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Report

SVI International TALK on

Emerging Technologies-Impact on Conventional and Nuclear Strategy

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Executive Summary

Speakers were of the view that Emerging technologies are still in development and evolution phase; thus, it is very difficult to ascertain their full implications at this stage. The debate about emerging technologies is futuristic. It is hard to put all emerging technologies in one cohesive group but they fall under one single category because of their cost, high barriers to entry and long development timelines, from fundamental research to usable capability in military terms. Any other typology of emerging technology must otherwise rest on the objectives and means of any given country.

Emerging technologies does not mean same thing for an emerging or frontier market economy aspiring to be a regional or middle power than it does for the world technology's leaders or for the states that have strategic reach in global systems.

Certain emerging technologies are dubbed as "disruptive technologies" because of their potential to pose serious challenges to survivability of offensive strategic forces, nuclear command, control, communications and intelligence systems. These technologies accelerate or escalate the crisis instability by increasing the uncertainty.

Innovative combinations of mature and widely available civilian technologies for military purposes signifies that emerging technologies are not just about the "what" but also the "how" and the "when" of the innovation. In last two decades the triangle between technology, economy and defense has tightened under the effects of genuine technological innovations but also because of the strategic competition primarily between the US and China and because of the coalition of willing. Such coalition allows these alliances to tap deep into global capital pools and determines which companies and countries would take the lead.

States go beyond dual use technologies to acquire purpose made technologies for national security purposes only, even when such technologies with security first objective are pursued they are complemented by the secondary civilian applications for purposes of economic cost sharing, deception or ambiguity.

Nuclear technology although old technology in itself is still relatively new to South Asia 25 years on. Discussion of nuclear-armed submarines, maneuverable reentry vehicles or ballistic missile defense are reflective of emerging technologies back in 1970's in the US-Russia-China context, it is still an issue and competitive domain for India and Pakistan. In case of Pakistan and India national security drives the process of learning and relearning rather than emerging technologies. For defense and security outlook for emerging technologies in South Asia, sufficiency and affordability are paramount. In next decade some of the focus in the South Asia will be on space-based capabilities and uses, which will be led by the India. But much of the Pakistan-India strategic deterrence and operations will hinge on more traditional air and sea power especially with developments in nuclear deterrence in the maritime domain. Promises to perpetuate

defense capabilities and doctrine asymmetries, with emerging technologies being both party of a problem but also part of a solution particularly for India, the temptation to simply raise the salience of nuclear weapons as a simplistic response to emerging technologies induced other complexities, and is not a real world policy option. AI displacing the human factor in nuclear weapons related decision making in South Asia for quite some years is not possible. But AI and deep fakes could play a negative role in distorting the perceptions of escalation in future crises. Moreover, it is not possible that countries would change their nuclear doctrines in haste as a result, especially in South Asia.

More research is needed in to the data and facts of emerging technologies related capabilities in South and Southern Asia. Also what is the role of these technologies in shaping current and future threat perceptions and also how they combine to enhance and undermine stability and therefore conventional and nuclear strategy?

Emerging Technologies-Impact on Conventional and Nuclear Strategy

SVI International Talk on “Emerging Technologies-Impact on Conventional and Nuclear Strategy” was held on June 20, 2023. Dr. Naeem Salik (ED, SVI) chaired the session and gave the introductory remarks. Mr. Antoine Levesques (Research Fellow, South & Central Asian Defence, Strategy, Diplomacy, International Institute for Strategic Studies, London) was the guest speaker.

Event was conducted through Zoom Video Conferencing. 75 participants registered for the event, 44 participants joined online, 122 watched it live on Official Face Book page. Live participants included researchers from think-tanks, students, faculty members, and retired military officials.

Dr. Naeem Salik (ED, SVI) in his remarks said that many emerging technologies are still in phase of development and evolution; thus, it is very difficult to ascertain their full implications at this stage. He further added that whenever any new technology is introduced, much hype is created about their potential and implications but often these technologies are cost-prohibitive, which makes it very difficult for states to sustain the development of such technologies at large scale. So, with regards to emerging technologies in 21st century we have yet to see how these technologies will continue to evolve and impact both conventional and nuclear strategy.



