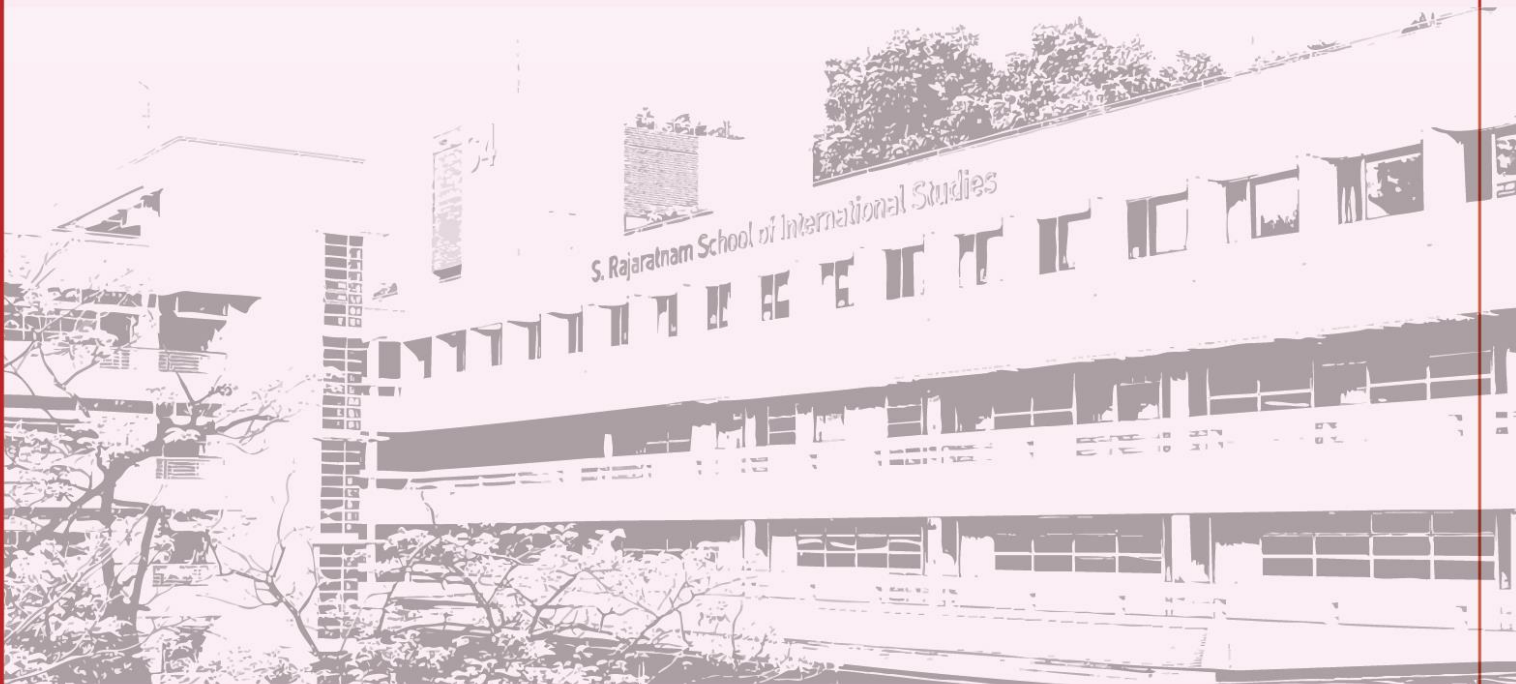


Navigating Uncertainty: Arms Control in an Age of Disruptive Technologies



Contents

Executive Summary	3
Framework for Discussion	6
Keynote Address	7
Panel 1: Arms Control in an Age of Disruptive Technologies	18
Panel 2: The Future of Governance for Military AI	20
Panel 3: Challenges in Cyberspace	22
Panel 4: The Future of Outer Space Security	24
Closing Remarks	25
Workshop 1: Four Futures for Arms Control of Disruptive Technologies	27
Workshop 2: Barriers to Arms Control and Disarmament Efforts for Disruptive Technologies	29
Programme	31
Biographies	36
About the Military Transformations Programme	44
About the Institute of Defence and Strategic Studies (IDSS)	44

Event Report

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Executive Summary

The Military Transformations Programme (MTP) at the S. Rajaratnam School of International Studies (RSIS) hosted its fourth annual conference on the theme “Navigating Uncertainty: Arms Control in an Age of Disruptive Technologies” on 7 and 8 November 2024. The conference built on the previous year’s event that explored the impact of disruptive technologies on strategic stability.

During the Cold War, arms control initiatives strived to keep the Doomsday Clock from striking midnight. They fostered communication and predictability, establishing a foundation of trust among the superpowers and mitigating the risk of an unending nuclear arms race. By containing the proliferation of nuclear weapons, arms control was intertwined with maintaining global strategic stability. Yet today, the Doomsday Clock stands at 90 seconds to midnight, the closest it has been since its inception in 1947. Global strategic stability is no longer underpinned solely by nuclear weapons, and the post-Cold War arms control landscape is facing significant challenges from the emergence of disruptive technologies amidst geopolitical rivalries and conflicts. Traditional notions of deterrence and escalation based on the technological circumstances of the Cold War do not apply as neatly as before, leaving existing norms, regulations, and governance mechanisms less effective and relevant.

Against this backdrop, the conference aimed to unpack the uncertainties presented by disruptive technologies in an evolving arms control landscape. The main objective of the panels on Day 1 was to facilitate discussion on four thematic issues: (i) existing arms control and governance mechanisms applicable to disruptive technologies; (ii) the future of governance for military artificial intelligence (AI); (iii) challenges in cyberspace; and (iv) the future of outer space security. Taken together, these issues represent cornerstones of global strategic stability today. To nurture ideas arising from the conference panels and take the conversation a step further, Day 2 followed with two interactive workshops that aimed to explore alternative futures for arms control of disruptive technologies and potential barriers to such efforts. The workshops sought to foster dialogue and generate innovative solutions to address potential challenges.

Ambassador Flávio Soares Damico of Brazil’s Ministry of Foreign Affairs delivered the keynote address. He highlighted the challenges facing arms control and how they are compounded by disruptive technologies such as AI, lethal autonomous weapon systems (LAWS), and biological weapons. Using the Cuban Missile Crisis and its aftermath as an example, he emphasised that progress often arises from periods of intense difficulty and stressed that a deeper examination of issues could reveal nuanced opportunities for progress.

The first panel evaluated existing arms control mechanisms and their relevance amidst the rise of disruptive technologies. The panel identified key challenges to current arms control mechanisms, including great power competition, mutual distrust among states, and the rise of disruptive technologies like AI and biotechnology. Drawing lessons from nuclear arms control, the panel emphasised that greater understanding of disruptive technologies was needed among diplomats and

policymakers to effectively address emerging threats. The panel stressed the need for greater engagement by Asian states and for them to voice their concerns about the risk of nuclear conflict.

The second panel discussed the challenges posed by military AI and the development of norms to ensure its responsible and ethical use. Panellists highlighted the inadequacy of existing legal frameworks to address these challenges, stressing the importance of involving a wide range of stakeholders in governance discussions. The panel also explored the divide between the Global North and Global South, particularly regarding LAWS, with the Global South advocating for a ban in contrast to the Global North's favouring soft law solutions. Geopolitical tensions, particularly between the US and China, were identified as a barrier to military AI governance. The panel emphasised the need for collaboration with the private sector to explore alternatives to traditional intergovernmental processes and develop national strategies for military AI regulation.

The third panel explored the growing role of cyber operations in warfare and the increasing involvement of the private sector, drawing on examples from contemporary conflicts such as the Russia-Ukraine war. The panel highlighted challenges associated with cyber operations, such as attribution, accountability, and blurred lines between military and civilian cyber use. Panellists discussed the need for robust international legal frameworks and norms to address the complexities associated with cyber operations. However, they disagreed on whether legally binding instruments were necessary to govern cyber operations. The panel emphasised the importance of discussions within states at the national level to address the challenges posed by cyber operations.

The fourth and final panel focused on the current international legal frameworks governing outer space security, highlighting significant gaps in these frameworks. The panel discussed the increasing democratisation of space technology, noting growing concerns among small states regarding space debris and its potential threats. Panellists emphasised the need for both voluntary norms and binding rules to protect the sustainability and security of outer space. Additionally, the panel highlighted the imbalance in outer space security discussions, specifically noting the underrepresentation of small states.

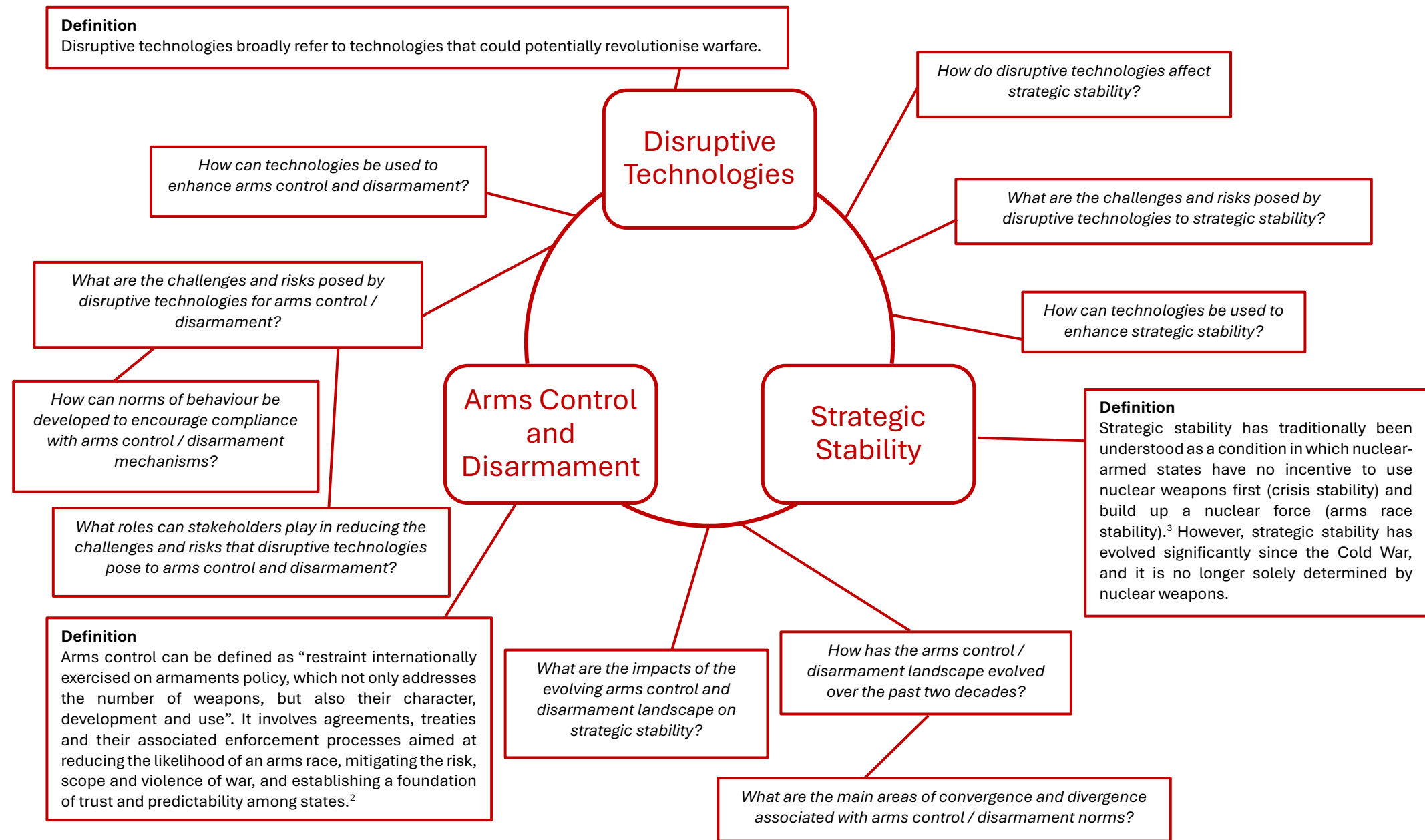
Brigadier-General Ng Pak Shun of Singapore's Ministry of Defence delivered closing remarks for the conference. He offered three reflections on the future of arms control. First, disruptive technologies present both opportunities and risks. Second, there is no one-size-fits-all solution to the challenges posed by disruptive technologies, which necessitates openness to adopting norms, principles, best practices, codes of conduct, and political declarations to prevent misunderstandings and avoid miscalculations. Finally, it is important to engage as widely as possible in arms control discussions.

