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ARMS RACE IN THE 21ST CENTURY: CONSEQUENCES AND MITIGATING MEASURES

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ABSTRACT

Historically, arms races generate a great deal of interest both in the academia and policy circles for a variety of reasons. They are widely believed to have significant consequences for states' security. In the debate over their consequences, one side holds that arms races increase the probability of war by undermining military stability and straining political relations. The opposing view holds that engaging in an arms race is often a state's best option for avoiding war when faced with an aggressive adversary. The 21st Century is witnessing the return of arms race amongst states. Coupling with the advancements in technology, the menace of arms race in the 21st Century, therefore, if not curtailed could lead to war more devastating than witnessed in the last century. Using basic content analysis the study revealed that the 21st Century arms races are mainly in the area of nuclear weapons, hypersonic missiles, missile defence, cyber-warfare, and space weaponisation. The arms races are prominently amongst the world's great powers such as the United States of America, Russia, and China as well as developing states like Iran and North Korea. This study discovered that nuclear weapons are still at the forefront of arms race in the 21st Century, despite efforts to reduce their role in global affairs and to negotiate further reductions in quantity. Also, states like the USA, China, and Russia are exploiting the advantage of speed and manoeuvrability to engage in arms race in hypersonic missiles. This has prompted nations to compete in the development of missile defences in order to counter the present missile threats. Furthermore, in anticipation for future warfare, nations such as the USA, China, and Russia are in arms race to weaponsise space by deploying space to space, earth to space and space to earth weapons, where appropriate. War in the 21st Century could in turn lead to more human, material, and environmental casualties due to the latest advancement in technologies and modernisation of existing weapons and associated equipments. Consequently, measures are needed to ensure that arms races in the 21st Century, if not eliminated, are reduced to the barest minimum in order to promote international peace and security. Renewed commitments on existing arms control measures, formulation of new arms control measures, and the complete elimination of nuclear weapons are the measures that could be considered.

INTRODUCTION

An arms race occurs, when two or more nations intentionally increase the quantity and quality of their military resources with a view to gaining military and political advantage over the others. Globally, arms race is run by a much larger number of contestants, often referred to as

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Nuclear Weapon States (NWS). These countries are the USA, China, Russia, Israel, India, France, Britain, North Korea and Pakistan. Due to the technological advancement of the 21st Century, the new arms race would have superior destructive strategic capabilities and potential of being widely spread faster than in any other previous period in history. According to Lamrani (2018), there has been violations of the treaties and agreements endorsed by both the USA and Russia during the Cold War to reduce nuclear weapons in their inventories.

The Pentagon, on 19 January 2018, released a US National Defence Strategy, which highlighted strategic struggle as the main hindrance to US prosperity and security as Russian and Chinese military capabilities increase (Department of Defence, 2018a). This concern was further expressed a month later by the US Secretary of Defence that, considering the steady expansion of the Russian and Chinese nuclear arsenals, the US could no longer continue to abide by the nuclear arms reduction treaties. At the same time, the US Ballistic Missile Defence Review, completed in October 2018, emphasised the need for the US to reinforce its missile defences to prevent possible attacks as strategic competition builds.

The Department of Defence (2018b) pointed out that the USA is preparing to introduce new nuclear weapons such as a low-yield warhead for Submarine-Launched Ballistic Missiles (SLBM). The use of the SLBM is to provide greater speed, flexibility and stealth capability thereby giving it greater security to the protection of nuclear arsenals.

According to the World Nuclear Association (2018), there are 448 operable nuclear plants by 30 countries across the globe used to generate electricity and 59 new nuclear reactors are undergoing construction. Furthermore, there are 28 countries looking for support to develop nuclear energy to generate electricity. Consequently, improvement in Missile Defence Systems (MDS), hypersonic missiles, and space militarisation and cyber-technology, among others, have combined to exponentially increase military spending across the globe. Generally, arms race among states erodes global stability mainly due to the non-compliance of arms control treaties and agreement among states as well as the rise of disruptive weapons technology.

The descriptive nature of scholarship in this area is a little worrisome. This research therefore sought to identify and critically analyse the aforementioned current trends and problems in the global arms races with a view to suggesting a mitigating circumstances. This research is significant basically in two main areas. Firstly, the analysis of the latest trend in 21st Century arms race is to aid political leaders, policymakers, military officials, security experts and relevant stakeholders to chart a way of regulating the arms race in order to ensure that it does not lead to war. The suggested solution to this arms race saga are through negotiations, diplomacy, public awareness, sanctions and enforcement where necessary. Secondly, it would serve as a basis for future researchers to conduct further studies into the subject matter. The scope of this study covered mainly a period from year 2000 to 2019. This range was chosen because it marked the end of the 20th Century and the first two decades of the 21st Century.

The Impetus for Arms Race

The main impetus for arms races is the desire to own pre-eminence in deterrence. Four main factors underlie the desire: capabilities; security; international norms and perception; and domestic political context. Capabilities entail bringing together both the technological and economic capabilities of states to engage in an arms race. The traditional motivations for states to struggle in arms acquisition has been focussing on security. On international norms and perception, states are motivated to acquire weapons more favourable, in order to increase their status and prestige. Domestic political context focusses on domestic political factors as drivers for decisions to acquire nuclear weapons.

LATEST ARMS RACE TRENDS

According to Stockholm International Peace Research Institute (SIPRI), there is steady growth on military spending from the beginning of the 21st Century till date (SIPRI, 2019). This trend is more discernible within the NWS which are often in strategic competition (arms race) with each other. The huge resources are used mainly in the development of nuclear weapons, hypersonic missiles, missile defences, Artificial Intelligence (AI), bio-convergence and cyber-warfare as well as weaponisation of space.