Dr. Salik also shed light on “disruptive technologies” which pose serious challenges to survivability of offensive strategic forces, Nuclear Command, Control, Communications and Intelligence systems. These technologies accelerate or escalate the crisis instability by increasing the uncertainty. Dr. Salik mentioned few of emerging/disruptive technologies that have potential to seriously impact the conventional and nuclear strategy, which includes high energy LASERs, hypersonic technologies, artificial intelligence (AI), quantum computing, cyber capabilities, drones and unmanned lethal autonomous weapons. He added that use of high energy LASER is recently seen in Russian-Ukraine War, where it is used to disable the drone systems. Global powers (US, Russia and China) are heavily investing in hypersonic technologies, which includes hypersonic cruise missiles and hypersonic glide vehicles.

With regards to AI and quantum computing, he was of the view that these technologies will act as enabling technologies by analyzing the huge amount of data and intelligence, states would receive through various sources. Moreover, AI would assist humans in formulating response options in quickest possible time. Resultantly, decision making time will be compressed between states. Secondly, increased reliance on AI in decision making processes will reduce human oversight that would eliminate the element of human compassion and empathy, required in any decision making.

Cyber capabilities and their disruptive implications were discussed, which have the potential to disrupt the economic and social activities of a state, because now social and economic structures are dependent on cyber networks. Cyber operations can also disrupt the nuclear command, control and communications of a state during crisis. Moreover, cyber-attacks have caused damage to nuclear facilities and nuclear power plants in recent history.

While discussing the emerging drone technology, Dr. Salik said that today drones fly at medium altitudes and have long endurance due to which they could provide real-time information. He said that drones technology along with microsattellites eliminates the advantage of mobile platforms, which were earlier considered as an essential element of retaliatory strike forces or in other words second strike forces.

For the purpose of assured second strike capabilities states heavily relied on submersible platforms (SSBNs). But, development of ISR technologies along with sea swarms have recently introduced the concepts like “transparent oceans”. So, today the introduction of unmanned underwater vehicles, such as swarm drones enabled the detection and attack on submarines, which hampers the credibility of second strike capability. Other than the individual impact of these technologies, combined impact of these technologies would cause disruption and instability. Speaker agreed that this debate about emerging technologies is futuristic. We need to be prepared for the negative consequences of these technologies, and take mutually agreed measures to mitigate their effects. Dr. Salik ended his remarks on the point that multilateral treaties and agreements can also regulate the development of emerging and disruptive technologies, which will allow mankind to harness benefits of these technologies.

After the introductory remarks by dr Salik, guest speaker was invited to deliberate on the topic.

Mr. Antoine Levesques initiated his remarks by stating that his perspective on the topic is purely civilian. He speaks on the topic from his decade plus experience of track 1.5 initiatives, specially



focusing on the nuclear and regional security issues in the South Asia and Southern Asia. Furthermore, he will cover the topic on the basis of IISS Report on “Nuclear Deterrence and Strategic Stability in South Asia: Perceptions and Realities”. He focused on four questions; how emerging technologies entangle technology, economics and defense? How emerging technologies relate to the changing distribution of global power? How emerging technologies mingle and intertwined with military strategy? And what will be the implications for the South Asia?

The meaning of emerging technologies varies depending on the countries self-image, its strategic outlook, degree of modernization of economy and national security and their willingness and industrial capability to compete for cutting edge technologies. The emerging technology for an emerging or frontier market economy aspiring to be a regional or middle power does not mean the same thing than it does for the world technology’s leaders or for the states that have strategic reach in global systems. Emerging technologies are at the heart of the strategic assessment and future proofing of the nations. Moreover, these technologies create vast uncertainties and

expectations, opportunities and threats, overblown pessimism about the loss of control, stability and sovereignty, as well as over optimism about dominance and decisive advantage over bullets. To clearly explain the existing state of emerging technologies, Antoine quoted remarks of UK's external intelligence Chief, Richard Moore at the IISS conference that "we live in a world transformed by digital connectivity and stand on the cusp of the revolutionary advances in technology which will affect the way we live and work in ways we cannot fully foresee. We may experience more technological progress in the next 10 years than we have in the last century with a decisive impact equal to the industrial revolution. As a society we have to yet internalize this stark fact and its potential impact on the global geopolitics."

