, facilities, ports and installations: Gadzhievo, Zapadnaya Litsa, Vidyayevovo and Gremikha. It has several airfields and airbases north of the 60th parallel, some of which have reopened in the past five years. These are: Alykel, Besovets, Khatanga, Kogalym, Kotelny Island, Mirny, Severomorsk (Murmansk), Olenya (Olenegorsk), Raduzhny, Salekhard, Surgut, Syktyvkar, Tiksi, Dresba airbase at Pevek, Petrozavodsk, Ugolny and Yakutsk. However, it is questionable how many of these are fully operational from a military point of view.²⁰

17. Ibid., pp.26–39.

18. Marcus M. Keupp, "Five Nations Jockey for Military Influence in Arctic," *National Defence Magazine*, March 2016, <http://www.nationaldefensemagazine.org/archive/2016/March/Pages/FiveNationsJockeyforMilitaryInfluenceinArctic.aspx>. Accessed on 01 August 2018.

19. Märta Carlsson and Niklas Granholm, "Russia and the Arctic", www.foi.se/ReportFiles/foir_3596.pdf, Accessed on August 1, 2018, p.12.

20. Keupp, n.18.

In terms of military security, the changing Arctic presents new challenges. The post-Cold War set-up, with a low priority given to the military-strategic role of the Arctic, is now changing. The melting of the ice provides scope for more military activity, and security forces will be needed to monitor and regulate the increasing human activity there. Parts of the strategic submarine forces, which operate continuously to provide a nuclear second-strike capability, are based in the Arctic and will be affected by this. The ice sheet, in the Arctic Ocean provides a cover for operations with these submarines, making them difficult or even impossible to detect. But with the melting and thinning of the ice sheet, this may change fairly soon. The implications are hard to predict and may impact on the future direction of these systems. The stress on the development of Ballistic Missile Defences (BMDs) could also lead to the development of such systems in these areas.²¹ In the case of the Arctic Ocean, a number of overlapping claims have been made, and Russia's claims to an extended EEZ overlap with those of Denmark, Canada and the United States.

According to the *Foundation of the State Politics of the Russian Federation on the Arctic for 2020 and in the Longer Perspective (2008)*²², the Russian national interests are:

- use of the Arctic zone of the Russian Federation as a strategic resource base of the Russian Federation for providing the solution of problems of social and economic development of the country;
- maintenance of the Arctic as a zone of peace and cooperation;
- preservation of the unique ecological systems of the Arctic;
- use of the Northern Sea Route as a national integrated transportation system of the Russian Federation in the Arctic.²³

The basic measures on the realisation of the state policy in the sphere of maintenance of environmental security in the Arctic zone of the Russian

21. Carlsson and Granholm, n.19, p. 12.

22. The document is available with the Ministry of Economic Development of the Murmansk Region

23. The Arctic Knowledge Hub, "Basics of the State Policy of the Russian Federation in the Arctic for the Period Till 2020 and for a Further Perspective," <http://www.arctis-search.com/tiki-index.php?page=Russian%20Federation%20Policy%20for%20the%20Arctic%20to%202020>. Accessed on August 1, 2018.

Federation are: introduction of special regimes of wildlife management and protection of the natural environment in the Arctic zone of the Russian Federation, including monitoring of pollution and restoration of natural landscapes, recycling of toxic industrial wastes and maintenance of chemical safety, first of all, in places having density of population. Russia wants to ensure preservation of the biological diversity of the Arctic flora and fauna, including by expansion of a network of especially protected natural territories and water areas, taking into account the national interests of the Russian Federation, the necessity of the preservation of the natural environment, alongwith the expansion of economic activities and global climate changes.²⁴

Russia's objectives for the Arctic 2020 further include the following:

- in the sphere of social and economic development: an expansion of the resource base of the Arctic zone of the Russian Federation capable substantially of meeting the requirements of Russia in hydrocarbon resources, water biological resources and other kinds of strategic raw materials;
- in the sphere of military security: defence and protection of the state border of the Russian Federation lying in the Arctic zone of the Russian Federation, maintenance of a favourable operative regime in the Arctic zone of the Russian Federation, including maintenance of the necessary fighting potential of groupings of general purpose armies (forces) of the armed forces of the Russian Federation, other armies, military formations and organs in this region;
- in the sphere of environmental security, preservation and maintenance of the environment of the Arctic by the reduction of the ecological consequences caused by the increasing economic activities as well as global climate change.

SWEDEN

Sweden's policy states that it endeavours to ensure that the Arctic remains an area of low political tension. Sweden's security has for long been influenced

24. The Arctic Knowledge Hub, "Russian Federation's Policy for the Arctic to 2020", <http://www.arctis-search.com/Russian+Federation+Policy+for+the+Arctic+to+2020>. Accessed on August 1, 2018.

The Arctic has considerable economic potential and fresh transport routes have opened the doors for new types of strategic and security policy opportunities and challenges.

by developments in the Arctic. During the Cold War, Arctic Sweden lay between the two spheres of interest of NATO and the Warsaw Pact. Even now, the overall security policy climate in the Arctic is dependent on the relationship between Russia and the United States.

The Arctic has considerable economic potential and fresh transport routes have opened the doors for new types of strategic and security policy opportunities and challenges. As a result of climate change, security may well become

more a question of public crisis management in extreme weather situations; and adaptation to the changed climatic conditions in order to protect human life, health and the economy.²⁵ In its strategy for the Arctic, Sweden has stated that it will promote—economically, socially and environmentally—sustainable development in the entire Arctic region. Sweden's growth and competitiveness can be promoted by means of greater free trade and proactive efforts to combat technical trade barriers in the Arctic region. It will work to ensure that the future extraction of natural resources (oil, gas and other minerals) and the use of renewable resources (including forest material) take place in a sustainable manner, environmentally, economically and socially. Improvement of the transport infrastructure is crucial. Activities shall be pursued using the safest available methods and technologies. Sweden highlights the importance of respecting international law when extracting the energy resources of the Arctic. It considers it important to continue development of regional cross-border cooperation in the field of sea and air rescue and to tighten the safety requirements for sea transport in several sectors.

The country looks forward to promoting the use of Swedish expertise in the field of environmental technology. The Swedish Trade Council office staff in Denmark, Norway, Finland, Russia, the United States and Canada,

25. Ministry of Foreign Affairs, Government of Sweden, "Sweden's Strategy for the Arctic Region," <http://www.openaid.se/wp-content/uploads/2014/04/Swedens-Strategy-for-the-Arctic-Region.pdf>. Accessed on August 1, 2018, p. 15.

as well as in northern Sweden, can be given the task of building up their expertise in order to promote Sweden's commercial interests in the Arctic. It aims to develop the tourism sector in a sustainable manner and improve communications between tourist destinations. Sweden wishes to contribute to the international efforts in the IMO aimed at limiting emissions of greenhouse gases from ships. Sweden will work for the adoption and entry into force of the IMO's Polar Code. It supports Arctic research and monitoring of the vulnerable marine environment. Improvement of, and cooperation between, the research resources that exist in the region in order to contribute to the region's sustainable management and development is one of the Arctic objectives for the country.²⁶ Sweden's climate and environment are a part of the Arctic and, as a result, both affect and are affected by it.

The first challenge for Sweden is to deal with the increase in precipitation caused by global warming, which may lead to greater water flows and changes in soil conditions. This, in turn, may affect its indigenous societies and their infrastructure.

However, the first challenge for Sweden is to deal with the increase in precipitation caused by global warming, which may lead to greater water flows and changes in soil conditions. This, in turn, may affect its indigenous societies and their infrastructure. The Sámi culture and industries traditionally have strong links to the surrounding natural environment and the weather conditions, leaving them particularly vulnerable. The Sámi people form the link between Sweden and the Arctic. The priorities for Sweden are climate and the environment, economic development and the human dimension. Sweden is actively pursuing issues relating to reduced emissions and the spread of oil, chemicals, waste, non-native organisms and other air pollutants. Swedish climate-related research in the Arctic has a long tradition and its findings are constantly helping to increase the understanding of ongoing processes. As a result of the long measurement series, in some cases, up to one hundred years, Sweden has contributed to greater global understanding of climate

26. *Ibid.*, p. 30.

change. It is important to continuously analyse levels of both known and new hazardous substances in the sensitive Arctic area.²⁷

THE UNITED STATES

The US' Arctic policy emphasises environmental protection, sustainable development, human health, and the role of indigenous people and other Arctic residents as stakeholders in the Arctic. The US seeks to promote the viability and socio-economic well-being of the Arctic communities. In addition, the US is determined to support scientific research and broaden international cooperation in achieving Arctic objectives. The US has been an Arctic nation with important interests in the region since the purchase of Alaska from Russia in 1867. At that time, national security and economic development were key US interests. While this remains true today, significant changes in the international political arena, scientific and technological developments, and increasing global interdependence have created new challenges and opportunities for the state of Alaska, the United States, and all other Arctic nations."²⁸

The Department of Defence, in its Arctic Strategy 2013, stated its desired end-state for the Arctic: a secure and stable region where US national interests are safeguarded, the US homeland is defended, and nations work cooperatively to address challenges.²⁹ The 2013 National Strategy for the Arctic Region implements the 2009 Arctic policy by guiding, prioritising, and synchronising three priority lines of effort: to protect US national and homeland security interests, promote responsible stewardship, and foster international cooperation.³⁰ It also articulates two main supporting objectives: to ensure security, support safety, and promote defence cooperation, and prepare to respond to a wide range of challenges and contingencies—operating

27. Ibid.

28. Department of State, "US Arctic Policy," <https://2001-2009.state.gov/g/oes/ocns/arc/>. Accessed on August 1, 2018.

29. US Department of Defence, "Report to Congress on Strategy to Protect United States National Security Interests in the Arctic Region," <https://www.defense.gov/Portals/1/Documents/pubs/2016-Arctic-Strategy-UNCLAS-cleared-for-release.pdf>. Accessed on August 1, 2018.