One of two workshops on Day 2 invited participants to envision alternative futures for arms control of disruptive technologies in 2034. Participants identified several key driving forces, including the increasing involvement of the private sector in warfare, escalating geopolitical tensions and strategic competition, and catastrophic

events such as world wars. Despite raising several concerns about the future of arms control for disruptive technologies, participants highlighted how existing mechanisms could be adapted to address emerging challenges.

The other workshop focused on barriers to arms control and disarmament for disruptive technologies. Participants expressed pessimism about the impact of disruptive technologies and the likelihood that countries would only be able to exert limited influence over the future of arms control and disarmament in this area. However, they acknowledged that states could still shape the future of arms control by collaborating with the private sector. Barriers identified included geopolitical tensions, a trust deficit among states, and knowledge gaps, while the dual-use nature of technologies and strategic competition among states were prioritised as the most critical barriers.

Framework for Discussion



¹ Jeffrey A. Larsen, 'An Introduction to Arms Control and Cooperative Security' in Jeffrey A. Larsen and James J. Wirtz (eds), *Arms Control and Cooperative Security* (Lynne Rienner, 2009), p. 4.

² *ibid* p. 10; RSIS Military Transformations Programme (MTP) 2023 Annual Conference Primer.

³ RSIS MTP 2023 Annual Conference Primer.

Keynote Address

Ambassador Flávio Soares Damico, Ministry of Foreign Affairs, Brazil

Let me start on a personal note. I am overwhelmed to be with you today in Singapore. From May 2016 to December 2019, I was posted here as Ambassador of Brazil, perhaps the happiest and most productive days of my career. As a rule, once or twice a week, I would attend a conference or a lecture on different topics, basking in the vibrant academic life of this city-state. Prominent in my schedule were visits to the RSIS. It is with great joy that today, rather than to be part of the public, I am delivering the initial remarks to this event. In the past, I was never disappointed, and I hope that today I will make myself worthy of occupying this position and keep the tradition of excellence permanently attached to the RSIS, honouring its motto "Ponder the Improbable".

I am particularly grateful to the Ministry of Defence of Singapore and the RSIS for this invitation. I have always been a firm believer in the positive effects of the interaction between practitioners and academics. This cross-fertilisation is enriching for both and brings light to very complicated processes, allowing for a better understanding of the main drivers of change. Being a practitioner, I avail myself of the liberty to operate beyond the strict confines of academic rigour.

Introduction

My educated guess is that I am here because you are seeking a view from the trenches of multilateralism. As my résumé indicates, I have had recent experience on the interplay between arms control and emerging technologies. I believe I can add some value to the discussion on this very intricate relationship with a crucial bearing on our future.

The question before this conference is whether we can throw some light on the uncertainties regarding arms control and disruptive technologies. The future being unknown, uncertainty is the essence of life. At best, we can expect to discern trends that will equip us to discard alternatives that are clearly not productive. Let us not forget, though, that there are no right answers, only trade-offs, as the great Thomas Sowell always reminded us.

The relevance of security is beyond dispute. Risks associated with it are compounded by the neck-breaking speed of technological progress that threatens to change the nature of conflict and the perspective that wars can be fought and won without compromising civilisation as we know it.

Initially, let's look at some key concepts: arms control, disarmament and non-proliferation. NATO defines them as follows.

Arms Control

Arms control refers to mutually agreed-upon restraints or controls (usually between states) on the development, production, stockpiling, proliferation,

deployment and use of troops, small arms, conventional weapons and weapons of mass destruction. Arms control includes agreements that increase the transparency of military capabilities and activities, with the intention of reducing the risk of misinterpretation or miscalculation.

Disarmament

Disarmament refers to the act of eliminating or abolishing weapons (particularly offensive arms) either unilaterally or reciprocally. It may refer either to reducing the number of arms, or to eliminating entire categories of weapons.

Non-Proliferation

Non-proliferation refers to all efforts to prevent proliferation from occurring, or should it occur, to reverse it by any means other than the use of military force. Non-proliferation applies to both weapons of mass destruction (including nuclear, radiological, chemical and biological weapons) and conventional capabilities such as missiles and small arms.

Those definitions are quite uncontroversial. For this presentation, quite loosely, I will use arms control and disarmament in an interchangeable way.

The Prominence of Security Over Other International Issues

Since 1945, material progress derived from bringing down economic barriers and the many years of peace – at least in the most developed countries – made us sweep under the carpet the fact that states have accumulated over the years weapons of mass destruction capable of destroying the world many times over. Confident that the prospect of mutually assured destruction would dissuade any leader of a sane mind to probe limits and, imbued with a sense that conflict was forever to be confined to the poorest corners of the planet, we carried on with the “March of Folly”. With a great sense of complacency, the attention span of world leaders was dedicated to pressing short-term management problems or to address climate change via revamping the energy matrix.

Let me put it bluntly, as I can't say it in any other way, the timescale to get to the so-called tipping point of climate change is infinitely larger than the one needed for a finger to press a red button!

The Crisis of Multilateralism

Having re-established the prominence of geopolitics, we have to look at the interactions of arms control and technology and how they affect each other. In appearance, it is a chicken and egg situation. I have a *parti-pris*. I believe politics and technology are evolving separately and the main driver of this interaction is the evolution of the international system. Technology is a tool and evolves at its own pace if geared towards the market. If a government provides incentives for weapons

technology development, this is the product of a previous political decision predicated on the attainment of material superiority over perceived rivals.

Signs of problems have abounded. Multilateralism and its system of collective security has been running on fumes for quite some time and clearly are on the way to their fragmentation. We might disagree on the reasons, but the fact is that the international community has been unable to create, update or universalise any international regime of consequence since the mid-90s.

The high-water mark of the embedded liberalism that presided over the recreation of the international system over the ashes of World War II under American hegemony was the creation of the World Trade Organisation in 1993, complemented by the Chinese accession in 2001.

Since then, successive failures have been accumulated over the years such as the Doha Round, the International Criminal Court, or even more telling, the reform of the United Nations Security Council (UNSC), not to mention the impossible task of the creating an international regime on environment and climate change, epitomised by the many American U-turns in relation to the Paris Accords. Some might argue that the G20 has been innovating multilateralism, but it is yet to fully prove itself.

Under the international liberal order, regimes share many common traits, particularly the preponderance of the interests of their founders and funders, which manifest themselves in exceptions, derogations and opt-outs – think of the veto power in the UNSC. Nevertheless, these regimes are predicated on their legitimacy derived from their acceptance. The inherent hypocrisy contained in them – the Orwellian quote that “some animals are more equal than others” comes to mind – does not deter their acceptance by participants, independently from their hierarchy in economic or military terms. It is so because participants believe their fundamental security and economic interests will be better served by joining the regime rather than remaining on the sidelines.

In any event, little doubt remains that multilateralism does not exist in a vacuum. It rests within a certain power structure that at present is undergoing rapid evolution. We have gone through various configurations of the international system: bipolarism, American unilateralism, multipolar competition, and Cold War II. There are differences in nomenclature and on the exact dates, but it is undeniable that the post-1945 world does not exist any longer, whereas the institutions created on the basis of outcomes from World War II still persist.

The lingering question is to know whether a new world order will be achieved through a diplomatic process of renegotiation of the international order or, tragically, as in the past, if violence will be the midwife of history. We find ourselves precisely at this crossroad where disarmament and arms control meet military power in all its dimensions – land, sea, air and space. And this is compounded by the impact of disruptive technologies. No wonder we are navigating uncertainties, as results will depend on the interplay of many independent forces. I will try to look into some of the critical drivers and add my two cents.

The crisis of multilateralism and strategic instability make it very difficult to achieve concrete results in arms control talks. But diplomacy is more necessary than ever. Arms control and disarmament talks are, in reality, a canary in the mine. They provide an early warning on the state of strategic trust among the military powers. Lack of commitment can be translated as the preference for avoiding losing degrees of freedom, evading long-term undertakings that freeze out perceived disadvantageous positions.

Paradoxically, although parties to these talks clearly lack interest in compromising, they are keen to keep communication channels open. Arms control talks are, in all likelihood, among the last to be broken before actual hostilities initiate.

Why Arms Control/Disarmament Talks Are a Difficult Proposition

International trade negotiations in a multilateral setting fit nicely in the so-called “two-level game”. States negotiate as much with their domestic interlocutors as with other states. Domestic interlocutors *grosso modo* can be grouped in two ideal types – producers and consumers. This model can be extended to disarmament talks: the commodity in play is security. Within a country, the defence industry (or as it was called in the past, the military-industrial complex) produces security, while the population at large is a consumer of security.

Security is an intangible asset and, by definition, difficult to measure. It is hard – if not impossible – for consumers to make an objective assessment of its value. On the other hand, the military-industrial complex has just one client – the government – and is acutely aware on how to measure the impact of disarmament – the number of budgetary cuts.

The consequences are obvious. The logic of collective action shows that national interest is likely to be captured by those that stand to lose the most by a compromise. Consequently, countries with powerful defence industries tend to take conservative negotiating postures refraining from engaging in efforts to contain, regulate and/or prohibit weapons. Less armed countries, as a rule, present themselves as disarmament *démandeurs*.