Speaker further added that it is hard to put all emerging technologies in one cohesive group. These technologies include; hypersonic or directed energy weapons, antisatellite weapons and other space based assets, AI of generative type or large language model, machine learning, autonomous weapons, quantum engineering and related offensive and defensive cryptography data mining and processing, specialist chip design and synthetic biology etc. He added that nuclear technology, although old technology in itself, is still relatively new to South Asia. Barriers and externalities to nuclear weapons technology is still very high in certain aspects, not least the growing life cycle costs which national economies have to support. So, although discussion of nuclear-armed submarines, maneuverable reentry vehicles or ballistic missile defense are reflective of emerging technologies back in 1970's in the US-Russia-China context, it is still an issue and competitive domain for India and Pakistan.

Speaker explained how emerging technology is not just evolution of new technologies but also it is the combination of certain new aspects of older technologies. He gave example of new drone concepts and satellite constellations in low earth orbit (LEO). He also highlighted the role of emerging space industry that made economically viable satellite constellations in LEO. Innovative combinations of mature and widely available civilian technologies for military purposes signifies that emerging technologies are not just about the "what" but also the "how" and the "when" of the innovation. If we have to conclude the point of putting emerging technology under one definition one can say that emerging technologies fall under one single category because of their high cost, high barriers to entry and long development timelines from fundamental research to usable capability in military terms. Any other typology of emerging technology must otherwise rest on the objectives and means of any given country.

Mr. Antoine added that in last two decades the triangle between technology, economy and defense has tightened ever more under the effects of genuine technological innovations, but also because of the strategic competition primarily between the US and China. He added that most innovations emerge in the civilian economy but are relevant in international security; this happens because either they have direct dual application for a range of purposes including intelligence, influence, command and control, compellance, deterrence to all the way direct use of force. According to speaker, another reason might be that these technologies are developed by the coalition of willing for themselves or for close partners and allies in such a way that it

creates a networked industrial base that ultimately supports shared prosperity, defense and collective deterrence. In such cases the experience, depth, breadth and sophistication of the national innovation, industrial and educational talent base as well as the ability to tap deep global capital pools determine which companies and countries lead.

The more dual use innovations would come out in such scenario would facilitate more easy supply chain that would contribute in industrialization and development for national security purposes across geographies. Denmark was pioneer in 2018 in coining the concept of “technology ambassador” to fit the new purposes of the connecting global economics and national security and to acquire or retain innovative leadership and to enable wider strategic goals. States go beyond dual use technologies to acquire purpose made technologies for national security purposes. When such technologies with security first objective are pursued they are complemented by the secondary civilian applications for purposes of economic cost sharing, deception or ambiguity. To explain this particular point speaker gave the example of concept of “space proximity operations” for military purposes fine-tuned under the guise of friendly repair operations.

Emerging technologies are common bedrock to all general national security documents such as Strategies, Reviews, Defense/White or Command Papers but also in some cases more specialized military-led doctrines or postures. To explain his point speaker used the example of Pakistan’s 2021 first ever national security policy, which includes a small but interesting section on space security. He also gave example of Indian Air Force’s 2023 doctrine, which speaks of leveraging ingenuity, innovation, tactics and technique to tackle high-end technologies. Such documents make budgeting for future-proofing capabilities somewhat easier but it is by no means easy task. National security documents set road-maps which government, national security advisors and defense planners can easily rely on.