Nuclear Weapons

The global nuclear weapon holdings have been on the decrease since after attaining a peak value of approximately 70,000 warheads in the mid-1980s with Russia and USA accounting to nearly 93 % (Kristensen and Norris 2019). This could be attributed largely to the mass reduction in the quantity of nuclear weapons by the USSR and USA through their various arms treaties and agreements. Presently, the overall number of nuclear weapons in the world continues to drop but the NWS are maintaining and modernising their current nuclear arsenals. The US Department of Defence (2018b) highlighted that the modernisation is mostly in the area of low-yield (tactical) nuclear weapons instead of high-yield (strategic) and super-fuse warheads aimed at enhancing the effectiveness of weapons against hardened targets. In total, the nine NWS as of 2018 possessed nearly 14,465 nuclear weapons which are lower compared with about 14,935 for 2017. Figure 1 shows a global spread of nuclear weapon stockpiles for 2019 totalling about 13,435.

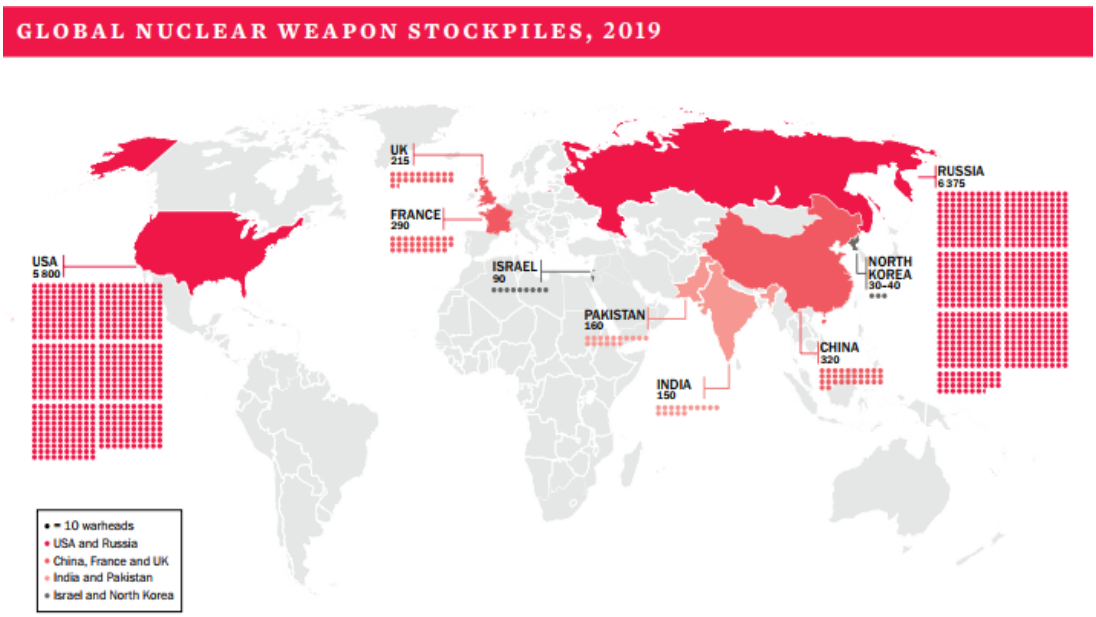

Figure 1: Global nuclear weapon stockpiles for 2019. Source: SIPRI Report 2020.

However, in spite of efforts to reduce the role of nuclear weapons in global affairs and to negotiate further reductions in the quantity of nuclear weapons, some states have not reduced the role of nuclear weapons in their national strategy and the number of nuclear weapons in their inventory (Department of Defence, 2018b). States such as China, Russia and the USA have introduced national policies, indicating the use of nuclear weapons and their associated delivery systems. India, Pakistan, North Korea, and even China are systematically increasing their nuclear holdings in the 21st century.

China continues to increase the number, modernisation, capabilities and protection of its nuclear forces. This is in line with the vision of the Chinese President to fully transform Chinese military into a first tier force by 2050 (Grossman & Chase, 2017). China's future intent is uncertain due to lack of transparency regarding the scope and scale of its nuclear modernisation programmes (Cordesman, 2018). China has continued fielding a new variant of nuclear medium-range ballistic missile, an improved road-mobile launcher for an existing ICBM. Furthermore, China has developed a new multi-warhead version of its DF5 silo-based ICBM as well as advanced submarine ballistic missile armed with new SLBM. In order to attain a nuclear triad, China is presently developing a new nuclear-capable bomber (Department of Defence, 2018b). This is in addition to already

deployed nuclear-capable precision guided DF-26 IRBM capable of attacking both land and naval targets.

Figure 2: Chinese DF 41 Intercontinental Ballistic Missile. Source: (Bora 2017).

Figure 2 shows a picture of DF-41 ICBM, one of the latest Chinese nuclear weapons of the 21st Century. The missile's range of 12,000 km and top speed of over Mach 10 indicate its ability to strike anywhere in the world from mainland China. Additionally, the ICBM can carry up to 10 nuclear warheads each of which can target separately (Kwong 2017). An overview of the Chinese nuclear weapons variants of the 21st Century and their associated capabilities is contained in a Supplementary document to this report. Also contained is the 21st Century nuclear weapons of Russia, USA and North Korea.

Evidently, Russia has an edge over other NWS in its production capacity on both strategic and non-strategic nuclear forces through active modernisation of its nuclear weapons (Department of Defence, 2018b). The modernisation coupled with an intensification in the number and size of military exercises and usual overt nuclear threats against other states add to the indecision about Russia's long-term intents. These issues according to Kristensen and Korda (2019) generate augmented defence spending, nuclear modernisation programmes and political antagonism to further nuclear weapons in Western Europe and the USA.