30. The White House, "National Strategy for the Arctic Region 2013," https://www.whitehouse.gov/sites/default/files/docs/nat_arctic_strategy.pdf. Accessed on August 1, 2018, p. 5.

in conjunction with other nations, when possible, and independently if necessary—in order to maintain stability in the region.³¹

With the opportunities emerging with the increasing accessibility and economic and strategic interests in the Arctic, the opening and rapid development of the Arctic region presents very real challenges. The Arctic region's energy resources factor into a core component of the US' national security strategy: energy security. The region holds sizeable proved and potential oil and natural gas resources that could provide valuable supplies to meet the US energy needs. Continuing to responsibly develop the Arctic oil and gas resources aligns with the United States' "all of the above" approach to developing new domestic energy sources, including renewables, expanding oil and gas production, and increasing efficiency and conservation efforts to reduce US reliance on imported oil and for its energy security.³² Protecting the unique and changing environment of the Arctic is a central goal of the US policy. Supporting actions will promote healthy, sustainable, and resilient ecosystems over the long term, supporting a full range of ecosystem services. The US wants to use an integrated Arctic natural resources management to balance economic development, environmental protection, and the cultural values of the indigenous population, while increasing the understanding of the Arctic through increased scientific research and traditional knowledge.³³

An analysis of the individual positions of each of the Arctic states presents a wide array of interests, probably arising out of their domestic priorities and objectives. While all the nations agree about the side effects of climate change and its implications for the Arctic overall, a few of them also perceive it as an opportunity to further research and explore resources that remain undiscovered till now. As the permafrost recedes and the waterways open, it provides options for Arctic shipping that can reduce the shipping time that otherwise circumvents the globe. In addition to scientific research and exploration, countries are likely to be interested in the natural resources that the Arctic is considered to have. However, the most serious implication can

31. US Department of Defence, "Arctic Strategy 2013," http://www.defense.gov/Portals/1/Documents/pubs/2013_Arctic_Strategy.pdf. Accessed on August 1, 2018, p. 2

32. n.31, p. 7.

33. *Ibid.*, p. 8.

China positions itself as a “near-Arctic state” even though it doesn’t share boundaries with the region. The changing natural conditions and resources exploration of the Arctic have a direct impact on China’s climate, environment, agriculture, shipping and trade, as well as social and economic development.

be the unfolding of military postures that can accompany the idea of safeguarding the commercial interests of the countries as well as acquiring the previously unoccupied regions in the Arctic formed due to the receding ice. It is too soon to conclude the same, nonetheless, it provides a serious case for nations to ponder over while evolving and developing their Arctic policies, individually as well as collectively .

became a member in 2013, alongwith India.

Not only the Arctic states, but the observer members are actively developing their Arctic strategies. One country that requires mention in this study is China that

CHINA’S ARCTIC POLICY

In 1925, China acceded to the Svalbard Treaty, marking the beginning of its presence in the Arctic. Since 2013, Beijing has become a formal observer at the Arctic Council.

Currently, China has one research station in the Arctic—the Yellow River Station, operational since 2014—and a Polar Research Institute in Shanghai to train scientists in Arctic research. China–Nordic research cooperation has been intensified over the past few years and institutes like the China-Nordic Arctic Research Centre (CNARC) have strengthened their ties with international counterparts. CNARC consists of 10 member institutes – four Chinese and six Nordic from Finland, Norway, Iceland, Denmark and Sweden³⁴. Currently, China has Arctic scientific cooperation and governmental dialogue with Norway, and relevant cooperation with Canada and the US.

China positions itself as a “near-Arctic state” even though it doesn’t share boundaries with the region. The changing natural conditions and

34. China-Nordic Arctic Research Centre. URL: <http://www.cnarc.info/organization>. Accessed on August 1, 2018.

resources exploration of the Arctic have a direct impact on the climate, environment, agriculture, shipping and trade, as well as social and economic development of most South East Asian nations, including China. Therefore, it sees itself as a 'major stakeholder' in the Arctic. According to the Arctic Policy of China, 2018, "The natural conditions of the Arctic and their changes have a direct impact on China's climate system and ecological environment, and, in turn, on its economic interests in agriculture, forestry, fishery, marine industry and other sectors. China is also closely involved in the trans-regional and global issues in the Arctic, especially in areas such as climate change, environment, scientific research, utilisation of shipping routes, resource exploration and exploitation, security, and global governance. These issues are vital to the existence and development of all countries and humanity, and directly affect the interests of the non-Arctic states, including China." It further states, "China's policy goals on the Arctic are: to understand, protect, develop and participate in the governance of the Arctic, so as to safeguard the common interests of all countries and the international community in the Arctic, and promote sustainable development of the Arctic." China is actively involved in multi-disciplinary research, including Arctic geology, geography, ice and snow, hydrology, meteorology, sea ice, biology, ecology, geophysics and marine chemistry, and is supportive of the development of environment friendly technical instruments to study the Arctic. "China hopes to work with all parties to build a 'Polar Silk Road' through developing the Arctic shipping routes... China will work with the Arctic states to strengthen clean energy cooperation, increase exchanges in respect of technology, personnel and experience in this field...."³⁵

As the ice in the Arctic Ocean thaws with climate change, China has been increasingly aggressive in its efforts to become an influential figure in the region. Beijing is also interested in making use of the expanding sea lanes for its growing needs of maritime shipping.

35. The State Council, People's Republic of China, "China's Arctic Policy," http://english.gov.cn/archive/white_paper/2018/01/26/content_281476026660336.htm. Accessed on August 1, 2018.

As the ice in the Arctic Ocean thaws with climate change, China has been increasingly aggressive in its efforts to become an influential figure in the region. Beijing is also interested in making use of the expanding sea lanes for its growing needs of maritime shipping. Russia holds a major part of the greater commercial access to the Far North through the Northern Sea Route between East Asia and northern Europe, that interests Beijing too.³⁶ The most important Arctic shipping route is the Northwest Passage which runs through Canada and links East Asia with the eastern USA during the summer when the ice melts. For China, this route is 40 per cent shorter, cheaper and faster than going through the Panama Canal. Li Zhenfu, director of Dalian Maritime University's research centre for polar maritime studies stated, "Whoever has control over the Arctic route, will control the new passage of world economies and international strategies." As both Russia and China are mutually dependent for investment, infrastructure development and raw materials, the nature of China- Russia relations is likely to determine the pace and magnitude of China's ambitious Arctic policy.

INDIA IN THE ARCTIC REGION

The Arctic is a region of importance for India for scientific, economic and strategic needs. India has been closely following the developments in the Arctic region in the light of the new opportunities and challenges emerging for the international community due to the global warming induced melting of the Arctic's ice cap. Today, India's interests in the Arctic region are scientific, environmental and commercial, as well as strategic. In becoming an observer, India had to agree to the following criteria set by the Arctic Council:

- Recognise the sovereign rights of the Arctic states.
- Recognise that the Law of the Sea and the U.N. Convention on the Law of the Sea, constitute the legal basis and the legal framework within which the Arctic will be managed.

36. "Two of a Kind", *Arctic Journal*, February 10, 2016. Accessed on August 1, 2018. URL: <http://arcticjournal.com/opinion/2137/two-kind>

- Respect indigenous peoples, local cultures and traditions.
- Be able to contribute to the work of the Arctic Council.³⁷

In accepting to abide by these criteria, India has recognised the territorial jurisdiction and sovereign rights of the Arctic littoral states, and, hence, their preeminent and even preemptive role over the Arctic zone. The acceptance of the Law of the Sea as the governing instrument for the Arctic also implies that the extension of jurisdiction over the continental shelf as well as over the maritime passage and the resources of the ocean space will lie with the littoral states.³⁸

The Arctic provides India with an opportunity to cooperate and collaborate with the Arctic Council member states at both the multilateral and bilateral levels. The Indian Ministry of External Affairs cites the beginning of its Arctic ties as the signing of the Svalbard Treaty in 1920, which recognised the sovereignty of Norway over the Arctic Archipelago of Svalbard (earlier called Spitsbergen). However, it was only in 2007 that India first initiated its Arctic Research Programme.