Then speaker shared his views on the emerging technologies and changing distribution of global power. He made two points; first, emerging technologies are central to strategic competition in the new age of major and great power competition and the cost for sovereign technological advantage through self-reliance or sufficiency. Concurrently, the management of their life cycle costs and the sheer complexity of their supply chain requires involvement of the global corporations at many stages. These reliances create partnerships among countries to come together while at the same time making it impossible to shed any and all dependencies on others, be they on fundamental research or more technical know-how. Second, emerging technologies are at the center of contest for redistribution of comprehensive national power. States face stark choices to share their emerging technology advantages with some and to restrict access to others. This determination is increasingly made based on strategic outlook and national interests rather than the global market dynamics and only secondarily based on established rules and norms. It is a matter of incontrovertible fact that conditional proliferation by West does not apply to nuclear weapons. Such as, at recent Shangri La Dialogue, Australian leaders have made very clear, that in case of AUKUS there is no proliferation of nuclear weapons involved. As an

instruments for the redistribution of power, emerging technologies feature prominently in leadership level joint statements. Increasingly, most of the technological and technical diplomatic specialized sectoral international working groups often lean on the corporate private sector for their own purposes. Emerging technologies form the basis on which old state alliances and partnerships are also reinvigorated and new ones are formed. On the flip side unless they genuinely are open and inclusive, single emerging technology based partnerships or groupings of countries and related interests can create their own protective impediments to free global trade of emerging technologies on national security grounds. The broad basing and fragmentation of the governance of this trade and export control regimes is nothing new since the end of the WWII. But the current momentum behind emerging technologies reintegrates all the policy questions about the benefits, actual possibilities and power politics of restricting access and use of emerging technologies to the few rather than the most.

While deliberating on the linkage of emerging technologies and military strategy, three significant observations were made by the speaker. Firstly, states, their militaries and corporations globally are learning new lessons and unlearning old ones on the implications of the emerging technologies for conventional military strategy. Neither of this invalidates the pre-existing need for jointness, preparedness, training and enabling etc. Among the most closely observed developments are those in cyber and space domains, where unprecedented public-private partnerships have formed, enhancing both operational and strategic C2 ISR, building awareness, resilience and all enabling persistence and precision. He quoted the example of Ukraine-Russia Conflict where beside innovative use of drones, Russia's use of advanced missiles and Ukraine's use of advanced air defences have disrupted the understanding of the balance of offense and defense, which is not just tactical but it also affects the broad strategic uses of air power. Speaker also said that network warfare does not necessarily require emerging technologies. The war has changed the understanding of the ecology of military innovation particularly the relationship between the weaponization frugalities, globally competitive but locally available IT talent pools and online fundraising.



Speaker added that emerging technologies today pose as much of an intellectual challenge as they posed at the start of the Cold war in relation to nuclear weapons and deterrence at the highest end of the spectrum of the conflict. Questions surrounding strategic deterrence and escalation control in the cyber domain in a nuclearized environment are over two decades old, despite numerous track 1, 1.5 and track 2 format meeting series. Moreover, there is little shared sense of lexicon, grammar and practices across major and great powers as to how to induce and actively manage stability involving cyber weapons. The proliferation of both militarized and weaponized systems in the space domain threatens nuclear early warning and possibly some command and control systems from space to land, commercial and government ISR coupled with AI stands to change appreciations of mutual vulnerability, which nuclear deterrence relies on. At a more practical level the integrity of nuclear command, control and communications is a

renewed area of vigilance and interest. An additional point here is to say that emerging technologies pose an unprecedented challenge to statecraft. Emerging technologies have rekindled major efforts to understand the process and limits of human decision making in the abstract and as well as in the regional context under the specific scenarios using emerging and disruptive technologies.