RS-28 Sarmat, RSM 56 (Bulava) and SU-34 Fullback are some of the Russia's nuclear triad of the 21st Century for land, sea and air launched respectively (Kristensen and Korda 2019). RS-28 Sarmat shown in Figure 3 is an ICBM with a range of 10,900 km and a speed of about Mach 20.7 and was to be deployed in 2020. Also, it can carry a 10-ton nuclear payload capable of creating an explosion 2,000 times greater than the one used by the USA to destroy Hiroshima during the World War II in 1945 (Shackleton 2017).

Figure 3: RS-28 Sarmat Intercontinental Ballistic Missile. Source: (Shackleton 2017).

Additionally, Russia is simultaneously developing and deploying a huge, diverse and modern set of non-strategic systems that could be armed with either conventional or nuclear weapons (Kristensen and Norris 2012). The exploitation of these non-strategic weapons by Russia could be attributed to the fact that these weapons are not accountable under the New START. Figure 4 shows an SSC-8 GLCM (9M729), one of the latest non-strategic nuclear weapons deployed in 2017.

Figure 4: SSC-8 Ground Launched Cruise Missile. Source: (Majumdar 2017).

The USA's 2018 Nuclear Posture Review (NPR) as directed by the President was aimed at ensuring a safe, secured and effective nuclear deterrent that would protect the US, allies and partners, and above all deters adversaries (Department of Defence, 2018b). The President also highlighted the long-term goal of eliminating nuclear weapons as well as the need for the USA to have modern, flexible, and resilient nuclear capabilities that are safe and secured until such a time that the nuclear weapons could be completely eliminated globally. The USA led the world for years in efforts to decrease the role and number of nuclear weapons. Within the period, the US nuclear weapons stockpile were reduced to more than 85% from its Cold War stock (Kristensen 2014). However, Russia, China and North Korea are increasingly using nuclear weapons to attain dominance in the international affairs in the 21st Century. In the 21st Century, the

USA has deployed only one of its nuclear triad namely Minuteman III ICBM, Trident II D5 and F-35A bomber aircraft in 2006, 2008 and 2017 respectively (Department of Defence, 2018b). Figure 5 shows a picture of the F-35A aircraft used by the USA for strategic mission.

Figure 5: The USA's F-35A aircraft. Source: (Trevithick 2018).

In view of this, the 2018 NPR affirms the USA's modernisation programmes of its nuclear ballistic missile submarines, strategic bombers, nuclear air-launched cruise missiles, ICBMs and other associated equipment. This is in order for the USA to be at par or even ahead of its perceived adversaries in nuclear weapons capabilities.

For the past two decades, North Korea has hastened its confrontational quest for nuclear weapons and missile capabilities (Department of Defence, 2018b). The country has equally expressed overt threats to use its nuclear weapons against the USA and its allies in the Korean Peninsula. Also, it is only a few months away from possessing the capability to strike the mainland USA with nuclear-armed ballistic missiles (Revere 2018). BBC News (2017) reported that North Korea has continued to produce plutonium and highly-enriched uranium for nuclear weapons and since 2006, it has conducted six nuclear tests.

Hypersonic Missiles

A hypersonic missile is so far the fastest missile in the 21st Century because it travels at least five times the speed of sound (Mach 5) which is equivalent to 1,715 m/s (Macias, 2018). However, according to NASA (2019), most ballistic or cruise missiles in the world travel at either subsonic (less than Mach 1) or supersonic (between Mach 1 and 4) speeds. Hypersonic missiles are designed to carry nuclear warheads or use their high speeds and accuracy to destroy targets with the kinetic energy impact alone.

Basically, hypersonic missiles could be either cruise missiles or glide vehicles. The hypersonic cruise missiles are powered by rockets or high speed jet engine throughout its flight and this enables the missile to travel at extreme speeds in excess of Mach 5 (Peake 2017). These missiles are simply the faster versions of the existing cruise missiles like Tomahawk. In hypersonic glide vehicles, the missile is initially propelled into space on an arching trajectory above existing ballistic missiles where the warheads are released and fall towards the atmosphere at hypersonic speeds on to its target (MDAA, 2018).

Hypersonic missiles offer a number of advantages over the existing cruise and ballistic missiles particularly with regard to the prosecution of time-critical targets where the additional speed and manoeuvrability of a hypersonic weapon is valuable (Muspratt, 2018). The current ballistic missiles are very fast but not manoeuvrable and reverse is the case for the current cruise missiles (The Economist 2019).

Another advantage of hypersonic missile is that there is no operational MDS that is capable of intercepting the hypersonic missile (Muspratt, 2018). This assertion was further affirmed by the Pentagon that the MDS of the US could not stop the current hypersonic missiles from penetrating their defences (Peck 2018). Therefore, the development and subsequent deployment of hypersonic missiles would avail states with significantly enhanced strike capabilities and potentially the means to coerce. This could justify the rationale behind advanced countries with powerful militaries like Russia, China and the USA struggle to develop hypersonic weapons.

Russia possesses a series of hypersonic weapons to comply with its 2010 Military Doctrine that called for long and short-range military projection capabilities to enable it compete with the USA and the European NATO members. These missiles include the U-71, Yu-74, BrahMos II and the 3m22 Zircon (Wang, 2016). Additionally, Russia has deployed Kh-47M2 Kinzhal, an operational air ballistic hypersonic missile capable of attaining a speed of Mach 10 and a range of 2,700 km (Mizokami, 2019a). Also, 3K22 Tsirkon (also known as Zircon), a sea and ground launched hypersonic missile with Mach 9 speed and an operational range of about 1,000 km was launched in 2012. In 2018, Russia developed its first and fastest ICBM launched hypersonic glide vehicle, Avangard which can deliver both nuclear and conventional payloads at a speed of Mach 27 (Novichkov 2019). Figure 6 shows a picture of the Russian Avangard hypersonic missile in flight. Other hypersonic missiles produced by the Russian Federation and their features are summarised in Table 1.