The major objectives of Indian research in the Arctic region are as follows:

- To study the hypothesised tele-connections between the Arctic climate and the Indian monsoon by analysing the sediment and ice core records from the Arctic glaciers and the Arctic Ocean.
- To characterise sea ice in the Arctic using satellite data to estimate the effect of global warming in the Northern Polar region.
- To conduct research on the dynamics and mass budget of Arctic glaciers, focussing on the effect of glaciers on sea level change.
- To carry out a comprehensive assessment of the flora and fauna of the Arctic vis-à-vis their response to anthropogenic activities. In addition, it is proposed to undertake a comparative study of the life forms from both the Polar regions.

37. Shyam Saran, *The Hindu*, July 13, 2013, "India's Date with the Arctic," <http://www.thehindu.com/opinion/op-ed/indias-date-with-the-arctic/article4915241.ece>, Accessed on August 1, 2018.

38. *Ibid.*

In terms of physical assets, India has a scientific presence in the Arctic in the form of a research station called Himadri, located at Ny Alesund, Spitsbergen Island, Norway, that has served as a hub of Indian scientific investigations since 2008. Research here is conducted on meteorological, biological, glaciological and climate studies. And while India has not denied that there are opportunities present in the Arctic for hydrocarbon exploration, in collaboration with the other members of the Arctic Council, the stress on renewable resources for development is its area of focus. The need for sustainable development is part of the responsibility that India has voluntarily taken upon itself by becoming a part of the Paris Climate Change Agreement. India would not like the push for green fuel to be impeded due to the possibility of obtaining fossil fuel from the Arctic region.

Apart from the impact on the climate, the melting of the Polar ice caps would also have humanitarian consequences for India. India has a large coastline of 7,516.6 km, with an estimated 14.2 percent or about 171 million people calling coastal districts their home.³⁹ This is apart from the marine life that thrives here. Climate change is likely to affect an estimated 55 million people of the coastal belt in India. They will not only face soil erosion, but also receding coastlines due to the loss of land to the sea, and land being inundated with salt water. This would make the land unsuitable for agricultural use. Coastal areas are also going to face tropical storms that will affect the habitat of fishes that breed near coasts; this will have an effect on small fishing communities, forcing them to travel deeper into the sea to catch fish. Understanding the Arctic and the means to slow down climate change is essential for India to avoid a humanitarian crisis.

The understanding of the Arctic is also important for India from the strategic and economic perspectives. Former Defence Minister AK Antony highlighted at a conference at the National Maritime Foundation in 2012, that China's ability to navigate the Northern Sea Route (NSR) would have implications for the Indian military strategy. The Indian military strategy

39. Centre for Coastal Zone Management and Coastal Shelter Belt, Ministry of Environment, Government of India, "Centre for Coastal Zone Management and Coastal Shelter Belt," <http://iomenvs.nic.in/index2.aspx?slid=758&sublinkid=119&langid=1&mid=1>. Accessed on August 1, 2018.

has so far been based on the assumption that if China commits aggression across the Himalayas, New Delhi could exert pressure on Beijing in the Indian Ocean by blocking off the Malacca Strait and choking Chinese energy supplies. However, the NSR opens up the possibility of China accessing oil from the north, thereby depriving New Delhi of this strategic leverage that it currently enjoys.⁴⁰

It is a well established fact that the Indian Ocean sea lanes are the commercial life line of the world. The rise in sea levels, as a result of the melting of the Arctic ice caps, would also have a consequence for the strategic sea routes in the region. India is studying the positive as well as negative aspects of alternatives to the existing sea routes and the impact this would have for the strategic space that India occupies in the Indian Ocean Region and the Indo-Pacific. India is also trying to understand the impact of the possible new sea routes on the shift of economic space from the Indo-Pacific to the Trans-Atlantic.

India's emerging role in the Arctic is driven by its strategic imperatives. It is the fourth-largest energy consumer in the world and its entry into the Arctic Council is an opportunity to join hands with the Arctic littorals in exploring the hydrocarbon potential of the Arctic. According to the United States Geological Survey estimate, the Arctic contains 90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas, which is approximately 13 percent of the world's undiscovered oil resources and about 30 percent of its undiscovered natural gas resources. But, as has been stated, India does not support the exploitation of fossil fuels at the cost of renewable sources of energy. India continues to support more technological and financial cooperation to develop renewable sources of energy.

Challenges for India's Arctic Research

As a nation that is not close to the Arctic, India faces the challenge of not just financing its Arctic research but also building and maintaining the equipment and personnel for the same. India has been in the process of

40. Husanjot Chahal, "India in the Arctic," <https://cqegheulaval.com/india-in-the-arctic/>. Accessed on August 1, 2018.

Getting Asian partners involved in the development of territories of the Arctic coastal states may contribute to responsible cooperation in the Arctic region, broaden the understanding of the region far beyond its borders, and create the conditions for the formation of new inter-governmental and inter-regional cooperative ties.

acquiring a Polar research vehicle, a ship to cut through sheets of ice and glaciers, for some time now. Indian companies now would like to bid for the same under the 'Make In India' scheme. With a lifespan of 30 years, this ship is expected to be central to India's ambitions in the Arctic and Antarctica in the coming years. The ship would reduce the dependency of Indian researchers on other vehicles to chart their research processes. It will also provide India with the ability to choose its areas and time for research. India is also faced with an important task of training qualified personnel for ice class vessels –

a key challenge for the national Arctic research programme, according to Indian experts. A solution may be found through long-term planning for the training of participants in national expeditions using the resources of countries that have substantial Arctic experience.

India is focussed on building cooperation with the littorals of the Arctic to take up recommendations on Arctic governance issues with a focus on climate change, as well as a leading role in building an 'Asian perspective' on the Arctic or the importance of the Arctic for Asia. Getting Asian partners involved in the development of territories of the Arctic coastal states may contribute to responsible cooperation in the Arctic region, broaden the understanding of the region far beyond its borders, and create the conditions for the formation of new inter-governmental and inter-regional cooperative ties.

The challenge before India and other member countries of the Arctic Council is to find a balance between commercial activities in the region and preserving its fragile environment. The economic viability of the resource extraction from the Arctic region remains a hurdle. India understands that it would not be possible to limit nations in exploring their options, but India's suggestion is that a balance be found between economic and environmental interests. India will not benefit

directly from the shipping routes and has no claims to the hydrocarbon resources in the Arctic region, but it would like to collaborate with the member states to fulfil its energy aspirations, if exploration is viable and possible.⁴¹

India can work with the council to expand cooperation to develop a comprehensive Arctic strategy. There is a great need for Arctic knowledge, training and research in the northern areas. Cooperation and networking between universities and educational establishments in the Arctic

region are needed because the gamut of research is broad in terms of contents and standards. The use of resources must be optimised. Research and training must generate expertise, growth and business operations. India's Arctic strategy needs dedicated research and a think-tank for research collaboration into the political and strategic aspects, apart from the scientific ones. Finland and other members of the Arctic Council can help India set up such an institute as a partner to impart knowledge to the future generation of strategists. This could also help in data collection that is needed to not only understand the impact of climate change on the Arctic but also to study how the Arctic and its environment are reacting to the mitigating efforts.

India has technological gaps that it could cover with collaboration. India could look at technological cooperation such as satellite technology for mapping of the Arctic. Active participation in Arctic-related affairs also requires India's permanent research beyond the Arctic circle. Technological emergencies in the region may cause irreparable environmental damage that needs to be arrested. India also wants to work with the Arctic Council to focus on the need to ensure that the Arctic remains a region free of military presence and Weapons of Mass Destruction (WMDs).

A major challenge before India in the Arctic is to strengthen its presence within the Arctic Council in both physical form and its policy-making assistance. It needs to do so by attending working group meetings of the council.

41. Ibid.

CONCLUSION

It has to be admitted that India's policy towards the Arctic is still evolving. A major challenge before India in the Arctic is to strengthen its presence within the Arctic Council in both physical form and its policy-making assistance. It needs to do so by attending working group meetings of the council. It has to take an active part in the meetings of the council; it has to build focus on the Arctic in its bilateral and multilateral relations with other nations such as Japan, South Korea and China. It has to broaden its engagement with the nations of the Arctic Council to also include matters of the Arctic. For example, in its relations with the member states of the Arctic Council, India has to feature the Arctic with more prominence than it has been accorded till now.

Nonetheless, India has noted this gap and, through its bilateral cooperation with the Arctic states, is taking part in the deliberations. For instance, over the last three years, top Indian officials have visited nearly all the member states of the Arctic Council. India's Prime Minister Narendra Modi visited Russia (December 2015), the US (September 2015), and Canada (April 2015), and India's President Pranab Mukherjee visited Sweden (June 2015), Russia (May 2015) and Finland and Norway (October 2014), where a video conference with researchers of the Indian Himadri Polar Station was held. India is slowly but steadily identifying its interests in the region and taking into account its experiences in Antarctica to contribute to its activities in the Arctic in order to build its future policy for the region. The impact of rapid changes in the Arctic region goes beyond the littoral states and any legitimate and credible mechanism to respond to these challenges calls for the active participation of all the actors who have a stake in the governance of the global commons. The interplay between science and policy has the potential to contribute to the better handling of the complex issues facing the Arctic. India, which has significant expertise in this area from its association with the Antarctic Treaty System, can play a constructive role in securing a stable Arctic. In its new role as a permanent observer in the Arctic Council, India is committed to participate in the deliberations of the council to develop effective cooperative partnerships that can contribute to a safe, stable and secure Arctic.