Nevertheless, even if military powers might be at odds with each other, the incentives for their collusion remain. A concrete example – negotiations within the Non-Proliferation Treaty (NPT). While united, the five Nuclear Weapon States constitute an irresistible force; when separated, they become an unmovable obstacle.

To sum up, the existing structure of incentives is such that, while seeking to enhance its security, an actor, for real or perceived reasons, will in all probability ignite an arms race. The emergence of new actors – or modifications of the actor's preferences or alterations in their relative capabilities due to technological changes – will, almost inevitably, engender a race to the bottom where we all will be losers.

Consequently, to be successful, disarmament talks depend on a very hard to achieve star alignment – instances in which a negotiating process initiated at the

highest political level was able to break the deadlock and entrenched resistance of bureaucracies aligned to the military-industrial complex. A good example was the Reagan-Gorbachev nuclear weapons talks.

During the Cold War, confronted with the daunting prospect of a nuclear conflict that could destroy humankind, the US and the USSR were capable of finding a strategic compact delinked from their fundamental divergences. Likewise, at the end of the Cold War, the hegemony of the winning power was able to impose a “Disarmament Golden Age” with new and expanded treaties and rejuvenation of existing conventions.

Other Associated Problems

Security negotiations remain a province where states reign sovereign. Other actors – civil society, non-governmental organisations (NGOs), interest groups, think-tanks, and academia do not have much sway either over the domestic or the international level. In multilateral fora, NGOs and other actors are considered merely as voice multipliers, echoing national governments’ perceptions without any real autonomy. As a result, in their conservatism, multilateral arms control talks do not differ greatly from the negotiations that led to the 1648 Westphalia Peace.

Moreover, the legal-diplomatic structure of disarmament negotiations runs counter to the well-known principle that security is indivisible. Why do we have different regimes for different types of weapons? One for each type of mass destruction weapons – nuclear, chemical, biological – and different ones for conventional weapons, mines or cluster munitions? While it makes sense to separately negotiate the specificities of different types of weapons, we sorely lack a body that would take up all of those commitments together. There is no single peer review body entrusted with discussing the most important issues regarding compliance, transparency in the implementation of commitments, and their universalisation.

States do not compete on just one type of armament; military power is a continuum. No incentive is provided to offer concessions in one area because these cannot be reciprocated elsewhere. A reminder of this is the “escalate to de-escalate” doctrine: the possession and threat of using nuclear weapons is leveraged to achieve strategic objectives that otherwise would be unattainable by conventional means alone.

There is also the question of negotiating methods. Disarmament deals are to be agreed by consensus. It would not make sense to do otherwise, as the incentive to become a free rider, exempting oneself from commitments, is too big. But the dark side of this is obvious: the negotiations can be held hostage to a single power’s good will. Armed with a veto, one member can frustrate everybody else.

Finally, a further complicating factor in any arms control undertaking rests in an effective implementation of a verification system that brings its own set of problems. Free riders are to be avoided at all costs, hence the well-known adage: “Trust, but Verify”.

The Impact of Technological Change

One of the crucial factors in the perception of strategic equilibrium is the technological progress incorporated in armaments. New types of weapons may radically alter the military power equation among states. We live in an era of accelerated technological development, especially in electronics and communications. This is further compounded by the fact that nowadays this progress is driven by civilian applications that, more often than not, have dual uses.

An interesting aspect is that the main military technologies available in the nuclear field – ballistic missiles, outer space travel, and unmanned aerial vehicles (UAVs) – are not new and date back to the end of World War II. Avoiding their proliferation is a frustrating effort. The recent experience of export control regimes illustrates the difficulty in implementing their provisions. Actually, the best result we can expect is to avoid unbridled proliferation, including to non-state actors.

The new disruptive element is the fantastic progress in information technology and computer capabilities with the development of artificial intelligence. This brings new challenges and circumstances that were confined not long ago to dystopia, such as conventional weapons with autonomous selection of targets. Even more challenging is the perspective that decisions regarding the use of nuclear weapons may be passed on to non-human intelligence. Likewise, recent experiments have demonstrated that artificial intelligence programs are capable in a matter of hours of identifying new chemical and synthetic biological substances that could be weaponised.

The increasing resort to military technology is driven not only by the wish to adopt better, more efficient and less costly weapons but is also linked to important societal trends. Urbanisation and declining fertility rates in modern societies decrease the pool of civilians to be recruited to the armed forces. Compensatory initiatives – like the recruitment of mercenaries – confirm this trend. Two examples come to mind: contractors in Iraq and the activities of the Wagner Group in Africa.

In East Asia, these demographic trends are more present than anywhere else. A rapid demographic contraction is taking place in China, Japan and the Republic of Korea. It is also a region with enormous industrial capacity and at the forefront of technological development with the presence of both nuclear weapons states and threshold states. Moreover, geopolitical tensions abound in East Asia. It is a matter of time before these states will take the lead in bringing autonomous capacity and artificial intelligence to the battlefield.

Although technology often leads to the disruption of the strategic balance, it may also provide tools for enhancing the verification of commitments via more advanced and less intrusive methods, such as satellite imaging or much improved open-source investigation. As of now, however, I do not hesitate to say the balance of technological impact is tilted more in the direction of disrupting strategic stability than towards improving it.

Other Trends

Some say the level of military expenditure has reached its absolute maximum and that another arms race would be unthinkable. I am a purveyor of bad news. Actually, more important than the total sums devoted yearly to armament is the military burden, i.e. the share of the GDP devoted to armaments. We are pretty close to a historical low point in terms of military burden, with a recent slight uptick after the Ukraine conflict. Current levels of military burden at around 2% of world GDP compare negatively with the whopping 6.3% at the height of the Cold War. We have a long way to go in terms of putting more resources into cannons without compromising butter for the people. Moreover, societies under duress can temporarily forego their wellbeing for the sake of security. According to SIPRI, Ukraine is now dedicating 58% of its government spending – equivalent to 37% of its GDP – to weapons. In times of crisis, a war economy imposes itself quite easily.

In Brief

How far have we gotten in your effort to navigate uncertainties in arms control in light of disruptive technologies? We have determined that arms control/disarmament prospects are dimmed by:

- 1) the dismal state of multilateralism provoked by the movement of tectonic plates of geopolitics and the breakdown of trust among the major actors,
- 2) the political economy of arms control/disarmament talks that requires a very rare to achieve political star alignment among various actors and decisive top-down intervention to make them successful,
- 3) the structure and the negotiating method of arms control/disarmament institutions that does not facilitate the task of reaching compromises,
- 4) the fact that impactful old military technologies are likelier to be proliferated,
- 5) dual-uses technologies that are more prevalent than ever, and
- 6) societal incentives that favour the introduction of manpower-saving technologies.

Silver Linings

Agency of Non-Armed or Less-Armed States

The “view of the forest”, the big trends and factors I have mentioned, points to a pessimistic outlook for arms control/disarmament.

Is this a hopeless task, or if we look closer – at the level of the leaves rather than the trees – can we discern silver linings? The situation is dire but not entirely hopeless. Disarmament talks are lopsided in favour of military powers. Nevertheless, non-armed or less-armed states have agency and historical examples abound of initiatives leading to positive results.

Indeed, in the nuclear dossier, the most relevant initiatives to curb the expansion of nuclear weapons were initiated by non-nuclear weapon states. Such is the case of

the Weapons-Free Zones, starting with the Tlatelolco Treaty covering Latin America and the Caribbean, a concept that has expanded over various regions of the planet. Likewise, the entry into force of the Treaty on the Prohibition of Nuclear Weapons closed an important legal loophole by prohibiting the most egregious weapon of mass destruction.

Likewise, civil society and its organisations do possess agency and have been effective in promoting the regulation and/or prohibition of some weapons. Wars are subject to limitations. The progressive development of international humanitarian law is a case in point thanks to the movement led by the International Committee of the Red Cross since the late XIX century. For example, the revulsion provoked by the widespread use of chemical weapons in World War I led to the negotiation of the Geneva Protocol of 1925, the precursor of the Biological and Chemical Weapons conventions. More recently, the major public outcry against anti-personnel mines resulting in the Ottawa Convention comes to mind.

There are reasons for guarded hope in some instances. Let us look at some scenarios of different negotiating fronts dealing with disruptive technologies.

LAWS – Lethal Autonomous Weapons Systems

Since 2014, the Convention on Certain Conventional Weapons (CCW) has been consistently evolving towards a possible sixth protocol on LAWS. These weapons are increasingly becoming a reality, and they are at the frontier of technological development. They depend more on the capacity of programmers and are relatively independent from a sophisticated industrial base. With lower barriers to entry, they can with more ease upend strategic stability.

Created in 2016, a Group of Governmental Experts is incrementally developing ideas and concepts in order to launch negotiations on a protocol to the CCW. In reality, there is a race between political-diplomatic efforts to regulate LAWS. Systems with varying degrees of autonomy are already in use, including in Ukraine and Gaza. More worryingly, the experience in the Ukrainian conflict indicates that jamming and other formats of interference have been successful in affecting the precision of weapons controlled from afar by operators. Should we also factor in the effects of the demographic crunch, the apparent tendency is to increase reliance on autonomous weapons. We could expect that leaders in research on AI will be more inclined to avoid regulation placing limitations that affect AI systems' performance.

On the other hand, humanitarian and ethical concerns derived from delegating life and death decisions to machines have caught the imagination of civil societies. NGOs have been quite successful in drawing public attention to the risks of LAWS. Moreover, technology companies and other defence providers are concerned about a possible moral backlash derived from their participation in the development of inhumane weapons and therefore welcomes some sort of international regulation. A large coalition of countries has embraced this notion and is committed to initiating negotiations at the soonest to advance the progressive development of international humanitarian law in this field.

The big question is whether those forces in favour of the negotiations will prevail or the powers leading the development of autonomous weapons will manage to delay the outcome of the negotiations, thus creating a *fait accompli*.

Military Uses of AI

In parallel to the discussions on LAWS, there is a notion that military applications of AI in areas such as command and control, management of information, logistics and training have been consolidating and should also be subject to some sort of regulation.

AI is a relatively recent development and is not widely understood and its technological, military and political ramifications are not fully mapped out. Consequently, various countries have launched concurrent and competing initiatives to format concepts leading to legal-diplomatic work at the multilateral level. It may take time for these processes to coalesce around one single initiative. Among them, the most promising one is the REAIM – Responsible AI in the Military Domain – a Dutch-Korean initiative that was recently approved overwhelmingly in the First Committee.

Outer Space

The strategic prominence of outer space is evident. Supremacy in outer space enables the control of battlefields on Earth. Moreover, outer space is not only becoming increasingly complex but also essential for critical communication infrastructures on Earth.