Figure 6: Russian Avangard hypersonic missile in flight. Source: (Wang, 2016).

Table 1: Overview of hypersonic missiles produced by Russia, China and the USA.

Missile name	Speed (Mach)	Range (km)	Warhead	Status	Year
			RUSSIA		
Yu-71	9	5,500	Nuclear/Conv.	In development	2015
BrahMos II	7	600	-	In development	2019
3M22 Zircon	9	1,000	-	In development	2018
Kh-47M2 Kinzhal	10+	2,000	Nuclear/Conv	Deployed	2017
Yu- 74	10		Nuclear	In development	2015
Avangard,	20+	6,000 +	Nuclear/Conv	In development	2018
			CHINA		
DF-17	-	1,400	Nuclear/Conv	In development	2017
DF-ZF	10	2,100	Nuclear/Conv	In development	2017
Starry Sky-2	6	-	-	In development	2018
			USA		
Arrow AGM-183	20	-	-	In development	2018
Hacksaw HCSW	-	-	-	In development	2018
AHW HGB		8,000	-	In development	2011
Boeing X-51	-	-	-	In development	2019
X-51A Wave rider	6	740	-	In development	2010
SR-72 Son of Blackbird	6+	-	-	To commence development	2020
Falcon HTV 2	20	-	-	In development	2010

China has produced an array of hypersonic missiles from its ongoing hypersonic projects. Some of the prominent missiles are the DF-17 and DF-ZF (Weitz 2019). The former is a ballistic missile-launched hypersonic glide vehicle designed to attain a maximum speed of Mach 10 and a range of about 2, 400 km (MacDonald and Pettit 2017). The latter which is shown in Figure 7 is a short to mid-range hypersonic glide vehicle that would be able to fulfil a long term strategic goal by mitigating any potential threat emerging from an adversary carrier groups (Muspratt, 2018).

Figure 7: Chinese DF-ZF hypersonic missile. Source: (Weitz, 2019).

Furthermore, China has conducted tests on its newly developed Starry Sky-2 hypersonic vehicles that could attain a top speed of Mach 6, change direction mid-flight and can carry a payload consisting of either conventional or nuclear warheads (Fedschun 2018). Other Chinese hypersonic weapons and their characteristics are also listed in Table 1.

The USA unlike Russia and China has not given much attention on the operational deployment of hypersonic missile capabilities (United Nations, 2019). It is trailing more advanced systems capable of long-range conventional precision strike as opposed to nuclear-armed weapons where accuracy is not much of a priority. Whilst the USA relies deeply on its nuclear-powered aircraft carrier groups to project power, Russia and China could use their hypersonic missiles to hit USA's carrier groups before reaching an operational range to launch airstrikes. This is so because the US F-35 stealth fighter jets have a combat radius of about 720 km-960km whereas hypersonic missiles usually have a range in excess of 1,900 km.

In order for the USA to bridge the existing gap with Russia and China with regards to missile technology, the Pentagon earmarked an average of over $2 billion per year from 2014 in developing hypersonic weapon systems for the US Army, Navy, and Air Force (Thompson 2019). The USA is currently developing a range of advanced hypersonic weapon systems ranging from hypersonic conventional strike weapon to air-launched rapid response weapon (Dolan, Gallagher and Mann 2019). Figure 8 shows a Boeing X-51 hypersonic missile being developed by the USA. Other hypersonic missiles undergoing development in the USA are listed in Table 1.

Figure 8: US Boeing X-51 hypersonic missile. Source: (US Air Force, 2011).

Missile Defence

The present global trends show that ballistic missile systems are becoming more flexible, reliable, mobile, accurate, durable and with extended range. This makes the ballistic missile threat rising both quantitatively and qualitatively and is possible to continue over the next decade. Consequently, states are investing in the development of missile defences to counter the existing missiles threats. However, advanced countries like the USA, Russia and China are perturbed that as missile defence technology is enhanced and becomes more dominant, it would render their modest arsenal futile (Department of Defence, 2019a). The USA is currently in the early lead of MDS and this had impelled Russia and China to keep working on their own MDS and also prompted them to beef up their offensive weapons (Lamrani 2018).

Russia remodels and maintains its enduring strategic MDS including the nuclear armed interceptors deployed around Moscow (Bodner 2018). The country has fielded different variants of mobile missile systems and shorter range

throughout Russia. Additionally, Russia is evolving a various suite of ground-launched and directed-energy anti-satellite weapon capabilities. It also continues to launch experimental satellites that conduct sophisticated on orbit activities to advance its counter-space capabilities.

In March 2019, Russia tested its latest Pantsir-SM MDS which has an extended range of up to 40 km and high efficiency against ultra-small targets (Frantzman 2019). A month later, the Russian Armed Forces disclosed the development of S-500 MDS that would be a successor to the existing S-300 and S-400 (Staff 2019). Although the specifications of S-500 remain undisclosed, the MDS is reportedly capable to neutralise targets up to 600 km away. It could be able to track and concurrently strike up to ten ballistic targets moving at speeds of about 7 km/s (Litovkin 2019). Defence World (2019) indicated that Russia is set to deploy S-350 MDS that will be responsible for the defence of the administrative, political centres, important objects and regions within the country.

China is vigorously trailing a wide range of mobile MDS capabilities including the purchase of S-400 systems from Russia (Gady 2019). This is in addition to emergent theatre ballistic MDS as well as testing a new mid-course MDS (Department of Defence, 2019a). A report from the Defence Intelligence Agency (2019) highlighted that China is developing anti-satellite weapons and continued to launch experimental satellites that could conduct complex on-orbit actions to advance its counter space capabilities.