The Ukraine war is prompting reappraisals of graduated escalation, defense vs. escalation but also appreciation of red lines. While explaining the strategic stability in unstable times, speaker gave reference to the recent proceedings of Wilton Park Track 1.5 meeting, where it was said that strategic stability at global level can only be pursued by acknowledging regional actors such as India and Pakistan. Entanglement with the cyber domain poses a particular challenge of learning data about past events in cyber domains, which could form the basis for collective learning, if shared widely, remain in fact tightly held by both attackers and defenders amid well-known attribution challenges. The space domain is comparatively a lot more transparent with efforts to create a shared middle powers led situational awareness governance system which is also known as a Space Traffic Control, are still somewhere away from reality. There is also the relevant UN led open-ended group on space that is very promising but is faced by significant challenges to policy makers. But these efforts form part of a continuum of governance and strategy, which affect the highest order contingencies when it comes to strategic deterrence. Speaker raised questions around the future of arms control in a no trust environment, as to what strategic guardrails and risk reduction means in a world of emerging technologies? and which norms of so-called responsible behavior can be enshrined in new stabilizing regimes, globally and regionally.

In the last section of this explanation Speaker said that South and Southern Asia never experienced a peace dividend from the end of the Cold War. Unresolved disputes and ongoing tensions as well as India and Pakistan's decision to overtly become nuclear armed states in 1998 preventing them from reaping the full benefits of export led and trade globalization. Therefore, in case of Pakistan and India national security drives the process of learning and relearning rather than emerging technologies. For defense and security outlook for emerging technologies in South Asia, sufficiency and affordability are paramount. In next decade some of the focus in the South Asia will be on space-based capabilities and uses, which will be led by India. But much of Pakistan-India strategic deterrence and operations will hinge on more traditional air and sea power especially with developments in nuclear deterrence in the maritime domain. These developments are hardly a new phase for other nuclear weapon states but still fairly a new one for India and Pakistan. Speaker reiterated element of "affordability of emerging technologies" in face of widening gaps in comprehensive national power for both Pakistan and India, but also for India and China. Promises to perpetuate defense capabilities and doctrine asymmetries with emerging technologies being both part of a problem but also part of a solution, particularly for India the temptation to simply raise the salience of nuclear weapons as a simplistic response to emerging technologies induced other complexities, and is not a real world policy option. Another point in the same vein is that if emerging technologies stand to change escalation management

in the future crises; prudence, restraint and minimalism remains more than relevant, if only on account of the increasing pathways for cross-domain escalation. Mr. Levesques said that he does not see AI displacing the human factor in nuclear weapons related decision making in South Asia for quite some years. But AI and deep fakes could play a negative role in distorting the perceptions of escalation in future crises. Moreover, it is not possible that countries would change their nuclear doctrines in haste as a result, especially in South Asia. He said nuclear doctrines in particular deserves to be respected and changes to it need to be carefully considered. Reviews can take place and wider conventional doctrines can evolve as higher defense managements would like to do that but it must be done slowly with aim to contribution towards integrated and joint deterrence. But, nuclear doctrines ought to be the last corner worth changing. However, threat perceptions still run ahead of the reality of those slow moving developments.

In the last two years both Pakistan and India have made public their new interests in a range of emerging technologies, which they will seek to acquire for their defense and security purposes by themselves or through the help of others. These technologies include AI, space capabilities, drones, information domain tools but also quantum technologies in case of India. Lack of trust and reassurance means each side struggling to refrain from passing and sweeping mechanistic judgements about the extent to which other side may be partnering with third parties. Such as China's partnership with Pakistan and India's partnership with the US. India and Pakistan may have a chance to resume dialogue after their current national election cycle ends and a hiatus of 12 years is over. Emerging technologies would need to feature prominently in the conventional and nuclear CBMs meeting, in case they resume. The way emerging technologies promote unprecedented transparency on the battlefield would lower the cost of having new transparency CBMs.

In his concluding comment speaker said that more research is needed in to the data and facts of emerging technologies related capabilities in South and Southern Asia; also their roles in shaping current and future threat perceptions and also how they combine to enhance and undermine stability and therefore conventional and nuclear strategy.