CLIMATE CHANGE, SEA LEVEL RISE AND TERRITORIAL SECURITY OF INDIA: TRACING THE LINK AND IMPACT

CYRIAC S PAMPACKAL

Climate change and environmental degradation have been major issues of concern to the global community since the latter part of the 20th century. However, countries are quite unwilling to either take responsibility or initiatives to address these challenges. For instance, a country such as the USA has even put a question mark on whether the phenomenon of climate change is real at all. Such debates among the international community seriously undermine the efficacy of the efforts to reduce the intensity of environmental challenges. Meanwhile, connected to the problem of climate change are other real security challenges, including serious threats to the territorial security of countries all over the world, that have largely gone unnoticed until now.

India, a country which is frequently battling environmental crises such as cyclones, earthquakes, tsunamis, landslides, avalanches, etc, will be facing a larger share of environmental challenges in the coming century, as its low elevation land regions are under the threat of sea level rise, increased and irregular patterns of cyclones, etc. India is already facing

Cyriac S Pampackal is a Masters' programme student of International Relations from Mahatma Gandhi University, Kerala. The paper was written during his tenure as a Research Intern at the Centre for Air Power Studies, New Delhi.

With its good disaster management and response mechanisms and an able civil and military infrastructure, India can cope with most of the natural calamitous conditions, but the question is, how well can India deal with human induced and natural disasters, as well as other mutually intensifying environmental problems?

territorial deterioration and will face it on a larger scale as the loss of territory will increase from nearly 100 sq km to a few thousand square kilometres. Several other national security threats will also evolve with a collective intensification of environmental problems. With its good disaster management and response mechanisms and an able civil and military infrastructure, India can cope with most of the natural calamitous conditions, but the question is, how well can India deal with human induced and natural disasters, as well as other mutually intensifying environmental problems?

This paper examines some of the challenges that India is likely to face with the rise in the sea level as a result of climate change and its concomitant effect on India's territorial security.

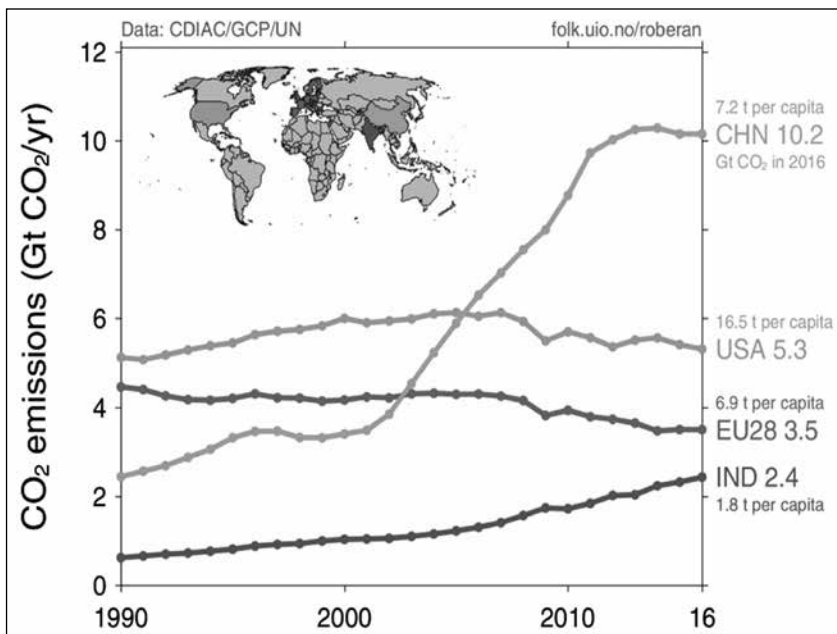
ENVIRONMENTAL CHALLENGES INDUCED BY HUMAN ACTIVITIES

Excessive 'carbon emission' is considered to be the largest contributing factor that fuels most of the environmental problems, including climate change. As of 2017, the whole world collectively emits about 41 billion metric tonnes of carbon¹, with active contribution from all major global players such as China, United States, India, European Union, etc. Even though the world community has been deliberating on the reduction of carbon emissions, it lacks serious binding initiatives to enforce it. Just like most countries around the world, India too burns a lot of fossil fuels for the production of electricity, transportation and industrial purposes. Statistically, the Indian contribution towards the global baggage of

1. Urmi Goswami, "India Emerging as a Climate Performer by Cutting Down on its Emissions," *The Economic Times*, November 13, 2017, https://economictimes.indiatimes.com/articleshow/61630473.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst. Accessed on May 30, 2018.

atmospheric carbon in 2017 was 2.5 giga tonnes, and it has an emission growth rate of 2 per cent per annum.²

Fig 1: Growth of Top 4 Carbon Emission Contributors over the Period 1990-2016 with Per Capita Emission



Source: Robbie Andrew, "Why India's CO₂ Emissions Grew Strongly in 2017," *Carbon Brief Clear On Climate*, March 28, 2018, <https://www.carbonbrief.org/guest-post-why-indias-co2-emissions-grew-strongly-in-2017>. Accessed on May 31, 2018.

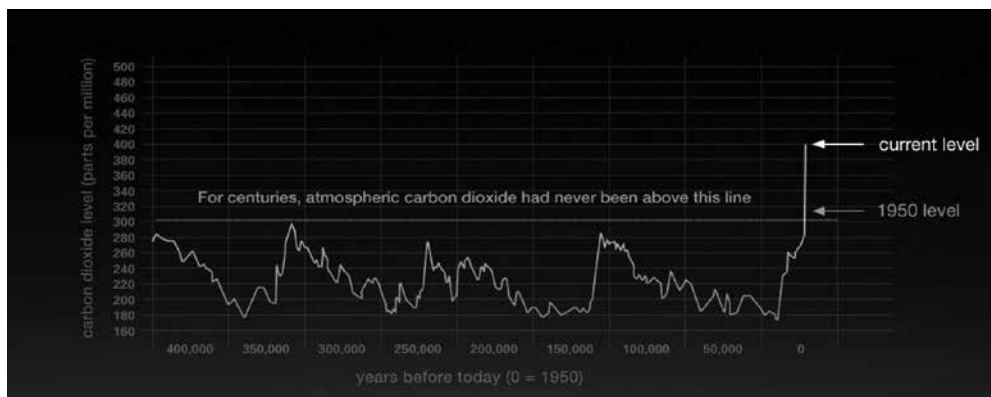
India is one of the countries with a low per capita emission rate (refer Fig. 1) owing to its large population, but the percentage growth in India's carbon emission since 1971 is almost 1,041 per cent, which surpasses the growth rate

2. Down To Earth Staff, "World's CO₂ Emissions to Increase by 2 per cent in 2017: Global Carbon Budget," *Down To Earth*, November 14, 2014. <http://www.downtoearth.org.in/news/world-s-co2-emissions-to-increase-by-2-per-cent-in-2017-global-carbon-budget-59102>. Accessed on May 30, 2018.

of even the largest emitter, China, which is at 1,038 per cent.³ As a result of the increased emission rates, many cities of the country, especially, the capital New Delhi, suffer from massive pollution problems.

The main adverse effect of high level of carbon emission is an increase in the amount of carbon dioxide in the atmosphere as deforestation levels are clearly degrading the planet's natural ability to reduce the carbon dioxide levels in the atmosphere. According to the Mauna Loa Laboratory, Hawaii, the amount of carbon dioxide was 412.60 parts per million (ppm) as of May 14, 2018 (refer Fig. 2), which happens to be the highest rate in the past 800,000 years.⁴

Fig. 2: Presence of Carbon Dioxide (CO₂) in the Atmosphere (parts per million)⁵



Source: NASA Global Climate Change, "Vital Signs of the Planet", <https://climate.nasa.gov/evidence/>. Accessed on June 1, 2018.

3. Badri Chatterjee, "India's Carbon Emission Jumped 1,041% Since 1971, Says Study," *Hindustan Times*, November 6, 2017, <https://www.hindustantimes.com/mumbai-news/carbon-dioxide-emission-from-fuel-combustion-in-india-increased-by-1041-from-1971-to-2015-study/story-ScRbLcJ3X6r7fIHfZKqwl.html>. Accessed on May 30, 2018.
4. Chloe Farand, "Carbon Dioxide Levels in Earth's Atmosphere Reach 'Highest Level in 800,000 Years,'" *Independent*, May 5, 2018, <https://www.independent.co.uk/environment/carbon-dioxide-concentration-atmosphere-highest-level-800000-years-mauna-loa-observatory-hawaii-a8337921.html>. Accessed on May 31, 2018.
5. This graph shows the presence of carbon dioxide (CO₂) in the atmosphere (parts per million) based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, and provides evidence that atmospheric CO₂ has increased since the Industrial Revolution.