The USA for the past 17 years has dedicated momentous efforts to developing and deploying a layered MDS (Department of Defence, 2019a). These efforts have led to the sustained development in the USA, allied, and partner missile defence performance and affordability. Presently, the USA had established a policy framework, a Missile Defence Review (MDR) that is reactive to new challenges and explore novel approaches to the defensive mission (ibid). The MDR implements a balanced and fused approach to opposing missile threats via a combination of deterrence, active and passive defences as well as attack operations. The current US MDS caters for mid-course and terminal flight missiles threats. Whilst SM-3, Ground Based interceptor and Aegis ships BMD systems are for mid-course flights, THAAD, PAC-3 and Sea-based Terminal are intended to neutralise enemy's missile on terminal flight (Defence Intelligence Agency 2019). In 2016, a latest version of the US MDS, Aegis Ashore shown in Figure 9 was launched (Williams 2018). The system incorporates a land-based versions of the various components used on Aegis ships. It is intended to serve as a midcourse defence against medium and short range missiles. Table 2 indicates the 21st Century's MDS of the USA and Russia. Based on the available information, the USA has deployed five MDS in the 21st Century as against four for Russia.

Figure 9: Aegis Ashore Ballistic Missile Defence System Source: (Williams 2018).

Table 2: Overview of the 21st Century Missile Defence Systems.

Type	Manufacturer	Status	Year	Max Range (km)
S-400 Triumf	Russia	Deployed	2007	400
S-500	Russia	To be deployed	2020	600
S-350E	Russia	Deployed	2017	120
S-350	Russia	-	-	-
Pantsir SM	Russia	-	2019	-
Patriot PAC-3	US	Deployed	2003	-
GMD System	US	Deployed	2018	-
THAAD	US	Deployed	2008	200+
SM-3 Blk IIA	US	Deployed	2018	2,500
RIM-161 SM-3 missile system	US	Deployed	2005	900
Aegis Ashore	US	-	2016	-

Artificial Intelligence, Bio-convergence and Cyber-warfare

According to Rosen (2018), the use of technology in the wars of the first two decades of the 21st Century is not regarded as a paradigm for projected future conflicts. This is because these conflicts were essentially fought in the air and on the ground in response to international interventions, suppression of intra-national uprising and civil wars.

Presently, the USA, Russia and China are in a fresh arms race to exploit the evolving disruptive technologies of the 21st Century (Bidwell and MacDonald 2018). The three countries are struggling to militarise Artificial Intelligence (AI), robotics, automation, biology, lasers, outer space and cyber-warfare (Rosen, The Arms Race of the 21st Century is About AI, Automation, Beam Weapons, Space, and Force Fields 2018). Also, there is an alliance of the military, academics and businessmen focused on future wars mostly in three broad areas namely AI, robotics and autonomy; bio-convergence and advanced computing; and cyber-warfare.

A report from the Congressional Research Service (2019) revealed that AI, robotics and autonomy would be integrated in future operational military environments with smart, connected and self-organising command and weapon systems. But this is with the close supervision of humans in terms of decision making in an operational theatre whether on land, sea, air or space. The race in these areas among the USA, Russia and China is aggravated with Russia's declaration that it would rule the world if it becomes a leader in AI and the Chinese New Generation Plan 2017 outlining strategy to lead the world in AI by 2030 (Pecotic 2019). Also, the USA signed an executive order creating the American AI Initiative.

Prominent military autonomous weapons of the 21st Century produced by Russia include Nerekhta Unmanned Ground Vehicle (UGV), autonomous nuclear submarines, the smart swarm robot missiles and the Armata T-14 super tank (Bartlett 2019). For instance, Nerekhta UGV as shown in Figure 10 is designed to move in over a target stealthily before it explodes with the force that could destroy fortifications or enemy tanks (Shackleton 2017). USA has produced its autonomous weapons like SGR-A1, sentry gun and modular advanced armed robotic system in the 21st Century (Bartlett 2019). China on its part inducted Rainbow-7 and Blowfish A2 drones as their foremost 21st Century autonomous weapons (Awford 2019).

Figure 10: Russian Nerekhta Unmanned Ground Vehicle. Source: (Shackleton 2017).

The second area is that of bio-convergence and advanced computing where human beings are network-connected via embedded and worn devices (Rosen, The Arms Race of the 21st Century is About AI, Automation, Beam Weapons, Space, and Force Fields 2018). Genetic engineering tools like Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) can be weaponised to produce better pathogens, synthetic biology or even transformed gut bacteria that could be conveyed by a chemical weapon to incapacitate human enemy force (Garthwaite 2016). Also, efforts are underway to improve brain implants connected to better reality, DNA-altering technologies in quest to producing a super-soldier, prosthetic limbs and development of exoskeletons to boost soldier's performance in combat (Rosen, The Arms Race of the 21st Century is About AI, Automation, Beam Weapons, Space, and Force Fields 2018).

The use of the cyber-warfare is on the increase to ensure human-AI assets are able to combat any new threat whether on the battlefield or in domestic space. Acquiring a cyber-warfare capability is one of the newest must-have for many countries which has generated a cyber-arms race that indicates no sign of slowing down (Mette 2018). Advanced countries are considering the option of cyber weapons along traditional weapons. Generally, cyber-warfare in the 21st Century is expected to accelerate, become a standard feature of warfare and stealthy cyber-war preparations will continue. Also, weaponised ransomware would be the next issue and the Internet of Thing (IoT) will be a cyber-war and cyber espionage gold mine.