Question/Answer and Discussion Session

After concluding remarks by the speaker the question/ answer and discussion session was opened by the moderator. First question was posed by Mr. Shayan Jamy (Research Officer, SVI) to both speakers that what are the common identifiable attributes in military technologies that lived up to their hype. In his answer Dr. Salik said that throughout the evolution of military technologies industry, one will find that no technology will ever emerge without soon finding its match. So, as soon as these technologies develop and mature, within a short while counter measures to it start to emerge. This pattern



has always been visible, so it will happen in case of emerging and disruptive technologies as well. Mr. Levesques added that he would second Dr. Salik's opinion but would also like to caution that technology can find its match in such a way that there could be strategic effects. He added that it is very easy to enter in to competitive dynamics, especially military ones, which may lead to tit for tat response as much as it is economically possible. So, over investment in equipment which are reactive to adversaries is one thing but the ability to affect strategic outcomes is not necessarily dependent on the ability to be reactive to others capabilities. More the people are working on diversity of a project, sometimes in combination and sometimes in competition, the more likely you are to create an ecosystem, which will be reactive to the needs and strategic imperatives of national defense. He added that the ability to shape specific technology as required for the purposes of strategic effects, and that balance is forever evolving because of the nature of technologies but also because of the country's ability to afford technology changes.

Two questions were posed by Shahnawaz Khan and Zohaib Altaf (Research Officer, CISS AJK). How asymmetrical acquisition of emerging technologies may result in lowering of nuclear threshold by the disadvantaged adversary and how does Indo-US technological cooperation is going to impact the strategic stability in South Asia? While answering the question on asymmetrical acquisitions of technologies and its consequences in lowering nuclear threshold, Mr. Levesques said that it is highly dependent on the context of asymmetry, it depends on affordability and nuclear use doctrines. In case of South Asia, Pakistan follows doctrine of FSD and quid pro quo plus in response to conventional escalation. So, in that context emerging technologies if adopted by Pakistan especially are important to be scrutinized in detail. It is very important to realize that plans to acquire technology are not the actual acquisition of the technology. The induction of the prototype does not equate necessarily significant force. And its induction does not equate to use. So it is very important to assess escalation dominance in general term and to understand the battlefield dynamics. Moreover, one cannot ignore the fog of war for asymmetries, because of information and perceptions, but due to emerging technologies, future battlefields could become more transparent. This fog of war in case of India and Pakistan can happen without the actual use of any offensive emerging technologies. However, what is worth mentioning here is that in last few years, particularly in 2019, threshold was crossed in use of air power by both South Asian countries in a way which is unprecedented, which reflects that both countries considered relying on new capabilities by taking risks. So, I think emerging technologies are especially important in enabling in political and strategic context.

While deliberating on implications of technological cooperation between India-US on Strategic Stability Mr. Levesques reiterated the need and importance of facts in this regard. Recent visit of Indian PM to US would secure transfer of certain technologies to India but here important aspect is detail and actual timeline of the implementation of such agreements. More broadly the India-US relationship is in very good place in terms of technology cooperation, applied or not to defense, because of this enabling framework announced by the leaders of two countries last year known as "Bilateral initiative on Critical and Emerging Technologies". The maturity of India-US

relationship and its ability to now function on the basis of institutions rather than individuals is an important aspect. More broadly the implications of that agreement for regional stability and crisis stability will take years to be borne out. He said that he would relentlessly invite analysts to consider the practicality of this as much as the outlook and the political messaging, which is undoubtedly significant and otherwise important.

Dr. Salik in his answer to the question of Indo-US technological cooperation said that the real concern in this regard is sharing of real time intelligence and information. Space based cooperation has increased India's surveillance and target acquisition capabilities that is going to impact security situation in South Asia. Although the general feeling is that the US is building India's capability to enable it to challenge China. But the issue is once those capabilities are acquired by India they can equally be used against Pakistan and that puts Pakistan at a disadvantage. But, unfortunately that is not the concerning matter for the US. Second aspect in this regards is that although these technologies are not going to make a mark in South Asia in near future. It is going to take some time before they are going to be really effective. Moreover, strategic non-nuclear weapons are going to have a serious impact not really bringing the nuclear threshold down but tempting the countries, which possess them to go for a preemptive first strike against the opponent's nuclear forces. As these weapons ensure the precision striking without the fear of collateral damage, greater readiness to use these weapons for a preemptive strikes will destabilize the situation.