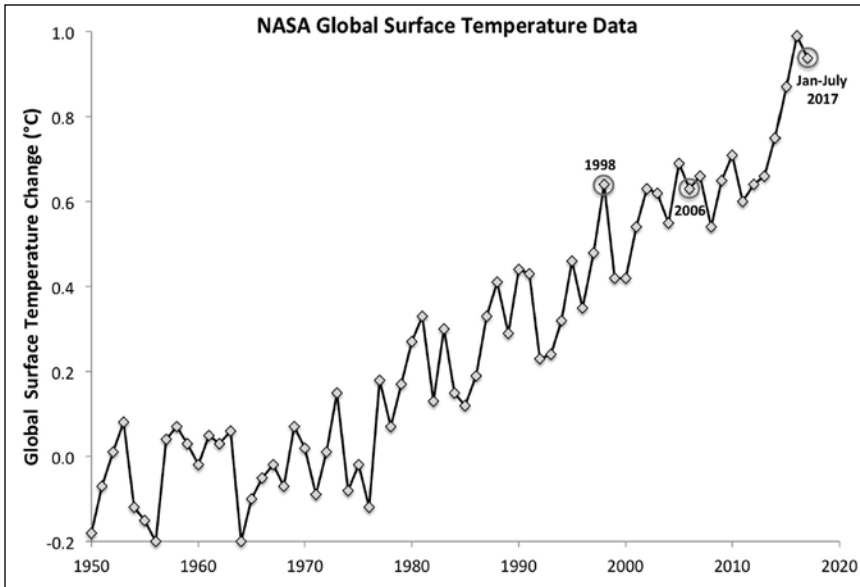
The exceptional ability of carbon dioxide and other greenhouse gases keeps our planet warm enough to make it habitable for life in the form that we know. The very same ability, but in increased amounts, is creating problems for the very same life that it supports. Increase in temperature is the first visible adverse effect of an increased amount of atmospheric carbon and also an inducing factor for a wide variety of problems. Before the 1950s, the largest influential factor in the global temperature fluctuations was the level of solar irradiance.⁶ However, in the later decades of the 19th century, this dependent course of the global temperature with solar output had deviated into a much more spontaneous and calamitous one, owing to the increasing carbon dioxide levels in the atmosphere and the increased influence of human activity such as deforestation, seismic blasting, etc. on the planet's ecosystem.

Ever since the beginning of the industrial age when humanity started to depend heavily on burning fossil fuels such as coal, oil, etc. The trend in temperature patterns started to defy the natural laws of the planet. Though the level of solar irradiance is falling to a level that is predicted to be equivalent to the creation of a mini ice age in the planet by 2030, the average temperature on the planet is on a rise, due to a warming period.⁷ The 20th century temperature patterns (refer Fig. 3) reveal the history of the coal fuelled industry of the 19th century. The 20th century showed an increase of 0.8°C in average global temperature, with a per decade increase rate of 0.07°C until 1970, and 0.17°C since 1970.⁸

Ever since the beginning of the industrial age when humanity started to depend heavily on burning fossil fuels such as coal, oil, etc, the trend in temperature patterns started to defy the natural laws of the planet.

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6. Zeke Hausfather, "Solar Influences on Climate Change," *Yale Climate Connections*, May 27, 2008, <https://www.yaleclimateconnections.org/2008/05/common-climate-misconceptions-solar-influences-on-global-temperature/>. Accessed on June 1, 2018.
 7. Habibullo I Abdussamatov, "Grand Minimum of the Total Solar Irradiance Leads to the Little Ice Age," *Journal of Geology and Geophysics*, April 28, 2013, <https://www.omicsonline.org/open-access/grand-minimum-of-the-total-solar-irradiance-leads-to-the-little-ice-age-2329-6755.1000113.php?aid=12810>. Accessed on June 4, 2018.
 8. National Oceanic and Atmospheric Administration, "Global Climate Report - Annual 2016", June 18, 2018, <https://www.ncdc.noaa.gov/sotc/global/201613>. Accessed on June 5, 2018.

Fig 3: Graph Showing the Global Temperature Anomaly during 1950-2017



Source: Dana Nuccitelli, "2017 is so far the Second-Hottest Year on Record Thanks to Global Warming," *The Guardian*, July 31, 2017, <https://www.theguardian.com/environment/climate-consensus-97-per-cent/2017/jul/31/2017-is-so-far-the-second-hottest-year-on-record-thanks-to-global-warming> . Accessed on June 5, 2018.

The year 2016 was the hottest year in recorded history, with the average global temperature rising up to a rate of 14.8, showing an increase of 1.10°C over the 20th century average temperature of 13.7°C. In fact, 16 out of the hottest 17 years in recorded history have occurred since 2001, foreshadowing the sweltering future of the 21st century.

Liquefaction of Solid Forms of Water

Liquefaction of the polar ice caps and glaciers is the major concern among the direct effects of the rising global temperature. Most scientists agree that the meltdown of the polar ice caps and glaciers of the mountain ranges such as the Alps is contributing substantially to the rising sea level, which is a major cause of concern for many island nations and coastal countries. The gravest

concern is that the meltdown of ice sheets is not only feeding the rising sea levels but also adding to the rising temperature. Ice caps, which are forming above the ocean, prevent the oceans from absorbing atmospheric heat and have the ability to reflect back the solar radiations into the outer atmosphere. With the loss of ice sheets, the planet is losing a natural mirror that reflects back the sunlight and keeps the planet habitable. Moreover, the melting ice dumps a lot of fresh water that can affect the saline composition of the oceans and shift, or even reverse, the course of water currents which have the capability to change the global climate. This would, in turn, abruptly disturb the climate and may cause serious problems like altered weather patterns and spontaneous outbreaks of calamities like cyclones, hurricanes, storms, storm surges, floods, droughts, etc with the resultant destruction of life, infrastructure, and the environment.

The Arctic is warming at twice the rate of the rest of the world. Every year, the Arctic recedes a few thousand square kilometres more than the previous year.

In fact, the adverse effects are already visible in the Arctic region which is a semi-enclosed ocean, almost completely surrounded by land. As a result, the sea ice that forms in the Arctic is not as mobile as the sea ice in the Antarctic. Although sea ice moves around the Arctic basin, it tends to stay in the cold Arctic waters. So this geographical barrier prevents the Arctic ice from melting and creating further problems for the structure of the planet. However, the rise in temperature and seismic blasting operations for the process of exploration for oil, minerals and new sea lanes, are cited as the main reasons of the loss of the Arctic ice caps. According to the National Oceanic and Atmospheric Administration's (NOAA's) latest annual Arctic Report Card, the Arctic is warming at twice the rate of the rest of the world. Every year, the Arctic recedes a few thousand square kilometres more than the previous year. The extent of Arctic sea ice for April 2018 averaged 13.71 million sq km. This was 0.98 million sq km below the 1981 to 2010 average, and only 20,000 sq km (7,700 square miles) above the record low April extent set in 2016.⁹ The polar

9. National Snow & Ice Data Centre, "Arctic Sea Ice News & Analysis", <http://nsidc.org/arcticseaicenews/2018/05/>. Accessed on June 5, 2018.

ice caps hold approximately 24 million cubic km of water of the total water in the ocean which is approximately 1.35 billion cubic km.

Unlike in the Arctic, in Antarctica, the ice sheets are neither confined to an ocean nor floating ones; instead, the ice sheets of Antarctica are forged on the foundations of landmasses fragmented at the South Pole. Antarctica is a landmass surrounded by an ocean. The open ocean allows the forming sea ice to move more freely, resulting in higher drift speeds. A large chunk of the ice sheets breaks away every year, and floats further northwards to the warmer oceans where this melts down at an increased rate. Also, the underwater erosion of ice sheets is a major problem that contributes additional ice loss to the breakaway of a large chunk of ice. It is estimated that the base of the ice around the South Pole shrank by 1,463 sq km between 2010 and 2016.¹⁰ This underground erosion is actually caused by the increasing temperature of ocean waters which makes the ice sheets thinner and more prone to future breakdowns. On the whole, Antarctica sheds 125 giga tonnes of ice per year which can cause a 0.35 mm rise globally in the sea level per year.¹¹ Glaciers all over the world are on a retreating trend in a fast mode. Most mountain glaciers, except some in the Himalayan mountain range of Karakoram, are showing a fast pace in meltdown. The glaciers of Karakoram get excluded from the list only because of another adverse effect of climate change, i.e excessive rainfall in the form of snowfall at high altitudes which reinforces the increased rate of meltdown and slows down the retreating process of the glaciers. However, the glaciers of the Alps and Alaska are all showing increased meltdown. For instance, the glaciers of Mt. Hunter in Alaska shows a much greater rate of meltdown which even scales up to 60 times greater than it was pre-1850.¹² This excessive meltdown and frequent untimely snowfall is making most of these mountain ranges more prone to avalanches

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10. Jonathan Watts, "Underwater Melting of Antarctic Ice Far Greater than Thought, Study Finds," *The Guardian*, April 2, 2017, <https://www.theguardian.com/environment/2018/apr/02/underwater-melting-of-antarctic-ice-far-greater-than-thought-study-finds>. Accessed on June 5, 2018
 11. NASA Scientific Visualisation Studio, "Hyperwall", <https://svs.gsfc.nasa.gov/30880>. Accessed on June 5, 2018.
 12. John Abraham, "Glacier Loss is Accelerating Because of Global Warming," *The Guardian*, April 18, 2018, <https://www.theguardian.com/environment/climate-consensus-97-per-cent/2018/apr/18/glacier-loss-is-accelerating-because-of-global-warming>. Accessed on June 5, 2018.

and other snow eroding phenomena which cause serious damage to life, infrastructure, etc.