SPACE WEAPONISATION AND THE 21ST CENTURY ARMS RACE

Space weapons are used mainly in space warfare, and depending on their roles, they are broadly categorised into space to space weapons, earth to space weapons (anti-satellite) and space to earth weapons. The weaponisation of space began during the Cold War between the USA and USSR. Arms race in space among states is on the increase in the 21st Century and this has shown a new round of concerns amongst states (L. David 2005). Currently, the USA, China and Russia have been sending military payloads to spy on each other's ground, sea and air forces thereby making them vulnerable. Whilst the USA and Russia developed and tested their anti-satellite weapons during Cold War, China launched its pioneer anti-satellite missile in space by shooting down its own weather satellites (Dupuy 2018). In view of this, both Russia and China could threaten the existence of the USA's satellites by attacking them when and where necessary.

In a quest for the USA's dominance in space and with the projection that future wars would be fought in space, the US President in June 2018 signed an executive order for the creation of a Space Force, a new military branch in the USA to perform independent space operations. The US

Department of Defence (2019b) indicated that the Space Force would also be responsible for space policy, doctrine, organisation, training, materiel, personnel, facilities, leadership and education as well as provision of space support to land, sea, air and cyber forces.

In December 2018, the US President ordered for the re-establishment of the US Space Command that would deal with the entire control of military space operations. According to Aljazeera (2018) report, the Command is also tasked with promoting technical advances and finding more effective and efficient means of protecting the US satellites and other assets in space which are mainly used for navigation, communications and surveillance by the US forces.

Weaponisation of space by the USA is considered inevitable by three categories of analysts namely space racers, space controllers and space hegemonists (Wang, 2013). The space racers opined that USA must be the first to develop space weapons when competing states remain resolute to acquire them. But, space controllers view space weapons as a valuable military assets that should be built once the USA deems them necessary, whereas, space hegemonists consider space weapons to protect the US military and political dominance in the 21st Century.

Russia is considered the foremost space adversary of the USA since from the Cold War-era it has a lot of operational space hardware till today. The initial militarisation of space in history was by placing a cannon, the Salyut-3 space station by the USSR. The USA is concerned with Russia's military counter-space program to deny or neutralize US space-based military and commercial satellites (Mizokami, 2019b). Russia is also making efforts to develop GPS jamming technology to be able to interfere with adversaries' space assets on the ground without necessarily going into space. The new technology could also jam and interfere with satellites and their ability to convey messages between terrestrial forces. In the late 2018, Russia deployed **Peresvet** laser weapon intended to attack enemy satellites as well as to test a ground-based mobile system meant for the destruction of incoming ballistic missiles and satellites (Pickrell 2018). Figure 11 shows a **Peresve**t laser weapon system unveiled by the Russian Ministry of Defence.

Figure 11: Russian Peresvet anti-satellite laser weapon system. Source: (Pickrell 2018).

China is another world's space power which first launched its pioneer satellite in April 1970 but stepped up the space activities in the late 1990s and 2000s due to its rapid economic boom (Bowe 2019). The Country in 2003 launched its first Taikonaut, Yang Liwei into space and in 2009 landed a probe on the far side of the moon (Wang, 2019). Also, China has a network of surveillance assets like radars and telescopes as well as space tracking ships such as the small fleet of Yuan Wang. It has also tested an anti-satellite missile, SC-19 against an obsolete Fengyun-1C weather satellite. Furthermore, China is attempting to interfere with enemy's satellites either from the ground or in space (Davis 2019). The ground based anti-satellite weapons could damage the optics of spy satellites in 2020 and further in the future, a more powerful laser to disable GPS and communication satellites.

China and Russia counter-space efforts are a portion of the military space efforts of the two countries and are viewed to be aimed at the USA's military assets. Both countries realise the USA's approaches of the modern way of war. The USA fights most of its wars in a country in close proximity to its enemy. In the event of war, US forces use communications and navigation satellites to coordinate the movement of aircraft, ships and formations of troops over thousands of miles across the Pacific and Atlantic Oceans to the doorsteps of both Russia and China (Lee and Steele 2014). In view of this, it could be deduced that China and Russia are exploring the means to disrupt that coordination of forces and equipment in wartime and attain an edge over the USA.

Russia and China in June 2014 presented a new draft Treaty on the Prevention of the Placement of Weapons in Outer Space (PPWT) to the UN in a quest to ban the placement of weapons in outer space. This was aimed at preventing the likely space warfare in the future amongst world's great powers (Listner & Rajagopalan, 2014). Despite the overt objective of the PPWT, the USA rejected the Treaty citing flaws such as no restrictions on the development and stockpiling of anti-satellite weapons on the ground and lack of a verification mechanism (Foust, 2014). In the interest of international peace and security, it is important for Russia and China to holistically review the PPWT with a view to amending the flaws highlighted by the USA. Also, the three great powers could negotiate on the flaws and attain a compromise that would enable the attainment of global peace.

ARMS RACE AND POSSIBILITY OF WAR IN THE 21ST CENTURY

One of the major areas of concern in arms race is whether it could lead to war or not. Although not all arms races lead to war, but major wars in history such as the two World Wars and even Cold War were as a result of arms races amongst world's great powers. The link between arms races and wars were extensively studied by Huntington (1958). Also, two prominent theoretical models namely spiral and deterrence justified the relationship between arms race and war (Levy and Thompson 2010). On one hand, Spiral model approach enables states to take actions against each other by increasing their military might for defensive purposes. Consequently, the defensive action of each state will be misinterpreted as offensive thereby leading to war. On the other hand, Deterrence model relates arms race to war when a nation refuses to sufficiently increase its military might to discourage other nation from attacking it.

North Korea remained adamant in its unlawful pursuit of nuclear weapons and missile projection despite the UN Security Council Resolutions and contravening the NPT of 1968 (Davenport 2018). The danger of the North Korea using nuclear weapons or its efforts to sell its nuclear technology and expertise is of an international concern which needs to be prevented.