From a handful of space-faring nations, the number of countries and private actors (the so-called “new space”) has mushroomed in recent times. While the number of interested parties has increased – including among developing countries – positions have hardened between two blocs: one led by the US favouring the adoption of norms of conduct regarding actions that jeopardise outer space security (e.g., anti-satellite tests that generate debris), the other led by Russia and China that favours the adoption of a legally binding agreement preventing the placement of weapons in outer space. The distinctions are academic as the most important aspect of any deal is whether it is going to be complied with. To make matters more difficult, accusations that Russia has developed an atomic weapon to be placed in outer space has put in doubt the good faith of the proposal of a treaty preventing the placement of weapons in outer space.

Of all the issues under discussion, outer space appears to me to be least likely to be conducive to any short-term compromise because space powers believe that the attainment of supremacy is within their reach – incentives are not in place to reach a compromise.

Biological Weapons

The first convention to eliminate an entire category of weapons of mass destruction, the Biological Weapons Convention (BWC) has failed to live by its promise. A massive multilateral effort was carried out in the 90s to set up a verification system to enable the Convention to perform as originally intended. It fell short. Divergence over how to

carry out inspections on dual-use industries and fears regarding proprietary rights doomed the effort. Since then, the convention has been kept in a sort of suspended animation with a skeleton staff and no ability to carry out its many original functions.

Between 2001 and today, unprecedented technological development in life sciences has radically altered threat perceptions. DNA-altering techniques became very accessible as their price went down dramatically – by many orders of magnitude. It is very cheap to access kits capable of carrying out experiments with lifeforms that might go catastrophically wrong, either by compromising human health, animal health, plant health or the environment.

The Covid pandemic was a shock. Confronted with a disease that provoked untold suffering and economic losses, the international community coalesced around the notion that more needs to be done to better confront biological risks. In the IX Review Conference of the BWC, a strong mandate was given to a working group to address the unfinished business of the Convention in terms of international cooperation and assistance, creating a scientific and technical group, a verification system and enhancement of assistance and preparedness. There is strong support for this effort, particularly among developing countries, but entrenched resistance still persists. In particular, some countries indicated that they will only agree to a strengthened convention if export control mechanisms outside of its scope, such as the Australia Group, are part of the conversation. This deadlock is hard to break. We run the risk of squandering the effort and ending up with a convention that will continue to be unequipped to discharge its mandate.

Export Control Regimes – The Missile Technology Control Regime (MTCR)

The MTCR is an informal political understanding among 35 partner states originally established in 1987, with the goal to limit the proliferation of unmanned delivery systems for all weapons of mass destruction (WMD) and to preventing terrorist groups and individuals from acquiring them. Its mandate covers all unmanned delivery systems for all WMD, military and dual-use equipment, software and technology related to missile technology.

It operates through the harmonisation of export controls based on guidelines that constitute a common export policy and list of controlled items (equipment, software and technology annex) and, finally, has a catch-all provision for non-listed items. In terms of structure, the MTCR has a plenary meeting for decision-making while technical work is carried out in three expert groups.

Export control is a strenuous, always evolving and difficult task. Being relatively old technologies – after all, missiles and UAVs have been around since World War II – one has to assume that proliferation is a matter of time. Hence, the default assumption is that technology will spread itself.

Over the years, it became apparent that the effort to contain proliferation was far more complicated than initially thought. The spread of technology, broadening of dual uses, and the use of less technologically advanced items facilitated the task of

would-be proliferators to find ways around existing control lists. It is a cat-and-mouse situation. Proliferators are actively seeking to circumvent restrictions. Stop-gap measures like catch-all provisions act as an extra layer of security to strengthen export control regimes and are a critical tool for advancing shared missile non-proliferation objectives. They are a creative way to enhance the capability of the regime and are not to be construed as export bans. They provide governments with the authority to legally regulate and control the export, transit, or transshipment of any commodity believed to be of proliferation concern.

In Conclusion

It is easier to make a strong case highlighting the many difficulties plaguing arms control negotiations and how technological disruption complicates an already dire situation. It is evident that headwinds are prevailing over the forces that drive disarmament talks forward. On the other hand, we should never despair. Recent historical precedents give us cause for persevering. The abyss of the Cuban Missile Crisis was rapidly followed by urgent action to bring down the risks of a nuclear confrontation. In the early 80s, we appeared again to be sleepwalking towards confrontation. Ten years later, the Golden Age of Disarmament set in. In disarmament affairs, it is darker before dawn.

Another aspect not to be lost on us is the role of contingency and human agency in reverting what, in appearance, resembles a hopeless situation. All avenues should be explored to the fullest. Moreover, looking at issues in a more granular way would show many more shades of grey than initially thought and will indicate avenues and efforts that are worth pursuing.

I will consider my mission of today fulfilled if I manage to persuade you that we are not at the entrance of Dante's inferno. It is too early to abandon all hope.

Thank you.

Panel 1: Arms Control in an Age of Disruptive Technologies

The first panel began by reflecting on the history and purpose of arms control, emphasising its role as a mechanism to maintain strategic stability and prevent unintended wars. The panel highlighted that Cold War-era arms control frameworks are now confronting significant challenges. First, great power competition has undermined the efficacy of such frameworks. States are often reluctant to engage in arms control dialogues due to concerns that increased transparency could place them at a strategic disadvantage.

Second, mutual distrust among states presents a significant barrier to sustaining arms control discussions. Despite the availability of platforms for dialogue, efforts to reach a consensus have been unsuccessful due to increasing divergence in states' perceptions, strategies, and cultures. Mutual trust and predictability are essential for reaching compromise. In the current climate of distrust, substantive agreements remain unlikely.

Third, the emergence of disruptive technologies, such as AI, cyber capabilities, space technologies, and biotechnology, presents challenges as traditional arms control mechanisms may not be easily applicable to them. The panel highlighted specific difficulties associated with these technologies, including challenges related to verification, dual-use, and the intangible nature of many disruptive technologies. However, it was also noted that disruptive technologies could potentially aid arms control efforts, particularly in areas such as monitoring and verification.

Lastly, the changing nature of warfare – ranging from the technologies used on the battlefield to the reduced time for military decision-making and the increased risks of miscalculation – has introduced additional uncertainties for arms control efforts.

Regarding the convergence and divergence of arms control norms, it was noted that despite Russia's withdrawal from the Nuclear Test Ban Treaty, there remains a broad concern about nuclear testing. Furthermore, no evidence suggests that the five nuclear-armed states have violated the treaty. However, these states appear to have lost their shared conviction that a nuclear war should never be fought. On the issue of divergence, the panel revisited geopolitical tensions and highlighted the differing approaches states take in interpreting arms control treaties.

In considering the relevance of traditional arms control mechanisms to disruptive technologies and the way forward, the panel identified communication as key to addressing the associated challenges. However, it was noted that communication has been largely absent in cyber arms control discussions. The panel also emphasised that valuable lessons could be drawn from nuclear arms control and the crucial role of education in building understanding around AI.

Biological weapons were discussed during the Q&A segment. It was noted that the 1972 Biological and Toxin Weapons Convention has significantly reduced the perceived risks associated with biological weapons by establishing a framework for arms control. However, the relationship between the convention and emerging

computing technologies is unclear. Despite this, it was noted that arms control for biological weapons remains possible, as states recognise the risks posed by such weapons.

The panel also examined whether states would always prefer to acquire nuclear weapons. While nuclear weapons can provide security through deterrence, it is important to consider states that have voluntarily relinquished their nuclear arsenals, such as South Africa. Strategic calculations and risk assessments regarding the possession of nuclear weapons are inherently complex and nuanced. Much depends on the security dynamics between military powers, particularly within the context of strategic competition. The key question is how non-nuclear states can effectively secure their interests without resorting to nuclear weapons.

In their concluding remarks, the panel emphasised the importance of Asian states engaging in nuclear risk reduction discussions and actively voicing their concerns about the risk of nuclear conflict in the Indo-Pacific region. They noted that Asian states have expressed concern over Australia's acquisition of nuclear submarines and China's launch of an intercontinental ballistic missile into the Pacific Ocean, which is a designated nuclear-free zone.

Panel 2: The Future of Governance for Military AI

Panelists unpacked current military AI applications in Gaza and Ukraine, the challenges arising from such use, and the potential development of norms to ensure responsible and ethical use. They made several key observations.

First, the technological development of military AI is accelerating the pace of human decision-making. Risk assessments must carefully consider the degree of human involvement in these processes, with particular caution advised for actions undertaken without any human oversight or with minimal human involvement. Second, due to AI's dual-use nature, its rapid proliferation and widespread democratisation have become increasingly apparent, with the private sector playing a leading role in military AI development. Third, discussions on military AI governance should extend to include a broader range of applications, such as AI decision-support systems and predictive analytics technologies. Fourth, the hostilities in Gaza and Ukraine have underscored the urgent need for regulatory frameworks to keep pace with technological advancements. Existing international legal frameworks, such as international humanitarian law (IHL), are insufficient to address the challenges posed by military AI. Lastly, various stakeholders, including the private sector, civil society, and academia, should be involved in military AI governance discussions to address its challenges while maximising its potential.

The panel also explored the divide between the Global North and Global South in military AI discussions, particularly within the context of the United Nations LAWS discussions. It was observed that fewer than 20 Global South states regularly contribute to these discussions. The Global South states primarily focus on economic development and capacity building; their priorities are reflected in regional and international military AI initiatives. The panel noted that the Global South has called for the prohibition of LAWS. However, this stance contrasts with the approach preferred by the Global North, which advocates for the development of soft laws as governance tools for military AI. Examples include the Responsible AI in the Military Domain Summit (REAIM) Blueprint for Action and the US Political Declaration on Responsible Military Use of Artificial Intelligence and Autonomy.

Regarding geopolitical tensions between the US and China, the panel highlighted that China was among the first states to call for a legally binding instrument on military AI. Nevertheless, rising geopolitical tensions and stricter access controls imposed by the US and other states have contributed to China's passivity and disengagement on the issue. The panel also emphasised the importance of both China and the US engaging in dialogue to reduce misunderstandings and maintain stability. However, the question is whether such dialogues may be viewed less favourably under the incoming Trump administration.

During the Q&A segment, the panel discussed the impact of AI on military culture and strategic perspectives. While AI has been praised for freeing up significant manpower by managing backend tasks and functions, some militaries, such as the People's Liberation Army, continue to prefer a more centralised control structure. The

panel also examined the role of AI in information warfare and the capabilities of military AI systems to defend against cyberattacks.

Additionally, the panel considered the possibility of establishing a legally binding instrument on LAWS. The panellists noted that it would be challenging for such deliberations to take place outside the framework of the CCW, given the significant disparities among states in their perspectives on LAWS, interpretations of international law, access to relevant technologies, and mutual distrust.

In their concluding remarks, the panel underscored the importance of collaborating with the private sector on regulating AI and other disruptive technologies. Recognising the challenges associated with military AI governance, the panel emphasised the need to explore avenues beyond traditional intergovernmental processes. They suggested that Track 1.5 dialogues like REAIM could play a crucial role in helping states build common ground and foster trust. The panel also highlighted that developing robust national strategies and regulations is a vital first step in overseeing the use of AI in the military domain.