Antione Levesques responded to few of the comments made by Dr. Salik. In his response he said that he acknowledges Dr. Salik's points about the intelligence and targeting capabilities. But, one cannot ignore how mature these technologies would be on the basis of actual sensors and the timelines around these issues. Regarding the question of bifurcation of capabilities, interesting aspect is can Pakistan and India come to any mutual understanding regarding the technologies that India particularly wants to acquire against China? But this proposition is rejected by the Pakistani establishment because of the view that capability is capability regardless of intent, which is very major assumption that is hard to circumvent. Speaker added that he is unaware of any historical precedence where it has been said that this particular weapon is destined for this particular adversary. The point here is that triangle or triangular relationship is emerging in South or Southern Asia. Which has a lot of implications in terms of capability, crisis behavior and crisis diplomacy in the region. On the point of preemptive strike by India Mr. Levesques was of the view that it depends on if India changes its nuclear doctrine, which according to him will not happen in the near future.

Next question was asked by Dr. Nasir Hafeez (Dir. Research, SVI) from Mr. Levesquest that how he perceives the impact of emerging technology on militaries, soldiers, landscape of the battlefield and conduct of war because induction of these technologies will bring change in how militaries will operate. Thus, is it possible for traditional organization like military to change its organization because of the technological change? In his response Mr. Levesques said that he could only provide answer to this question from civilian perspective as he has no expertise of



military organizations. He said as far as changing ethics of conflict and changing human experience are concerned, war in its simplest form is a question of kinetic effect, violence and genuine in-person interaction but postmodern experience of warfare have been around for a decade now. However, the challenge is not to forget that abstract and remote actions have an impact on real people. In the last few years cyber operations are actually contributing in re-establishing a

link between a cyber-domain and physical infrastructure. The number of successful cyber operations have disabled part or whole of infrastructure in different countries, which reflect that the link between the operator and the real world effect is shorter than assumed. I think the to and fro between virtualization of the experience of the warfare and the real kinetic effects will continue to guide the thinking of militaries.

AVM Ashafaq Arain (Director, CASS) asked that would it not be better to develop emerging technologies for civilian applications and then use them in the defence sector as a spin-off benefit. Because somehow the development of emerging technologies remain synonymous to defence and this perception is limiting the benefits states could acquire from these technologies. Dr. Salik in his answer said that most of the emerging technologies are dual use, particularly the space technology, the communication technology and information technology. Dual application of these technologies is not a new phenomenon. If we go back in history for instance the railways and telegraph, which brought revolution to warfare were basically civilian technologies. So, research and technology goes on regardless of their use for civilian or military purposes. Once a particular technology is developed for particular use, it does have a spin off. For instance nuclear weapons were initially developed as weapons for military use but later their peaceful application was also developed.

Mr. Levesques in his reply said that there is no doubt in his mind that the vast majority of these technologies have originated from the civilian domain. Difficulty arises with technologies when their trade and exchange occurs between countries and because of their dual use properties threat of proliferation arises. Panelists agreed that some of the technologies are specifically tailored for military purposes and requirements.

Last question was regarding the arms control treaties on emerging technologies. Virtual participant asked that should there be arms control treaties for countering or regulating

emerging technologies to reduce the uncertainty. Dr. Salik said that yes there is a need for arms control and efforts are ongoing. Such as negotiations in Geneva to regulate the cyber domain and AI. But, there is slow progress of negotiations. Since the bulk of the countries do not have these technologies there is a little interest in developed or advanced countries to accept any kind of restriction on their capabilities. Once these technologies will spread at larger scale than there will be greater incentive for every state to be part of the multilateral regulations and arrangements in the form of arms control agreements and other restrictions.

With this moderator ended the question and answer session. Guest speaker was thanked for his time and valuable insights.