WHAT CHANGES WILL IT CAUSE TO THE PLANET?

Sea level rise is the most important adverse environmental challenge that concerns the whole world. The factors that are contributing to the rise of the sea level are being debated by different streams of scholars. While the environmentalists emphasise environmental deterioration, the economists are concerned about the economic liabilities that accompany such a calamitous situation. However, everybody agrees that sea level rise is an issue of great concern, causing problems to the population, infrastructure etc. According to most scientists, the sea level is rising mainly due to three reasons: thermal expansion of the ocean; mountain glacier melting; and discharge of water from ice sheets as a result of global warming. The total sea level rise projected for every 1°C rise in global temperature is 2.3 metres(m),¹³ but the rise in sea level is not necessarily in step with the rising global temperature—it can happen over a much longer span of time: sea level rise due to a decade-long temperature rise can occur only over a period of a century. On the other hand, even though the temperature rise may be halted by some means and efforts, there is a possibility for the trend of sea level rise to remain in its inertial status. This creates a difficulty in predicting how long the trend in sea level rise will last.

Global sea level trends and relative trends are on a different scale as the rise in sea level is not uniform throughout the Earth. Sea level rise at specific locations can be more or less than the global average due to many factors that influence it on a local scale such as subsidence, upstream flood control, erosion, regional ocean currents, variations in land height, etc.¹⁴ For instance, there are places in the Pacific Ocean that face a rate of sea level rise of up to 10 mm per year.¹⁵ According to the European Space Agency's study about the ocean heights, there

13. Erik Kirschbaum, "Seas May Rise 2.3 Meters Per Degree of Global Warming: Report", July 15, 2013, <https://www.reuters.com/article/us-climate-ice-study-idUSBRE96E0GQ20130715>. Accessed on June 5, 2018.

14. NASA Global Climate Change, "Vital Signs of the Planet", <https://climate.nasa.gov/news/16/rising-waters-new-map-pinpoints-areas-of-sea-level-increase/>. Accessed on June 6, 2018.

15. Ibid.

Data proves that our planet is deviating from the course of climatic conditions that it was heading in due to human activities such as deforestation, carbon emission, etc. The rise in global sea level that our planet is witnessing is the highest it has been in the last 6,000 years.

are differences of up to 3 m in ocean heights which are maintained by wind and pressure variations. Any major change in temperature can alter these patterns and the ocean currents which are driven by the ocean height differences.¹⁶

After the last ice age which ended approximately 26,000 years ago, the sea level rose at a very high rate, but post climate stabilisation, the sea level rise slowed down some 7,000 years ago.¹⁷ Since then, the sea level was on hold at a stable level until it started showing a considerable increase around the 1900s. Between 1900 and 2000, global sea level rose between 0.05 inches (1.2 mm) and 0.07 inches (1.7 mm) per year, on average.¹⁸ In the 1990s, that rate jumped to around 3.2 mm per year. In 2016, the rate was estimated to be 3.4 mm per year, and it is expected to jump higher by the end of the century.¹⁹ Today, global sea level is 5-8 inches (13-20 cm) higher, on average, than it was in 1900. This data proves that our planet is deviating from the course of climatic conditions that it was heading in due to human activities such as deforestation, carbon emission, etc. The rise in global sea level that our planet is witnessing is the highest it has been in the last 6,000 years.²⁰ Data collected through several satellite missions have helped calculate that the average rate of global sea level rise is 3.2 mm, per year, give or take 0.4 mm.²¹

16. Smithsonian Institution, "Ocean Find Your Blue", <https://ocean.si.edu/through-time/ancient-seas/sea-level-rise>. Accessed on June 6, 2018.

17. Ibid.

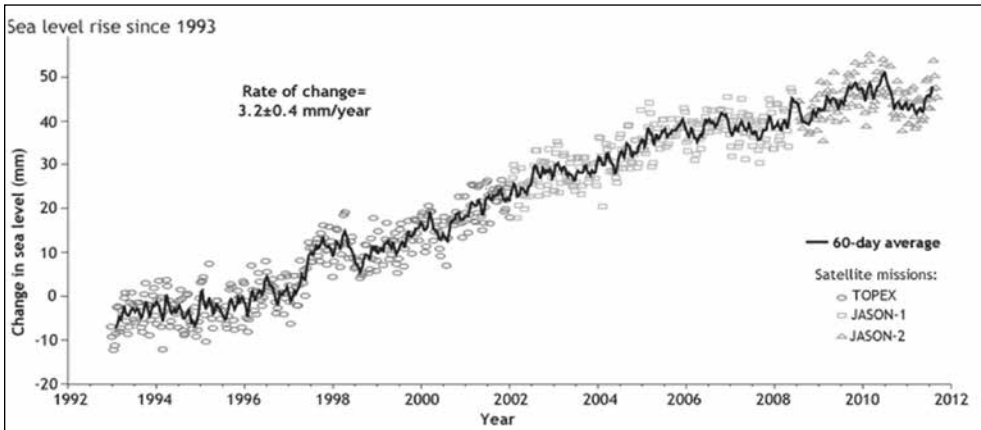
18. Ibid.

19. Ibid.

20. Ibid.

21. NOAA, "Climate.gov", <https://www.climate.gov/news-features/understanding-climate/state-climate-2011-global-sea-level>. Accessed on June 6, 2018.

Fig 4



Source: NOAA, "Climate.gov", <https://www.climate.gov/news-features/understanding-climate/state-climate-2011-global-sea-level>. Accessed on June 6, 2018.

Many research organisations like NASA and NOAA are preparing several models and projections of the increasing global temperature and the accompanying rise in the sea level that varies from 1 m to 6 m. These simulations are based on the average 1-2°C rise in average global temperature which the global community is trying to adhere to. Since the global effort is becoming ineffective in restricting the rise in global temperature, these simulations can escalate even further to an unpredicted scale. Several millions of people will be affected by the sea level rise of even 1 m and that number may climb up to a billion in the worst case scenario of a 6 m rise. Other physical changes that our planet experiences due to the increased temperature are the shifts of air and ocean currents, which are all inter-related and dependent on wind and pressure differences. The frequency in the occurrence of calamitous weather conditions will be an increasing trend as the weather will start to behave in a more unpredictable manner.

ADVERSE IMPACT ON TERRITORIAL SECURITY OF INDIA

India, with its geographical location, is in a vulnerable situation when it comes to environmental degradation, climate change and sea level rise. It is estimated that an average of 1m rise in sea level will hit South Asia

Other physical changes that our planet experiences due to the increased temperature, are the shifts of air and ocean currents, which are all inter-related and dependent on wind and pressure differences. The frequency in the occurrence of calamitous weather conditions will be an increasing trend as the weather will start to behave in a more unpredictable manner.

adversely, even submerging some of its island nations such as Maldives completely. India, with a coastline over 7,500 km, will also face the gravity of the situation. Several low lying areas of the Indian mainland and the strategically important island groups of Lakshadweep, and Andaman and Nicobar, would be badly affected due to sea level rise and coastal erosion.

India, with a mainland coastline of 5,422.6 km and island coastline 2,094 km, is at the forefront of coastal erosion. The Indian Ocean which is considered to be one of the roughest oceans in the world, with increased oceanic activity, cyclones, earthquakes and tsunamis, is a vulnerable region for increased coastal erosion. According to a study, "Coastal Erosion along the Indian Coast on 1:25,000 scale Using Satellite Data of 1989–1991 and 2004–2006 Timeframes", jointly conducted by the Indian Space Research Organisation (ISRO) and Central Water Commission (CWC), India lost 250.211 km² of land territory due to coastal erosion, while it gained 177.15 km² land territory due to coastal accretion. During this 15-year period, India ended up with a net shrinkage of 73.061 km² of land territory, including a considerable land loss of over 93 km² in the Nicobar Islands alone.²² More importantly, the 2004 tsunami which triggered a spontaneous loss of land actually brought the issue of land loss into the limelight. Coastal erosion can be caused by both the slow and long-term processes, because of oceanic waves and sudden spontaneous events such as tsunamis, cyclones, storms, storm surges, etc. The pace of future

22. A. S. Rajawat et. al., "Assessment of Coastal Erosion Along the Indian Coast on 1 : 25,000 Scale Using Satellite Data of 1989–1991 and 2004–2006 Timeframes," *Current Science*, vol. 109, no. 2, July 25, 2015, pp.347-353, http://cwc.gov.in/CPDAC-Website/Paper_Research_Work/Assessment%20of%20coastal%20erosion%20along%20the%20Indian%20coast.pdf. Accessed on June 6, 2018.

coastal erosion is witnessing an increased intensity because of the possible shift in oceanic currents, which can alter the patterns of oceanic activity.