Iran through the Joint Comprehensive Plan of Action has settled to restraints its nuclear program. However, it still preserves the necessary expertise to develop a nuclear weapons within a year if decided to do so (Laub 2018). Iran is alleged to be at the forefront of sponsor of terrorism in the world and hence its nuclear weapons programme is a thing of concern. The country declared that its new factory for centrifuges is near completion and this feat would enable Iran to push towards a nuclear bomb more quickly (O'Connor 2018). In response to this threat amongst states, Saudi Arabia a regional rival with nuclear powered plants for peaceful energy pronounced that it would develop its nuclear bomb as soon as possible once Iran produced its own.

In reaction to emerging threats posed by Russia, China, Iran, and North Korea amongst other states in terms of strategic policies, programs and capabilities especially nuclear, the USA had expressed its intention to commence a new arms race against its perceived adversaries. The USA had pulled out of the INF Treaty of 1987 with Russia, unveiled its Nuclear Posture Review in 2018 and Missile Defence Review in 2019. Also, the USA had re-established its Space Command in preparation of establishing a Space Force to be responsible for the defence of its assets in space.

MITIGATING MEASURES

The mitigating measures against arms race in the 21st Century could be classified into three broad areas. These are renewed commitments on existing arms control measures, formulation of new arms control measures and the complete elimination of nuclear weapons.

Renewed Commitments on Existing Arms Control Measures

There are several arms race control measures which are geared towards reduction and in the long run elimination of nuclear weapons, other strategic weapons and associated equipment. Prominent arms race control measures include Non-Proliferation Treaty (NPT), Strategic Arms Limitation Talks (SALT), Intermediate-range Nuclear Forces (INF), Strategic Arms Reduction Treaty (START), Strategic Offensive Reduction Treaty (SORT), New START and recently Prohibition of Nuclear Weapons Treaty (PNWT) which is still opened for signature. In all the existing control measures, only NPT and PNWT are multilateral treaties involving several states whilst the rest are bilateral mostly between the USA and Russia erstwhile USSR.

The NPT which was signed in 1968 and still effective till date is considered old in age and unable to foresee recent global happening that evolve with time. This makes changes or modifications difficult since its foundations were based on the arms race trends of 1968. Challenges on the issues of non-compliance by member states, membership withdrawal, nuclear terrorism and modernisation of nuclear energy need to be looked into in tandem with the current realities of the 21st Century. The numerous bilateral treaties between the USA and Russia have weakened the NPT and gave room for other states such as China and North Korea to develop weapons of their choice and mostly contrary to the existing bilateral treaties since they are not binding on them.

In view of this, it is important to review and co-opt states like China and North Korea into the existing INF Treaty, SALT, START, SORT and New START. The USA and Russia on their part need to renew their commitments on the arms control agreements between them. Specifically, the recent withdrawal of both countries from the INF Treaty would certainly drawback the five decades' efforts of arms race control measures. This might result in not extending the New START Treaty which is due to expire in 2021. In the interest of international peace, security and stability, it is necessary for the USA and Russia to go back to the negotiation table to sort out any perceived grievances on the INF Treaty and begin modalities on the ways to extend the New START.

Formulation of New Arms Control Measures

China and Russia as the leading states in space weaponisation need to deliberate extensively with the USA on the existing PPWT of 2014 with a view to amending the flaws highlighted by the USA which prevented her from joining the Treaty. In the meantime it is important for the three states to ensure non-proliferation of the space weapons and relevant expertise in order not to aggravate the existing danger of space warfare. This would also make the scope of control measures confined to the three countries only. Currently, China and Russia in a quest to dominate the outer space have established Space Forces in 2015 each as an independent branch of their respective armed forces. This made the USA to declare its intent to set up Space Force to boost its military might in space. In view of the impending threats and the motives behind Space Forces, it is necessary for Russia, China and the USA to deliberate and formulate a framework that would regulate and monitor the activities of their respective space forces.

Arms race on hypersonic missiles is on the increase, especially amongst states like the USA, China and Russia. This could be attributed to their ability to penetrate into adversary's missile defences unhindered. Consequently, it is imperative to formulate a new policy that would control the use of these hypersonic weapons.

Elimination of Nuclear Weapons

The recently adopted multilateral Treaty on the PNW in 2017 is a right step in the right direction towards the elimination of nuclear weapons in the world. The Treaty entered into force on 22 January 2021 after the 50th ratification was deposited on 24 October 2020. Despite this feat attained, there is need for massive media campaigns by the general public to ensure that their respective governments become a party and compliant to the PNWT. This is so because most victims of nuclear attacks are the ordinary citizens as experienced in Hiroshima and Nagasaki in 1945.

In a quest for a nuclear free world, it is also important that three key issues are considered. These are the USA Factor, the USA-Russia-China Relationship Factor, and the Transformation of the UN Security Council.

The USA Factor

The threat that was central to the Cold War national security in the USA has dramatically changed a decade after the end of the War in 1991. Presently, the USA has no consensus on which country could be identifiable as posing primary external threat. The terrorist threats and attacks against the USA, her allies and partners do not warrant the use of unconventional weapons. Therefore, the USA has a cause to eliminate their reliance on nuclear weapons for security. As a superpower nation amongst the NWS and with the least to lose in terms of security, the USA needs to be a responsible leader and declare its intention to move towards eliminating nuclear weapons. It could make the commitment quite apparent in its military force posture and resource allocation. The USA needs to then follow up this unilateral move in negotiation with other NWS. These states need be brought on board or forced to face negative public and diplomatic fall out.