Panel 3: Challenges in Cyberspace

The third panel examined the growing use of cyber operations in warfare. Panellists also discussed the private sector's expanding role, using Ukraine's partnerships with technology companies as an example. Even before Russia's invasion of Ukraine in 2022, these companies were already working with Ukraine to manage cyber risks. The panel observed that corporate responsibility under IHL remains insufficiently defined.

The discussion also highlighted several challenges posed by cyber operations, including the difficulty of attribution and accountability, the blurred lines between military and civilian use of cyberspace, the double-edged implications of integrating AI into cyber operations, and the challenges faced by international law in governing cyber operations during armed conflicts.

The panel observed broad support among states for the application of IHL to cyberspace operations. Nevertheless, the way in which IHL should be applied remains a subject of debate. The principle of non-intervention and the prohibition of the use of force outlined in the UN Charter are key considerations shaping ongoing deliberations by states. A key concern is that should IHL be deemed inapplicable, states might be incentivised to prioritise cyber warfare over conventional methods. The panellists disagreed on whether there is a need for a legally binding instrument governing cyber operations during armed conflict. It was observed that there is a general lack of political will, especially among Global North countries, to negotiate such an instrument.

The panel noted that while the International Criminal Court (ICC) has recognised crimes in cyberspace as falling under international criminal law, significant legal challenges remain in determining how this body of law applies to cyber operations. To address these challenges effectively, it is crucial for the ICC to collaborate closely with technical experts, ensuring that legal frameworks evolve together with technological advancements.

When examining the implications of these developments for ASEAN member states, the panel noted that ASEAN was the first regional grouping to adopt the 11 norms of responsible state behaviour in cyberspace. ASEAN has also initiated a regional action plan to implement these norms, starting with foundational steps such as capacity building.

In the Q&A segment, the panel further unpacked the topic of norms of behaviour in cyberspace. It was highlighted that the checklist for norms implementation developed by ASEAN has served as a valuable tool for states to evaluate their progress and has been recently adopted by the UN.

In their closing remarks, the panel reflected on prospects for a fundamental shift in norms of behaviour in cyberspace. They highlighted that the UN Open-Ended Working Group remains the only inclusive universal mechanism for addressing governance challenges in cyberspace.

Finally, the panel emphasised three critical issues in cyberspace that have been sidelined: implementation, accountability, and transparency. It was argued that effectively addressing these issues would enable the international community to better navigate the complexities of international law in governing cyberspace.

Panel 4: The Future of Outer Space Security

Panellists kicked off the discussion by sharing their perspectives on the current international legal frameworks governing outer space. It was noted that while there are both legally binding and non-legally binding instruments governing outer space, significant gaps remain, especially regarding the use of weapons in outer space. For instance, while nuclear explosions are prohibited in outer space under the 1963 Partial Test Ban Treaty, the placement of conventional weapons in orbit is not explicitly banned. Moreover, the transit of a nuclear-armed intercontinental ballistic missile through outer space is also not prohibited.

The panel also sought to examine the unique concerns regarding outer space security among small states, including emerging space players. Although the outer space domain has long been dominated by great powers, access to launch and space exploration technology is becoming increasingly democratised, including in Southeast Asia. While the proliferation of access to space has unlocked enormous economic opportunities for small states, there is growing concern that geopolitical tensions in outer space could jeopardise these gains.

Additionally, the panel noted that small states have raised significant concerns about space debris and its potential to render outer space unusable. In response, small states have called for sensible guardrails, whether through voluntary norms or binding rules, to ensure the sustainable use of outer space. The emphasis is on developing practical solutions to address these challenges and chart a constructive path forward.

When discussing the dynamics between emerging space players and space superpowers, the panel observed some common interests among these states. Space superpowers generally prefer a regulatory regime that avoids imposing undue restraints, while emerging space players are willing to accept certain restrictions to protect their limited space-based infrastructure, such as satellites. However, the international community faces a significant challenge – small states are often underrepresented in outer space discussions. Therefore, it is crucial for small states to participate in these discussions and collectively voice their concerns. Without small states' active participation, outer space discussions risk remaining a domain dominated by space superpowers, with negotiations reflecting this imbalance.

During the Q&A segment, the panel deliberated on ways to move beyond current geopolitical dynamics in outer space discussions. It was noted that the Group of Governmental Experts appeared to have reached new consensus on further practical measures to prevent an arms race in outer space. It was observed that while great powers seek to maintain their dominance, it is essential for them to recognise and engage widely in order to determine the norms of behaviour in outer space.

Regarding the growing involvement of the private sector in outer space activities, the panel acknowledged the significant role it now plays. However, a key challenge identified by the panel was how to effectively involve the private sector in discussions on outer space arms control.

Closing Remarks

Brigadier-General Ng Pak Shun, Ministry of Defence, Singapore

Good afternoon, ladies and gentlemen. As we draw day one of the conference to a close, I would like to first take the opportunity to acknowledge the contributions of our distinguished guests, conference speakers, and colleagues from the Singapore government.

Special mention goes to RSIS for organising this conference for the fourth time. This year's conference theme, "Navigating Uncertainty: Arms Control in an Age of Disruptive Technologies", is particularly timely and salient. The arms control landscape of today is very much a product of the Cold War. It has been largely successful, especially in achieving nuclear deterrence. However, more than 30 years on, we now face a much broader range of strategic risks and uncertainties posed by disruptive technologies.

It is thus important to figure out together how we should navigate the uncertainties of our time. In this regard, our distinguished speakers have shared their insights on how we should approach arms control vis-à-vis disruptive technologies such as AI, LAWS, cyber, and outer space. The situation may appear dire, amidst the fractious geopolitical and security climate, but it is not hopeless. Earlier today, Ambassador Damico reminded us of the times when we were able to make progress even when the situation looked desperate, as it is always "darker just before dawn".

Adding on to Ambassador Damico's point, allow me to share three reflections on arms control moving forward.

First, we should not throw the baby out with the bathwater in relation to emerging technologies in arms control. Emerging technologies can bring about both benefits and risks. Hence, we should seek to maximise their benefits while minimising their risks. The recent conversations at the UN Open-Ended Working Group on Cyber give me hope that the global community recognises such dynamics.

For example, the 3rd Annual Progress Report detailed for the first time the concerns posed by new and emerging technologies such as AI and quantum technologies, including how these technologies could be used to exploit vulnerabilities and expand the scale and impact of cyberattacks. However, many states also highlighted that it was important to recognise the potential benefits of these technologies, such as how AI can actually be used to enhance cybersecurity and improve response time to cyber incidents.

Second, we should avoid a one-size-fits-all approach to the risks posed by emerging technologies in arms control. Existing arms control measures come mostly in the form of legally binding treaties. However, we should remain open to norms, principles, best practices, codes of conduct, or political declarations. They could be useful first steps for preventing misunderstandings and avoiding miscalculations. States are more likely to find initial common ground on these "low-hanging fruits" and work their way towards building consensus on more formal regulations in future. Patience is

key to accommodating different approaches and working on their convergence over time.

It is for this reason Singapore has consistently supported both the UK-proposed and Russia-proposed UN OEWGs on outer space security. Despite the different mandates, we view them as complementary, rather than mutually exclusive, and we look forward to further progress being made in the space security domain next year.

Third, we should engage all stakeholders, big and small, in conversations on arms control. Major powers remain critical to arms control conversations because their advanced militaries will likely be early adopters of disruptive technologies. However, the democratisation of disruptive technologies means that every state as well as its citizens are far more likely to use them. In this regard, any governance framework for disruptive technologies cannot be negotiated by only the major powers.

In this spirit, Singapore is glad to have been actively involved in the Responsible AI in the Military Domain (REAIM) process, co-led by the Netherlands and the Republic of Korea. We hosted the REAIM Regional Consultations for Asia in February this year, bringing together regional voices to examine the policy, legal, and technical issues around responsible military AI. We also co-hosted the 2nd REAIM Summit with other international partners in September, which saw the successful adoption of the REAIM Blueprint for Action by more than 60 countries. This Blueprint lays out principles and guidelines on governing military AI, which lays the groundwork for further conversations on this domain.

Singapore, along with Australia, will also be co-hosting a series of virtual workshops on outer space security early next year. The workshops are part of a capacity building effort for Asia-Pacific states to foster their understanding on pertinent outer space security issues ahead of the two OEWGs. We will reach out to our colleagues within the region on further details closer to the date.

Before I conclude, I thought that it is worth highlighting that our predecessors had also faced similar uncertain terrain during the advent of nuclear weapons during the Cold War. The fact that we are where we are now should give us confidence that it is possible to move forward safely in this age of disruptive technologies. However, we can no longer blame our predecessors, as we are now responsible for the peace and prosperity of our future generations, whether as officials, academics, or industry players. I would thus like to express my gratitude to each of you for joining us, and for sharing your views so generously. For those attending the workshops tomorrow, I wish you an enriching time, as you deep dive into some interesting issues related to arms control and disruptive technologies, including envisaging how arms control could look like in 2034.

Workshop 1: Four Futures for Arms Control of Disruptive Technologies

What might arms control for disruptive technologies look like in 2034? This question was the focal point of Workshop 1, where participants envisioned alternative futures for arms control of disruptive technologies aligned with three broad archetypes: collapse, limits, and transformation.

Participants identified several key factors driving change within their scenarios, including the growing involvement of the private sector in warfare, escalating geopolitical tensions and strategic competition, the potential for accelerated conclusion of arms control mechanisms following catastrophic events, and the expanding domains of warfare, including in outer space and the information environment.

Regarding the growing involvement of the private sector in warfare, participants reflected on contemporary conflicts and observed that private entities can shape outcomes by deciding when to support certain parties in armed conflicts and when to withhold their assistance. If this trend continues, the private sector could play a more significant role in shaping arms control for disruptive technologies. Participants believed that collaboration between states and the private sector could support capability building for arms control and foster responsible behaviour.

Turning to geopolitical tensions and strategic competition, participants expressed concern that the incoming Trump administration could undermine existing arms control measures, leading to a decline of confidence in nuclear deterrence. Additionally, participants were concerned that certain states might pursue nuclear weapons in response to a weakened arms control regime, causing further destabilisation.

In a scenario where the arms control regime keeps pace with technological advancements, participants identified the growing role of private sector actors in the chipmaking industry as a key driver, suggesting it could disincentivise the US to defend Taiwan. This development could trigger a geopolitical shift, eroding confidence in US security assurances and weaken existing western-centric arms control frameworks. Participants believed that while these developments outlined in the scenario were drastic, the existing arms control regime would not disintegrate. They drew on the historical example of World War II's aftermath to support this belief.