As mentioned earlier, sea level rise in the coming century is expected to vary between 1-6 m, depending on factors such as an increase in temperature and the melting of ice sheets, sea ice, glaciers, etc. At a very limited rate of temperature rise of 1°C, the expected sea level rise would be 1-2 m. However, if the temperature rise is in excess of up to 2° C by the end of the century, it can trigger a sea level rise that would scale up to 6 m. Therefore, according to a study prepared by a group of ecologists led by Dr M Zafar-ul Islam, which presents an overview of the potential consequences of 1 m and 6 m sea level rise for coastal conservation areas on the Indian subcontinent, the total area loss due to marine intrusion into the coastal areas of the Indian subcontinent is estimated at approximately 13,973 sq. km under a 1 m rise in sea level, and around 60,497 sq km under a 6 m rise, which will be equal to 1.84 percent of the total land area of India.²³ This will result in direct shrinkage of territory, with loss of thousands of miles of coastlines as well as complete submergence of island territories. To understand this phenomenon in action in the Indian context, it is imperative to observe the track record of the island territories of the country and study the impact they have sustained over the years.

The loss of islands is an important adverse effect due to sea level rise and coastal erosion. The union territory of Lakshadweep is a tropical archipelago of 36 atolls and coral reefs in the Laccadive Sea, off the coast of the state of Kerala, India. This group of coral atolls, situated in the heart of the Arabian Sea, is allowing India to enjoy a significant strategic vantage point over the sea, especially in protecting the mainland from maritime threats and fighting the piracy activities that disrupt the global trade routes along the Indian Ocean. The Lakshadweep Islands, with a 132-km-long coastline are subjected to coastal erosion to a great extent. According to a recent study, Parali 1, of the Bangaram atoll in the Lakshadweep Islands has got eroded away, foretelling

23. Press Trust of India, "14,000 sq.km. Land at Risk with Rising Sea Level: Report," *The Hindu Business Line*, June 18, 2013, <https://www.thehindubusinessline.com/news/14000-sqkm-land-at-risk-with-rising-sea-level-report/article23105650.ece>. Accessed on June 6, 2018.

Several Indian naval detachments are situated in the Lakshadweep Islands, which will face the rising sea levels and may become inoperational within this century: this can become a strategic disadvantage for India as a major chunk of global trade passes through this area.

the fate of the rest of these islands. According to Dr. Hidayathulla,²⁴ Parali I Island, part of Bangaram atoll, which had an area of 0.032 sq.km in 1968, has been completely eroded, resulting in its inundation. Apart from Parali 1, several other atolls of Lakshadweep are facing an increased amount of net erosion such as Parali II (80 per cent), Thinnakara (14.38 per cent), Parali III (11.42 per cent) and Bangaram (9.968 per cent), etc.²⁵ “Since the absence of this island (Parali I) is noticed in both observations carried out in 2003 and 2007, it is assumed that the island has been

subjected to complete erosion during the 1968-2003 period and an assessment of the exact year of its inundation requires data analysis for a span of 35 years extending from 1968”.²⁶ The data obtained over this period was processed using Remote Sensing (RS) and Geographic Information System (GIS) software.²⁷

In a similar case, the Maldives Islands, which have coral foundations, are facing problems due to the sea level rise. Lakshadweep Islands, with a similar coral foundation, will also face a similar fate, as they are exposed to the same part of the Indian Ocean. Several Indian naval detachments are situated in the Lakshadweep Islands, which will face the rising sea levels and may become inoperational within this century: this can become a strategic disadvantage for India as a major chunk of global trade passes through this area.

It is worth noting that on December 24, 2004, nature unleashed its fury in the form of a tsunami in the Indian Ocean. The Andaman and Nicobar

24. A native of Androth Island in Lakshadweep, who was awarded a doctoral degree in July, 2017 by Calicut University in Kerala for his work entitled “Studies on Coastal Erosion in Selected Uninhabited Islands of Lakshadweep Archipelago”

25. Press Trust of India, “Lakshadweep Island Parali 1 has Vanished,” *The Hindu*, September 07, 2017, <http://www.thehindu.com/todays-paper/tp-life/lakshadweep-island-parali-i-has-vanished/article19633348.ece>. Accessed on June 6, 2018.

26. Ibid.

27. Ibid.

Islands, the sentinel outpost of the Republic of India in the Indian Ocean, comprised one of the areas which was devastated by the killer waves. The Car Nicobar Air Force Station, which was situated in the Car Nicobar Islands, was devastated during the tsunami and it took about three months to rebuild it to operational status. The Car Nicobar Air Force Station, with its 2-m elevation, could face problems in the future, not only from natural calamities such as tsunamis, cyclones, storm surges, etc. but also from the rise of sea levels and heavy coastal erosion. .

In fact, there is considerable threat to strategic places situated in these islands as well as in the coastal locations of the country's mainland too. It is believed that the Indian naval and air force facilities in the island groups of Lakshadweep, and Andaman and Nicobar are under threat of partial or complete destruction from the rising sea level in the near future itself. The *INS Dweeparakshak*, situated on the island of Kavaratti, which has an average elevation of zero metres, is an example of how even a minimal level rise can affect these military installations. Similarly, the Agatti aerodrome, situated in the Lakshadweep Island of Agatti, with an elevation of 4 m, and the Car Nicobar Island Air Force Station are examples of military stations vulnerable to natural hazards. Other coastal naval facilities that are stationed at cities such as Porbandar, Karwar, Kavaratti, Minicoy, Andrott, Bitra, Kochi, Chilka, Chennai, Uchipuli, Thoothukudi, Paradip, etc have an elevation under 6 m and may also face similar problems with increasing sea levels and coastal erosion. They are also at a high level risk from a natural calamity such as a tsunami, cyclone, etc, accompanied by long-term environmental challenges. Table 1 shows some of the coastal

***INS Dweeparakshak*, situated on the island of Kavaratti, which has an average elevation of zero metres, is an example of how even a minimal level rise can affect these military installations. Similarly, the Agatti aerodrome, situated in the Lakshadweep Island of Agatti, with an elevation of 4 m, and the Car Nicobar Island Air Force Station are all examples of military stations vulnerable to natural hazards.**

military facilities that may face a threat from the climate change phenomenon in terms of existence, operational efficiency and operational cost.

Table 1

Name of the Facility	Name of the City	Approximate Elevation (in metres)
INS Dwarka	Okha	5
INS Sardar Patel	Porbandar	1
NAE Porbandar	Porbandar	1
INS Kadamba	Karwar	6
INHS Patanjali	Karwar	6
INS Vajrakosh	Karwar	6
INS Dweeprakshak	Kavaratti	1
INS Minicoy	Minicoy	2
INS Androth	Androth	1
INS Bitra	Bitra	2
INS Garuda	Kochi	1
INHS Sanjivani	Kochi	1
INS Venduruthy	Kochi	1
INS Dronacharya	Kochi	1
NAE Kochi	Kochi	1
INS Chilka	Chilka	2
INHS Nirvani	Chilka	2
INS Parundu	Uchipuli	5
INS Tuticorin	Paradip	1
Campbell Bay NAS	Great Nicobar	5
Car Nicobar AFS	Car Nicobar	2
Port Blair AFS	Port Blair	5

Source: Compiled by author.

Apart from damaging the existing territorial space and the infrastructure, sea level variations, climate change and other environmental disruptions can also cause territorial crises between states. A classic example in the Indian

context would be the case of New Moore Island. Formation of new islands by the deposition of sand due to oceanic activity is happening all over the world, but the location of such formed islands in a contested area can create problems. The loss of one island territory in the Lakshadweep sector denotes that the coral atolls can easily be washed away, in a situation of rising sea level, even without any calamitous environmental event. This phenomenon of loss of islands can reduce the marine territory of our country, as the two groups of islands are contributing significantly to India's territorial waters and Exclusive Economic Zone (EEZ). Similarly, islands can also be formed from accretion due to oceanic activity and shifts in oceanic currents and shifts in tectonic activities. New Moore (South Talpatti), an offshore sandbar island in the Bay of Bengal, off the coast of the Ganges-Brahmaputra delta region, was formed in the aftermath of the Bhola cyclone in 1970. The formation of this island created more complexities in the delineation process of the maritime territory between India and Bangladesh. Both countries contested sovereignty over the newly formed island which was about 3.5 km long and 3 km wide, because it was speculated to have reserves of oil and gas. Bangladesh referred to the island as South Talpatti. There were no permanent structures on New Moore Island but India sent some paramilitary soldiers to its rocky shores in 1981 to hoist its national flag.²⁸ This forced Bangladesh to resort to the option of approaching the Permanent Court of Arbitration (PCA)²⁹ to resolve the territorial dispute that had emerged between Bangladesh and its giant neighbour.