The feasibility of a nuclear free world was sighted with the coming of the US President, Obama in 2009 and subsequent adoption of New START in 2010 between the USA and Russia. Also, the USA could champion the 2017 PNWT which is still opened for signature aimed at total elimination of nuclear weapons in the world. These decisions could be reached after due assessment of the economic implication of nuclear deterrence. The USA government aims at achieving its objective at the least cost to the American tax payer. Thus, the motive of the nuclear arms downsizing and the 2017 PNWT notwithstanding, are giant leap being made towards a nuclear free world.

USA-Russia-China Relationship Factor

The USA nuclear disarmament posture could achieve ripple effect if there is more cooperation with Russia and China since both states are permanent members of the UN Security Council and key enforcers of the non-proliferation as well as disarmament regime. Also, the USA officially considers China and Russia as a near-peer competitors in virtually every sector of national developments.

Russia and China are also the most likely suppliers of nuclear weapons, materials, components and technology to states of proliferant concern. Thus the feasibility of nuclear arms free world is dependent on tri-lateral commitment of the USA, Russia and China towards stringent enforcement of treaties and their verification as well as denial of nuclear technology and material to other NNWS.

Reform of the UN Security Council

The politics of reforming permanent membership of the United Nations Security Council (UNSC) had been a long standing issue. Expansion of the UNSC offers an opportunity to transform the circumstance whereby only NWS are permanent members (USA, UK, Russia, China and France). Although there exist ten non-permanent members of the UNSC on a two year term basis, they still do not have veto power on substantive UN Resolutions on international peace, security and enforcement. Consequently, elevating NNWS to this rank can send a positive signal globally that nuclear weapons are not necessary to achieve great international power as reflected in the permanent members of the UNSC. Fortunately, amongst the leading contenders for the new permanent seat are India and South Africa which possess and denounced nuclear weapons respectively.

The UNSC permanent seat question is singularly important to India as it had advocated. The quest for the UNSC permanent seat could become a possible bait for India to drop its nuclear programme. If the UNSC reform is put into practice, the possibility of a bargain whereby India would win a permanent seat in exchange for becoming a NNWS exist. India's case for membership would also likely hinge on some

resolution on the Kashmir dispute. As without such a resolution, Pakistan could rally round its allies to try to block India's desire. If India chooses nuclear weapons over permanent seat, then the International Community would be in a much stronger position to deflect India protest over SC reform.

Thus, the transformation of the UNSC into a Council with new entrants comprising NNWS like Germany, Japan, Brazil, and South Africa could support the move towards a nuclear arm-free world, because it would indicate to states that possession of nuclear weapons are not necessary to achieve international power. India a NWS, could be enticed to give up its nuclear weapons in return for a permanent seat at the UN.

CONCLUSION

In the 21st Century, states such as the USA, China, and Russia are involved in strategic competition (arms race) with each other with the formulation of policies and incessant increase in their defence budgets to enable them acquire nuclear weapons, hypersonic missile, missile defence, space weapons, artificial intelligence and cyber-warfare. The arms race is geared towards attaining global dominance or relevance in international affairs amongst states.

This study discovered that nuclear weapons are still at the forefront of arms race in the 21st Century despite efforts to reduce their role in global affairs and to negotiate further reductions in quantity. Based on the available data, it was found that in the 21st Century, the USA has produced a total of nine land, sea and air based strategic nuclear weapons out of which four are deployed and five are undergoing development. For Russia, it has produced a sum of nine land and sea based nuclear weapons where seven are deployed and two are undergoing development. Furthermore, this study found that China has ten land and sea based nuclear weapons where eight and two are deployed and undergoing development respectively. North Korea has a total of 13 land and sea based nuclear weapons where only two are deployed and the remainder are undergoing development. It was further discovered that Russia and USA possess non-strategic nuclear weapons in the 21st Century. The former has eight land, sea and air launched weapons out of which six are deployed and two are currently in development. The latter has only one air launched weapon undergoing development.

From all indications, states like the USA, China and Russia are exploiting the advantage of speed and manoeuvrability to engage in arms race in hypersonic missiles to be able to penetrate into adversaries air defences unimpeded. Smaller nations (North Korea, Iran etc), apprehensive of the bullying position, especially of the US and Israel, are equally advancing measures to acquire more sophisticated weapons. In view of this, arms races are ongoing in the area of missile defences in order to counter the present missile threats. States are making efforts to militarise AI, robotics, bio-convergence and cyber-warfare as tools for future warfare in the 21st Century. Also in anticipation for future warfare, states such as the USA, China and Russia are in arms race to weaponsise space by deploying space to space, earth to space and space to earth weapons where appropriately.

It is clear that, the existing nuclear powers will interpret news of successful interceptor tests as an impetus for a new arms race. They will make even faster missiles with more decoys and countermeasures, new warheads for more flexible uses in a greater variety of strategic scenarios, and of course their own shields.

The current arms race as well as the political, economic and diplomatic decisions towards a perceived adversary if not carefully handled by the affected states and relevant international institutions could lead to an undesired consequences such as war. The war in the 21st Century could in turn lead to more human, material and environmental casualties due to the latest advancement in technologies and modernisation of existing weapons and associated equipment. Consequently, measures need to be taken to ensure that arms races in 21st Century if not eliminated, are reduced to the barest minimum in order to promote international peace and security.

Renewed commitments on existing arms control measures, formulation of new arms control measures and the complete elimination of nuclear weapons are the measures that could be considered. Additionally, for a nuclear free world to be attained, three keys issues namely the USA factor, the USA-Russia-China relationship factor and the transformation of the UNSC are to be

considered. For the mitigating measures to be effective, it would be necessary for regulatory agencies and organisations like International Atomic Energy Agency and UN Office of Disarmament Affairs be reinforced to discharge their duties effectively.

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