The scenario featuring a dysfunctional arms control landscape was driven by three key factors: (i) the breakdown of strategic stability due to geopolitical fragmentation; (ii) the failure of arms control measures leading to uncontrolled proliferation; and (iii) a major crisis necessitating fundamental changes to the existing system. When exploring this scenario, participants pointed to the paralysis of the current arms control regime, the rise in proxy wars, and the erosion of trust between states. They also expressed concern that non-state actors, including technology

companies, might violate arms control mechanisms. Participants disagreed on whether disruptive technologies would serve as a catalyst for the use of nuclear weapons.

Despite envisioning some bleak futures for arms control of disruptive technologies, participants emphasised the continued importance of dialogue and engagement among nuclear-armed states to manage strategic competition. Additionally, they noted that while the international community has struggled to develop new arms control mechanisms for disruptive technologies, existing regimes remain mutually reinforcing and continue to be adhered to by states.

Workshop 2: Barriers to Arms Control and Disarmament Efforts for Disruptive Technologies

At the outset of Workshop 2, participants were invited to partake in an icebreaker designed to encourage them to explore and articulate their perspectives on the impacts of disruptive technologies on the future of arms control and disarmament. During the activity, participants were asked two questions: (i) how do you feel about the impact of disruptive technologies on the future of arms control and disarmament? and (ii) how do you feel about the influence that countries have in shaping the future of arms control and disarmament for disruptive technologies?

Reflecting on the first question, most participants expressed pessimism regarding the impact of disruptive technologies on the future of arms control and disarmament. They cited factors such as the uncertainty of technological trajectories, strategic competition among states, and the realities of warfare which have marginalised arms control efforts. Additionally, most participants felt that countries have limited influence over the future of arms control and disarmament for disruptive technologies. They attributed this to the fact that technological advancements are largely driven by the private sector, combined with the reactive nature of arms control and disarmament mechanisms, such as treaties, which struggle to keep pace with rapid technological progress.

However, participants also noted that states play a key role in determining how technologies are used in warfare, and many technology companies developing military capabilities are closely linked to states. Therefore, there is an opportunity for states to collaborate with the private sector, exercise control, and shape the future of arms control and disarmament for disruptive technologies.

During the guided discussion, participants explored the differences between traditional arms control and disarmament efforts versus those related to disruptive technologies. They noted that the rise of disruptive technologies has failed to resolve existing challenges in arms control and disarmament – instead, these technologies have exacerbated them. Participants emphasised that the dual-use nature of disruptive technologies such as AI further complicates efforts to establish effective arms control and disarmament measures. A key question raised was whether these technologies should be prohibited, regulated, or both.

In assessing the current and future barriers to arms control and disarmament for disruptive technologies, participants identified several key obstacles, including: (i) the lack of political will; (ii) the lack of trust between states; (iii) geopolitical tensions and strategic competition; (iv) knowledge gaps between technology experts and policymakers; (v) disparities between states in access to resources and technology; (vi) the dual-use nature of disruptive technologies; and (vii) ambiguities in international legal frameworks. These obstacles were ranked based on their impact, with two emerging as the most critical: geopolitical tensions and strategic competition, and the dual-use nature of disruptive technologies.

Participants identified several mitigation measures to address their prioritised barriers to arms control and disarmament for disruptive technologies. A common recommendation from the group discussion was to foster dialogue with key stakeholders, including the private sector, militaries, and rival states engaged in strategic competition.

Participants generally agreed that legally binding instruments may not be the most effective mechanism for arms control in this context, as the potential of disruptive technologies must be harnessed. As such, they favoured the development of norms through political declarations, national strategies and frameworks, and advocacy efforts via regional groupings and platforms. Participants also emphasised the urgent need for capacity building to address disparities between states.

Programme

Day 1 – Conference (7 November 2024, Thursday)

0815 (30 min)	Registration
0845 (5 min)	Welcome Remarks
0850 (5 min)	Opening Remarks
0855 (20 min)	Keynote Address
0915 (10 min)	Group Photo
0925 (1 h 20 min)	<p>Panel 1 <i>Arms Control in an Age of Disruptive Technologies</i></p> <p>The arms control and disarmament landscape has undergone significant changes over the past two decades. Post-Cold War arms control mechanisms have been tested by geopolitical tensions and the shifting balance of power. States have struggled to develop consensus as norms around transparency, verification, and non-proliferation have evolved. The emergence of disruptive military technologies has also introduced additional complexities and challenges. This panel will discuss existing arms control regimes and explore their continued relevance.</p> <ul style="list-style-type: none"> • How have conventional and nuclear arms control frameworks, treaties, and conventions evolved over the past two decades, and what are the main areas of convergence in terms of norms? • What are the main areas of divergence in terms of norms and challenges for verification and enforcement associated with existing arms control mechanisms? • What concepts can we apply from existing arms control mechanisms to disruptive technologies, and are any of these mechanisms losing their relevance? What are the alternatives?
1045 (30 min)	Morning Break
1115 (1 h 20 min)	<p>Panel 2 <i>The Future of Governance for Military AI</i></p> <p>Recent events in Ukraine and Gaza have demonstrated the transformative potential of AI on the battlefield and prompted greater urgency for robust discussions on military AI applications. However, the complexities surrounding military AI governance, such as the lack of consensus on definitions, suggest that there is a long road ahead</p>

	<p>before the international community concludes any binding agreement. This panel will explore the challenges posed by recent military AI developments, and the ways in which norms of behaviour could be further developed to ensure responsible and ethical use.</p> <ul style="list-style-type: none"> • What are the challenges posed by advancements in military AI – particularly as seen in Gaza and Ukraine – for existing conventional arms control regimes? • How should norms for military AI go beyond high-risk applications such as LAWS to incorporate other types of applications such as AI-based decision support systems? • What role should the private sector play in strengthening norms for military AI? • How can norms of behaviour within the international community be developed further beyond platforms such as REAIM / the US Political Declaration?
1235 (1 h 30 min)	Lunch
1405 (1 h 20 min)	<p>Panel 3 <i>Challenges in Cyberspace</i></p> <p>Cyber operations have increasingly become a part of armed conflict, and the increased involvement of private sector actors poses significant challenges to arms control and international law frameworks. Disruptive technologies further exacerbate this issue by introducing new capabilities that can complicate attribution and accountability, posing risks for escalation. This panel will discuss various dimensions of cyber operations in armed conflict and explore the way forward beyond the United Nations open-ended working group on security of and in the use of information and communications technologies (OEWG on ICT).</p> <ul style="list-style-type: none"> • What are the challenges posed by the growing militarisation of cyberspace, including by the greater involvement of private sector actors? In particular, what has been the impact of convergence across multiple disruptive technologies in cyberspace? • What are the challenges for interpreting and applying international law in relation to cyberspace? What are the main areas of convergence and divergence in terms of application of international law in cyberspace? • Since countries have agreed upon the 11 norms of responsible state behaviour, what should be the next bound of priorities for cyber norms beyond the OEWG on ICT which ends in 2025?
1525 (30 min)	Afternoon Break

<p>1555 (1 h 20 min)</p>	<p>Panel 4 <i>The Future of Outer Space Security</i></p> <p>Rapid technological advancements coupled with greater private sector involvement in outer space activities are challenging the effectiveness of arms control efforts, which seek to prevent an arms race in outer space and to ensure its peaceful use. This panel will focus on the challenges in applying international law to outer space, and the implications for developing a unified framework for outer space security.</p> <ul style="list-style-type: none"> • How are kinetic and non-kinetic military operations in outer space evolving, particularly with the increased adoption of disruptive technologies? What is the impact of this on greater private sector involvement in outer space activities? • What are the challenges for interpreting and applying international law in relation to warfare in outer space? What implications does this have on the ongoing discussions to develop a common framework for outer space security? • How can differences between competing international outer space security platforms be bridged? What is the role of emerging space powers relative to established space powers in this domain?
<p>1715 (10 min)</p>	<p>Closing Remarks</p>
<p>1725 (5 min)</p>	<p>Administrative Brief</p>
<p>1730</p>	<p>End of Day 1</p>
<p>1830</p>	<p>Conference Dinner</p>

Day 2 – Workshops (8 November 2024, Friday)

Workshop 1: Four Futures for Arms Control of Disruptive Technologies

Synopsis

- “Four Futures” is a method to develop scenarios rapidly without significant preparatory work compared to traditional scenario planning. No prior expertise or experience is required – anyone can contribute meaningfully to a Four Futures exercise.
- As with traditional scenario planning, a Four Futures exercise is anchored around a focal question: what will arms control for disruptive technologies look like in 2034?
- Participants will discuss and collaborate in small groups to develop scenarios around pre-defined archetypes: “continued growth” (fundamental drivers remain in place), “decline / collapse”, “discipline / limits” (adherence to specific values dominates), “transformation” (fundamental break from the present). These archetypes will be framed within the context of arms control.
- Output from this session will be a wireframe of a scenario, i.e., participants do not need to write out a complete narrative.
- The “continued growth” scenario will be shared as a reference for participants to develop their wireframes on the day.

Programme

The workshop is divided into two sessions taking place from 0925 – 1045 and 1115 – 1240.

0845 (30 min)	Registration
0915 (10 min)	Administrative Brief and Overview of Workshop
0925 (35 min)	Group Discussion
1000 (45 min)	Scenario Development
1045 (30 min)	Morning Break
1115 (1 h)	Group Sharing
1220 (20 min)	Open Discussion and Q&A
1240 (1 h 30 min)	Lunch
1410	End of Event

Workshop 2: Barriers To Arms Control and Disarmament Efforts for Disruptive Technologies

Synopsis

- This workshop has three objectives: (1) unpack participants' perspectives related to the impact of disruptive technologies on the future of arms control and disarmament, (2) identify current and future barriers to arms control for disruptive technologies in the military domain, and (3) explore potential solutions and mitigation measures. No prior expertise or experience in arms control is required – all workshop participants will benefit from having a variety of perspectives represented.
- A key outcome of the workshop discussion is to have participants rank their identified barriers to arms control and focus on developing concrete suggestions for policy.
- Participants can refer to the following pre-reading material: <https://www.rsis.edu.sg/rsis-publication/idss/ip23085-barriers-to-new-arms-control-regulation-on-ai/>.

Programme

The workshop is divided into two sessions taking place from 0925 – 1045 and 1115 – 1240.

0845 (30 min)	Registration
0915 (10 min)	Overview of Workshop
0925 (20 min)	Polak Game
0945 (60 min)	Guided Discussion Part I – Current and Future Barriers
1045 (30 min)	Morning Break
1115 (50 min)	Guided Discussion Part II – Solutions and Mitigation Measures
1205 (30 min)	Group Sharing
1235 (5 min)	Administrative Brief
1240 (90 min)	Lunch
1410	End of Event

Biographies

John Borrie is Unit Manager for Disarmament, Non-Proliferation and Export Controls at the New Zealand Ministry of Foreign Affairs and Trade. Previously he was Special Adviser for Disarmament, based in Wellington, and Principal Adviser with the New Zealand Permanent Mission in Geneva.