However, in March 2010, Sugata Hazra of the School of Oceanographic Studies at Jadavpur University, Kolkata, India, reported that the island had disappeared and that the sea level rise caused by climate change was

28. Associated Press, "Disputed Isle in Bay of Bengal Disappears," *The Hindu*, March 24, 2010, <http://www.thehindu.com/news/international/Disputed-isle-in-Bay-of-Bengal-disappears/article16611142.ece>. Accessed on June 15, 2018.

29. The Permanent Court of Arbitration, established by treaty in 1899, is an inter-governmental organisation providing a variety of dispute resolution services to the international community. Source: Permanent Court of Arbitration, <https://pca-cpa.org/en/home/>. Accessed on June 15, 2018.

responsible for it.³⁰ He further stated that sea level rise, changes in monsoonal rain patterns which altered river flows, and land subsidence were all contributing to the inundation of land in the northern Bay of Bengal, and there were other similar cases of loss of islands in the region such as the loss of Lohachara, Ghoramara.³¹ Even after the submergence of the island, the contestation for the maritime region continued until 2014, when the PCA gave its verdict in favour of Bangladesh, awarding it 19,467 km² out of the 25,000 km² disputed territory, including the submerged New Moore Island region.³²

In incidents such as mentioned above, islands are naturally claimed by the nation having control of the nearest land territory or the nation that has the capability to hold that territory by instituting infrastructure, population or by employing hard power. Formation of such islands in a neighbouring country's marine territory can further extend its EEZ. If a hostile country is acquiring this sort of island, then it can extend its capability in monitoring our coastal areas, as well as extend its claim closer to our waters. This phenomenon can give rise to situations of extension of a country's existing EEZ overlapping with the EEZ of another country and can lead to a number of territorial conflicts. There is a possibility for further escalation of the dispute into an armed conflict and instability if both nations are not willing to negotiate because of the area's strategic and economic value.

Moreover, many other security threats can arise due to environmentally challenged territorial crises between states, such as given below:

Human Security Threats: The 21st century, predicted to witness the dawn of a new age of climate induced refugees, is about to see a new category of "permanent refugees", due to loss of homeland caused by environmental hazards. This term is way out of the official UN definition of a refugee. The loss of land due to sea level rise would make people stateless and unable to

30. Associated Press, "Island Claimed by India and Bangladesh Sinks Below Waves," *The Guardian*, March 24, 2010, <https://www.theguardian.com/world/cif-green/2010/mar/24/india-bangladesh-sea-levels>. Accessed on June 8, 2018.

31. Ibid.

32. Rajeev Sharma, "UN Tribunal Puts an End to 40-year-old India-Bangladesh Maritime Dispute," *Russia Today*, July 16, 2014, <https://www.rt.com/op-ed/172960-un-india-bangladesh-dispute-end/>. Accessed on June 15, 2018.

return to their homeland forever. The South Asian island country, Maldives, is believed to face a similar fate. Bangladesh faces a loss of a significant area of its coastal land, which will trigger displacement of people and can cause a massive exodus of refugee population into neighbouring countries, including India. According to a recent news report, many fishing villages of the Bangladeshi islands in the Bay of Bengal have simply been eroded away into the sea.³³ UN scientists predict that some of the worst impacts of climate change will occur in Southeast Asia, and that more than 25 million people in Bangladesh will be at risk from sea level rise by 2050.³⁴

The domestic population of Lakshadweep Islands and Andaman and Nicobar Islands, collectively numbering about 400,000 people, would face an existential threat from the sea level rise and coastal erosion due to increased ocean activity. These threats comprise a slow process of destruction which these island groups are heading towards. The 65,000 people living in the coral atolls of Lakshadweep would be the first in line.

Economic Security Threats: The territorial issue evolving due to the environmental crisis can cause problems for the economic well-being of our country—it can disrupt economic activities through loss and damage of infrastructure, loss of revenue generating land, resources, etc. The loss in infrastructure will be on a greater scale as most of India’s iconic cities like Mumbai, Chennai, Kochi, etc are coastal ones and comprise important economic hubs. The military infrastructure that has developed over the course of decades of defence development in the coastal regions, in which a large share of defence expenditure is invested, is also under threat from rising sea levels. Any threat to these facilities will force the authorities to relocate and the economic liability that this would impose upon the defence budget will be high, besides creating strategic vulnerabilities.

Loss of territory can cause significant damage towards the operational status of many seaports as many of them would become inaccessible, non-

33. Karen McVeigh, “On the Climate Change Frontline: The Disappearing Fishing Villages of Bangladesh,” *The Guardian*, January 20, 2017, <https://www.theguardian.com/global-development/2017/jan/20/climate-change-frontline-disappearing-fishing-villages-bangladesh>. Accessed on June 15, 2018.

34. *Ibid.*

One of the upcoming environmental threats will be the loss of low lying coastal farmlands of the country, which can cause a serious decline in India's agricultural productivity and food security.

economical or submerged. The ports, which are considered to be the boosting portals of our economy, are vital to our economic growth and development. These port areas are generally hotspots of investment and development, and any damage to their quality and existence will be a great blow to our economy as they entail huge investments and can affect future economic growth.

Submersion of coastal areas would cause a serious blow, as most of these threatened coastal areas comprise densely populated cities like Mumbai, Chennai, Kochi, etc, which are the main centres of economic activity in the country. Territorial crises can also cause disruption to the trade routes that the country is relying on, by means of over-extension of the marine territory of a hostile country in the case of new island formations.

Agricultural Security Threats: One of the upcoming environmental threats will be the loss of low lying coastal farmlands of the country, which can cause a serious decline in India's agricultural productivity and food security. For example, the Kuttanad Below Sea-level Farming System (KBSFS)³⁵ practised in Kuttanad, Kerala, is an example of low level cultivation which is going to be affected by the rising sea level. Cultivation of such farmlands and many others may be affected because of the sea level rise and would cause a serious decline in food production. And, any sort of decline in food security can alter the stability of the country's growth pattern.

35. The Kuttanad Below Sea-level Farming System (KBSFS) is unique, as it is the only system in India that practices rice cultivation below sea level. The major land use structure of KBSFS is flat stretches of rice fields in about 50,000 ha of mostly reclaimed delta swamps. The rice fields, which are popularly known as "*Puncha Vayals*" exist in three landscape elements: Karapadam (upland rice fields), Kayal (wetland rice fields) and Kari (land buried with black coal-like materials) Source: Food and Agriculture Organisation of the United Nations, <http://www.fao.org/family-farming/detail/en/c/283069/>. Accessed on June 15, 2018.

WHAT CAN BE DONE?

The whole world is on a collision course with environmental crises, in which everyone will be affected, directly or indirectly, by the environmental changes and their after-effects. Humanity needs to be aware of this impending challenge, and prepare for it. Humanity is well set on this collision course and it is now beyond the human capability to avert the situation. The only thing that the global community can do is reduce the intensity of this collision by reducing the carbon emissions, by planting more trees, etc.

India, being the largest and an important country in the most affected South Asian region, needs to act responsibly. To be prepared is the only responsible thing that we can do to face the territorial crisis that might occur due to these environmental changes. We need to prepare contingency plans for all strategic infrastructure such as airstrips, early warning systems, nuclear and thermal power plants, space exploration facilities, etc in case any one or some of them become inoperational due to the impact of the calamitous environmental changes. There is an economic burden involved in such an effort and it will be possible only in a several phased course of action. "Act Fast" is a common strategy that can be used in tackling the further intensification of these multiple environmental disasters. India can contribute to the efforts of the world to reduce the presence of carbon in the atmosphere through a rigorous forestation process. Reduction of carbon emission is the best possible way to minimise the rate of climate change. Being a country with low per capita carbon emission rate and a large population, India can effectively make a change in its global share by initiating individualistic reduction methods such as using highly efficient and low energy consuming gadgets and encouraging people to walk when the distance is short instead of using a form of transport.

Each and every person has to share the responsibility in the evolving crisis as both the causers and the recipients are the same. Each extra watt of electricity used could be causing the breaking away, and melting of, a large chunk of ice sheet from the main ice sheet. A debate is on between different schools of thought on whether humanity will survive these changes as it

survived the last ice age and warming period, but a major dilemma is that the human population has increased from a few millions to billions, and the timescale of that inflation is very short. Thus, the human population, with its bigger numbers, will definitely survive, but will suffer from the combined intensification of environmental issues. Conservation of energy in all its forms, and reduction of pollution everywhere are the best ways to save the planet and ourselves.

NOTES FOR CONTRIBUTORS

Articles submitted to Air Power Journal should be original contributions and should not be under consideration for any other publication at the same time. If another version of the article is under consideration by another publication, or has been, or will be published elsewhere, authors should clearly indicate this at the time of submission.

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