Prior to that, John served in various roles at the United Nations Institute for Disarmament Research (UNIDIR) in Geneva, including as head of its Weapons of Mass Destruction and Other Strategic Weapons Programme, Chief of Research, and chargé d'affaires in late 2020. John also worked on weapons law and policy issues at the International Committee of the Red Cross (2003-04) and was posted to Geneva as a New Zealand diplomat (1999-2002). John's working experience has covered many aspects of arms control, disarmament and humanitarian affairs and he has published widely, including on issues around nuclear weapons, cross-domain strategic dynamics, and autonomous weapons. John has a D Phil (PhD) from the University of Bradford and an Honours Degree from the University of Canterbury. He is the author of *Unacceptable Harm: How the Treaty to Ban Cluster Munitions Was Won* (United Nations, 2010).

Samuel Bresnick is a Research Fellow at Georgetown's Center for Security and Emerging Technology (CSET), focused on AI applications and Chinese technology policy. Previously, he was a Senior Research Analyst at Carnegie China, where he conducted research on U.S.-China relations, Chinese foreign policy, and East Asian security and economic issues. Sam's analysis has been published in *Wired*, *Foreign Policy*, and *The New Republic*, among other outlets. Prior to joining Carnegie, Sam worked as a journalist in Colombo, Sri Lanka and as a teacher in Chiang Mai, Thailand. He holds an AB in Comparative Literature from Brown University and an MA in Asian Studies from Georgetown's Walsh School of Foreign Service.

Dongyoun Cho is a senior researcher in the Security and Technology Programme at the United Nations Institute for Disarmament Research (UNIDIR). Her research focuses on the convergence of security and emerging technologies, including artificial intelligence, autonomy, cyber, and quantum.

As a former Major in the Republic of Korean Army with over 20 years of experience in intelligence, military strategy, defence policy, and the aerospace and defence industry, she brings a wealth of expertise. Additionally, she serves as an Assistant Professor in the Department of Military Studies at Seokyeong University, where she established and led the Centre for Future Defence Technology and Entrepreneurship as a director.

Dongyoun graduated from the Korea Military Academy and holds a master's degree in public administration from the Kennedy School of Government at Harvard University. She was also recognized as a World Fellow (2018) at Yale University.

Simon Cleobury is Head of Arms Control and Disarmament at the Geneva Centre for Security Policy (GCSP). He is a former British Deputy Disarmament Ambassador (2017 – 2023), where he represented the UK at the Conference on Disarmament and other

disarmament fora in Geneva. Prior to that he worked in the Security Council Team and then the Peacebuilding Team at the UK Mission to the UN in New York (2012 – 2016).

Prior to his diplomatic career, he was a corporate lawyer with global law firm Baker McKenzie. Simon obtained a bachelor's degree in modern history at University College London and a master's degree in Historical Research from Oxford University. He studied law at BPP Law School, London.

Briony Daley Whitworth specialises in cyber, digital and technology policy at its intersection with international relations. Briony leads Australia's multilateral cyber and tech engagement, with a particular focus on UN processes discussing cybercrime, international law, and responsible state behaviour. She represents Australia as Head of Delegation to the UN Open Ended Working Group on cyber (OEWG) and the UN Ad Hoc Committee to elaborate a convention on cybercrime (AHC) and serves as Vice Chair to the AHC.

Briony served as Australia's lead negotiator for a protocol to the Budapest Convention on Cybercrime, and as Australia's cybercrime expert to the UN Commission on Crime Prevention and Criminal Justice and UN Intergovernmental Experts Group on Cybercrime. Briony's previous experience at the Commonwealth Attorney-General's Department and Department of Home Affairs focused on cybercrime law reform, telecommunications security policy, and combatting online child exploitation.

Flávio Soares Damico, born in 1960, is a Brazilian career diplomat since 1986 and was ascended to ambassador in 2014. In this capacity, he was assigned to Singapore (2016-2019), to Paraguay (2019- 2022), to the Conference on Disarmament in Geneva (2022-2024) and to Ecuador (2024-). With ample multilateral experience in the political and trade fields, Ambassador Damico participated in various meetings of the WTO during the Doha Development Round in the area of agriculture. Also, was a member of Brazilian delegations to meetings of the United Nations General Assembly (1992-94, 1998- 99 and 2022-23) and Security Council (1994) and led the Brazilian delegation in various meetings of the Non-Proliferation Treaty, Treaty on the Prohibition of Nuclear Weapons, Biological and Toxin Weapons Convention, Convention on Certain Conventional Weapons, Arms Trade Treaty, Anti-Personnel Mines Convention (2022-2024). From 2022 to 2023, Ambassador Damico presided over the Group of Governmental Experts on Lethal Autonomous Weapons Systems of the Convention on Certain Conventional Weapons. From March 2023 to May 2024, chaired the Working Group on Strengthening of the Biological and Toxin Convention, created during the IX Review Conference of the BTWC.

Ambassador Damico is married and has three children.

Tiana Desker is Director (International Security & Emerging Technologies) in the Defence Policy Office at the Ministry of Defence, Singapore. In that role, she oversees arms control and disarmament, with an emphasis on the governance of emerging technologies in the military domain. She has a particular focus on the domains of AI and autonomy, cyber, and outer space. Tiana has represented Singapore at the UN Group of Governmental Experts on Lethal Autonomous Weapons Systems and the UN

Open Ended Working Group on Reducing Space Threats. Tiana holds a concurrent appointment as Director (Strategic Futures) at the Ministry of Defence. In that role, she oversees scenario planning and contingency planning exercises. Earlier in her career, Tiana was Deputy Head of the Centre for Strategic Futures, a think tank within government. She also worked on digital government and public sector reform initiatives. Tiana began her career as a policy analyst in the Ministry of Defence covering Southeast Asia. She holds a B.A. in History and an M.Sc. in Management of Innovation.

Han Hua is Associate Professor and Director of the Center for Arms Control and Disarmament at the School of International Studies (SIS), Peking University, China. She teaches courses in International Arms Control, Disarmament and Non-Proliferation, and IR and nuclear deterrence in South Asia, International Relations Theory. Her research interests cover nuclear-related deterrence and strategic stability both in regional and global perspectives. She has led programs and projects on those areas. Han Hua has been a visiting researcher at Belfer Center, Harvard University, USA; School of International Affairs, Georgia Institute of Technology, USA; Stockholm International Peace Research Institute (SIPRI), Sweden; etc.

Manoj Harjani is a Research Fellow and Coordinator in the Military Transformations Programme (MTP) within the Institute of Defence and Strategic Studies at the S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University. Prior to joining MTP, Manoj was part of the Future Issues and Technology research cluster at RSIS, where he worked on building up the school's research agenda and networks at the intersection of science, technology, and national security.

Manoj began his career in the Singapore Public Service, with stints at the Ministry of Trade and Industry and Centre for Strategic Futures, where he held roles focusing on analysing long-term trends and building up public sector capabilities in futures thinking and scenario planning. He was also part of a team at the Public Service Division under the Prime Minister's Office which led an initiative to build the public sector workforce's digital capabilities.

Manoj holds a Bachelor of Arts in Political Science from the National University of Singapore.

He Qisong graduated from Fudan University in 2002 with a Ph.D. In 2011, he was a visiting scholar at the University of Hamburg, Germany. He Qisong is a professor at the East China University of Political Science and Law, where his research focuses on space, cyber, maritime and nuclear issues.

Michael Karimian is a Director on Microsoft's Digital Diplomacy team for which he has responsibility for Asia and the Pacific. In this role Michael works with governments, civil society, and the private sector to promote responsible behaviour in cyberspace. The work includes a mix of multistakeholder diplomacy, capacity building, confidence building, data and research. Michael was previously a Director on Microsoft's Human Rights Team.

Prior to joining Microsoft, Michael worked in trade finance at the Royal Bank of Scotland in London, and in business and human rights at the UN in Bangkok. Michael has a BA in Management from the University of Nottingham, an MA in International Relations from the University of Durham, and an MPA from Columbia University.

Feroz Khan is a Research Professor in the Department of National Security Affairs of the U.S. Naval Postgraduate School. Prof. Khan is a former Brigadier in the Pakistan Army. He served domestically and abroad with numerous assignments in the United States, Europe, and South Asia. He last held the post of Director, Arms Control and Disarmament Affairs, in Pakistan's Strategic Plans Division, Joint Services Headquarters.

Khan holds an M.A. in International Relations from SAIS, John Hopkins University and has held visiting fellowships at Stanford University, the Woodrow Wilson International Center for Scholars, the Brookings Institution, and the Sandia National Lab in New Mexico. He has many published articles, books chapters, and papers, and regularly participates in numerous security-related national and international conferences and seminars. Feroz Khan is the author of the well-reviewed *Eating Grass: The Making of the Pakistani Bomb* (Stanford University Press, 2012) and *Subcontinent Adrift: Strategic Futures of South Asia* (New York: Cambria Press, 2022).

Tal Mimran is an Associate Professor at the Zefat Academic College, and the Academic Director of the International Law Forum of the Hebrew University. Tal is also a fellow at the Federmann Cyber Security Research Center in the Law Faculty of the Hebrew University, and head of a program on law & technology at Tachlith Institute.

In the past, Tal worked as a Legal Adviser in the Israeli Ministry of Justice, representing Israel before UN human rights bodies, and he served for a decade as an operational legal adviser in the Military Advocate General at the IDF (in reserve duty), consulting about international law issues.

Ng Pak Shun joined the Republic of Singapore Air Force in 2000 as an Air Warfare Officer (Air Battle Management). BG Ng graduated from the French Command & Staff Course in 2012 and the Indonesian Joint Command & Staff Course in 2018. During his career, he held various command and staff appointments, including Senior Assistant Director of Research and Enterprise Division at the Ministry of Trade and Industry, Commanding Officer of 200 Squadron, and Deputy Director of Defence Policy Office at the Ministry of Defence. He was appointed Head of Air Training Department in Jan 2019 and Head of Air Plans Department in Feb 2020, prior to his appointment as Commander Air Defence and Operations Command in Jan 2021.

BG Ng assumed his current appointments as Group Chief, Policy & Strategy and Group Chief, Plans & Transformation in Mar 2022.

BG Ng is a recipient of the SAF Overseas Scholarship and graduated with a master's degree in international relations and bachelor's degrees in economics and public policy studies from the University of Chicago. He then received a bachelor's degree in translation & interpretation (English/Chinese) from the Singapore University of Social

Sciences, and a master's degree in sciences historiques, philologiques et religieuses from the Ecole Pratique des Hautes Etudes. He is a recipient of the SAF Postgraduate Award, and most recently graduated with a Master of Business Administration from the Massachusetts Institute of Technology – Sloan School of Management.

Ankit Panda is the Stanton Senior Fellow in the Nuclear Policy Program at the Carnegie Endowment for International Peace. An expert on the Asia-Pacific region, his research interests range nuclear strategy, arms control, missile defence, non-proliferation, emerging technologies, and U.S. extended deterrence. He is the author of *Kim Jong Un and the Bomb: Survival and Deterrence in North Korea* (Hurst Publishers/Oxford University Press, 2020).

Panda was previously an adjunct senior fellow in the Defense Posture Project at the Federation of American Scientists (FAS) and a member of the 2019 FAS International Study Group on North Korea Policy. He has consulted for the United Nations in New York and Geneva on non-proliferation and disarmament matters and has testified on security topics before the U.S. Senate Armed Services Committee and the congressionally chartered U.S.-China Economic and Security Review Commission.

Guangyu Qiao-Franco is an Assistant Professor of International Relations at Radboud University and a Senior Researcher of a European Research Council-funded project AutoNorms that investigates international regulations surrounding military AI. Her recent publications from this project include a special issue with *Global Society* that features various interdisciplinary studies on algorithmic warfare (co-edited with Prof. Ingvild Bode), and several journal articles and reports on the evolution of Chinese AI policy. She is currently working on articles on dual-use technologies-related export controls and China's policymaking on AI and arms control.

She actively promotes Track-Two dialogues between China and Europe in the area of emerging technologies and is a member of the European delegations to the Sino-Europe Cyber Dialogue and the Europe-China Expert Working Group on AI and International Security. She is also an active member of various AI-related networks, including the Interdisciplinary Hub for Digitalization and Society of Radboud University, the Defense AI and Arms Control Network, and the Hague Program on International Cyber Security.

Kumar Ramakrishna is Professor of National Security Studies, Provost's Chair in National Security Studies, Dean of the S. Rajaratnam School of International Studies (RSIS), as well as Research Adviser to the International Centre for Political Violence and Terrorism Research, at RSIS. Prior to his current appointments, he was Head, International Centre for Political Violence and Terrorism Research (2020- 2022), Head, Centre of Excellence for National Security (2006-2015) and Head, National Security Studies Programme (2016 to 2020). He was also Associate Dean for Policy Studies (2020 to 2022).

A historian by background, Professor Ramakrishna has been a frequent speaker on counterterrorism before local and international audiences, a regular media commentator on counterterrorism, and an established author in numerous

internationally refereed journals. His first book, *Emergency Propaganda: The Winning of Malayan Hearts and Minds 1948-1958* (2002) was described by the International History Review as “required reading for historians of Malaya, and for those whose task is to counter insurgents, guerrillas, and terrorists”. His second major book, *Radical Pathways: Understanding Muslim Radicalisation in Indonesia* (2009) was featured as one of the top 150 books on terrorism and counterterrorism in the respected journal *Perspectives on Terrorism*, which identified Professor Ramakrishna as “one of Southeast Asia’s leading counterterrorism experts”. His recent research has focused on understanding, preventing and countering violent extremism in Southeast Asia. His latest book is *Extremist Islam: Recognition and Response in Southeast Asia* (New York: Oxford University Press, 2022).

Michael Raska is Assistant Professor in the Military Transformations Programme at the S. Rajaratnam School of International Studies, Nanyang Technological University in Singapore. His research and teaching focus on defence and military innovation, projecting the impact of AI and emerging technologies on international security and future conflicts, and mapping security challenges posed by the cyber revolution.

He is the author of *Military Innovation and Small States: Creating Reverse Asymmetry* (Routledge, 2016), co-editor of *The AI Wave in Defence Innovation* (Routledge, 2023), *Defence Innovation and the 4th Industrial Revolution* (Routledge, 2022), and *Security, Strategy and Military Change in the 21st Century: Cross-Regional Perspectives* (Routledge, 2015). He has published in academic journals such as the *Journal of Strategic Studies*, *Strategic Studies Quarterly*, *Prism – Journal of Complex Operations*, *Air Force Journal of Indo-Pacific Affairs*, *Korea Journal of Defence Analysis*, and *Journal of Strategic Analyses*. His contributions also include chapters in edited volumes, policy reports, and commentaries, including collaborative projects with the Center for New American Security, Defence AI Observatory at the Helmut Schmidt University of the Bundeswehr, Hague Centre for Strategic Studies, Institute for Security Policy at Kiel University, International Institute for Strategic Studies, National Institute for Defence Studies Japan, Norwegian Institute of Defence Studies, Strategic Studies Institute at the US Army War College, Swedish Defence University, and UC Institute on Global Conflict and Cooperation.

Dr Raska has taught courses and seminars at the SAF Goh Keng Swee Command and Staff College, and his recent teaching experiences include visiting fellowships at the Australian War College, and invited lectures, seminars, and briefings advising on military AI for select professional military education institutions and defence colleges in Europe, East Asia, and the U.S. In Singapore, he has contributed research and teaching for the Ministry of Defence, Defence Science and Technology Agency, and all service branches of the Singapore Armed Forces. In 2024, he was selected as a member of the expert advisory group for the Global Commission on Responsible Artificial Intelligence in the Military Domain (GC REAIM).

Arun Sukumar is assistant professor of global security and technology at the Institute of Security and Global Affairs, Leiden University. He is a lawyer by training from NALSAR, with a PhD in international relations from The Fletcher School at Tufts University. He is the author of *Midnight's Machines: A Political History of Technology in*

India (Penguin RandomHouse India, 2019), which was listed among Bloomberg's Best Books of 2020, and won the Ramnath Goenka Award for Best Non-Fiction (2019). Arun is the co-editor of *Building an International Cybersecurity Regime: Multistakeholder Diplomacy* (Edward Elgar Publishing, 2023) and *Responsible State Behaviour in Cyberspace: Global Narratives and Practice* (EU Publications Office, 2023). He is currently working on a monograph on international cybersecurity law and an edited volume on the protection of core internet infrastructure located around the world from cyber operations. His work has been published in *Contemporary Security Policy*, *Policy & Internet*, *IEEE-CyCon Proceedings*, among other journals. Arun served on the board of the Digital Public Goods Alliance in 2022-23 and was previously part of the World Economic Forum's Global Future Council on the Digital Economy and Society.

Virpratap Vikram Singh is a Research Fellow for the Cyber Power and Future Conflict programme at the International Institute for Strategic Studies, which explores global strategic competition and future warfare, with a focus on emerging cyber strategies, and rapidly advancing information and communication technologies.

Prior to joining the IISS, Virpratap was the Research and Program Coordinator for the Cyber Program at Columbia University's School of International and Public Affairs in New York City. As the Competition Director for the NYC Cyber 9/12 Strategy Challenge, co-hosted by the Atlantic Council and Columbia SIPA, he played a key role in designing and organising the cyber crisis competition, which engaged over a thousand students. He formerly worked as a consultant for the Atlantic Council, where he co-authored a report on maritime cybersecurity. A 2020 graduate of Columbia SIPA's Master of International Affairs programme, Virpratap previously managed publishing and content for Gateway House in Mumbai, where he anchored their flagship podcast series. Virpratap's work has been published by the NATO Cooperative Cyber Defence Centre of Excellence, the Council on Foreign Relations, the Atlantic Council, Observer Research Foundation India and OODA Loop.

Olga Volynskaya is a qualified international lawyer with 17 years of academic and practical experience in space law, policy and diplomacy. She was Chief International Law Advisor of the Russian space agency, then practised space law at the Russian Ministry of Foreign Affairs. In 2020, Dr Olga joined the academia full time and introduced her author courses on space law at the Space Research Department of Moscow State University (Russia). In her current affiliation as Assistant Professor of the College of Law at Prince Sultan University, Dr Olga is promoting space law education and research in Saudi Arabia. In 2024 she coached the first-ever Saudi student team which successfully participated in the International Space Law Moot Court Competition and was granted the Spirit of Lachs award.

Dr Volynskaya has extensive expertise in academic legal research and teaching. She is author and co-author of 88 scientific publications, lectured on space law and policy in universities of France, Germany, Japan, the Netherlands, Russia, Saudi Arabia and South Africa. Olga is a member of the International Institute of Space Law (IISL) and academician of the Tsiolkovsky Russian Academy of Cosmonautics.

Yeo Seow Peng was appointed the Executive Director of the ASEAN Defence Ministers' Meeting (ADMM) Cybersecurity and Information Centre of Excellence, or ACICE, in September 2022.

ACICE is an initiative that was approved by the ASEAN Defence Ministers in 2021 to promote cooperation on cybersecurity and information threats through information sharing and capacity building. As the Executive Director, Ms Yeo oversees the work of three centres; namely the Cybersecurity Centre; the Information Centre and the Research Centre. She also builds networks and partnerships with ASEAN's partners, regional and international organisations as well as academics and industry players that bring relevant expertise to contribute to ACICE's objectives and scope of activities.

Prior to this current appointment, Ms Yeo was the Director for ASEAN and International Affairs at the Defence Policy Office, Ministry of Defence of Singapore. Ms Yeo has built her career in the Defence Policy Office upon graduating from the National University of Singapore. Over the years, she has assumed various appointments in the Ministry and spent most of her time working on multilateral issues and the regional security architecture, including issues related to ASEAN and the United Nations.

About the Military Transformations Programme

The **Military Transformations Programme (MTP)** was established in 2003. It aims to develop policy-relevant and scholarly expertise on issues arising from the development, adoption, and use of disruptive technologies by militaries.

Priority areas for MTP's research include:

1. Military innovation - understanding the impact of disruptive technologies on the development of new types of armaments and other military equipment that may lead to novel capabilities and advantages for militaries in the long term (i.e., out to 2040). These include advances in AI, autonomous systems and quantum technologies, among others, as well as their strategic and operational interactions.
2. Military-strategic competition - assessing the relative strengths and weaknesses of militaries and their sources of competitive advantage derived from disruptive technologies, and the implications of this for regional strategic stability.
3. Governance and norms - monitoring militaries' approaches to governance of disruptive technologies across different domains, e.g., in cyberspace and outer space. This includes the emergence of non-binding norms, arms control measures, multilateral dialogue, and application of international law.

About the Institute of Defence and Strategic Studies (IDSS)

The **S. Rajaratnam School of International Studies (RSIS)** is a global think tank and professional graduate school of international affairs at the Nanyang Technological University, Singapore. An autonomous school, RSIS' mission is to be a leading research and graduate teaching institution in strategic and international affairs in the Asia Pacific. With the core functions of research, graduate education, and networking, it produces research on Asia Pacific Security, Multilateralism and Regionalism, Conflict Studies, Non-traditional Security, Cybersecurity, Maritime Security and Terrorism Studies.



IDSS comprises nine research programmes, namely: China, Indonesia, Malaysia, Maritime Security, Military Studies, Military Transformations, Regional Security Architecture, South Asia, and the United States. The Military Studies Programme focuses on professional military education for the Singapore Armed Forces.

For more details, please visit www.rsis.edu.sg and www.rsis.edu.sg/research/idss. Join us at our social media channels at www.rsis.edu.sg/rsis-social-media-channels or scan the QR code.