EMERGING VOICES NETWORK BASIC

The Emerging Voices of Planetary Security:

Envisioning the Future of Nuclear Security

JULY 2025

Based on a Capstone Project as part of the Ploughshares & Horizon 2045 Nuclear Futures Fellowship

Declan Penrose

HORIZON 2045

PLOUGHSHARES

The British American Security Information Council (BASIC)
Work + Play
111 Seven Sisters Rd
Finsbury Park
London N7 7FN

Charity Registration No:
1001081

T: +44 20 3488 6974
www.basicint.org

© The British American Security Information Council (BASIC), 2025

The opinions expressed in this publication are the responsibility of the authors and do not necessarily reflect the views of BASIC.

All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical including photocopying, recording or any information storage or retrieval system, without the prior written permission of the copyright holder.

Please direct all enquiries to the publishers.

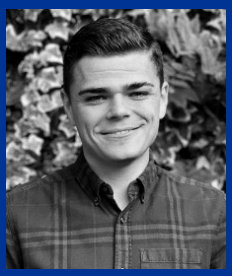
BASIC

BASIC is an independent, non-profit think tank working to safeguard humanity and Earth's ecosystem from nuclear risks and interconnected security threats for generations to come. We have a global reputation for convening distinctive, empathic dialogues that help states overcome complex strategic and political differences. Our established networks and expertise, developed since 1987, enable us to get the right people in the room and facilitate effective, meaningful exchange between siloed and often hostile political communities.

Emerging Voices Network

Launched in December 2020, the Emerging Voices Network (EVN) is a digital network of high-potential, next-generation leaders on nuclear issues who will inherit the responsibility of managing nuclear threats. In founding the EVN, BASIC's aim was to create a truly inclusive digital space wherein younger voices from marginalised communities around the world are heard on nuclear issues. The network promotes collaboration, dialogue and bridge-building between next-generation leaders from the Global North and South, with diversity and inclusivity at the forefront of the Network's ethos and mission.

Declan Penrose



Declan Penrose is a Policy Fellow working on the Inclusive International Security Programme. He is also a PhD Candidate at the University of Manchester. He has previously been the Online Coordinator at Youth for TPNW. Declan focuses on nuclear disarmament, the global nuclear order, emotions and affect, and activism. Declan is also a Nuclear Futures Fellow with Horizon 2045, completed the Global Peace and Security Changemakers programme with SOIF in 2023 and is interested in the application of futures and foresight methods. Declan has also completed a Multi-level Negotiation, Mediation, and Diplomacy programme with the Oxford Network of Peace Studies. He has an MRes in Gender Studies from the University of Chester, an MA in International Politics, and a BA in Human Geography and International Politics.

Acknowledgements

This project has been made possible by the generous financial support of Ploughshares and additional training from Horizon 2045. This report does not reflect the views of Horizon 2045, Ploughshares, nor the views of BASIC. This publication would not have been possible without the support of the EVN Manager, Dave Cullen, who provided valuable insights, review, and support throughout the project. I would like to thank BASIC Research Director Dr Gry Thomasen for her valuable feedback on this report. I would also like to thank Chris Spedding for his guidance he provided on developing my first Kumu map and his enthusiasm for the project. This was also not possible without the training I received from Horizon 2045's Erika Gregory, Morgan Matthews, and Pupul Bisht. I am also grateful for the support I have received from the Ploughshares team throughout the Capstone Project, including Habib Bako, Alex Hall, and Shafaq Khan. I would also like to show my appreciation to the emerging experts who contributed to both the map and the scenario exercise.

Contents

Introduction

In 2024, I was awarded a place on the Horizon 2045 Nuclear Futures Fellowship. The Nuclear Futures Fellowship is a joint venture between Ploughshares and Horizon 2045. It is designed for new and incumbent leaders who want to develop the adaptive leadership practices, tools and relationships necessary to help the nuclear field succeed in a dramatically changing landscape.

We received training in Foresight Methodologies over several online sessions and an intensive training week in Washington DC, with the Horizon 2045 team. We were also invited back to Washington in September 2024 for the Horizon 2045 and Ploughshares co-hosted "Security & the Future," a three-day symposium designed to promote long-term thinking about intersections between nuclear challenges and other global threats to human and planetary security.

Furthermore, each fellow was given a grant to develop a Capstone Project to implement the skills we had developed with our organisations. For my Capstone project, I wanted to produce collaborative research with BASIC's Emerging Voices Network (EVN). After participating in the "Security & the Future" workshop in DC, I was struck by the incredible insights we received from participants from other security domains, such as biosecurity and finance. This inspired me to reach out to other early-career networks specialising across various security domains. These included climate, biological, and finance, just to name a few. I also hoped that this project could kickstart future connections and collaborations between these security domains and networks.

Phase I

Phase I of the project was the creation of a systems map that would visualise the key drivers of the future of nuclear security, according to the next generation of security experts. The IAEA defines nuclear security as "the prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities".[1] I am also using this term more broadly to consider the role of nuclear weapons in state and planetary security, specifically the prevention of their use by any actor or weapons-related accidents. I created a 'scanning form' which was circulated to many early career security networks. It asked them which drivers they believed would be the most important in shaping the future of nuclear security in the seven security domains. They were then asked to name which of the drivers they felt were most connected and why these connections were important. Their answers were converted into a systems map using the programme Kumu, with guidance from consultant Chris Spedding, founder of Loop Works. This resulted in The Emerging Voices Future of Nuclear Security Map, a free-to-access online resource.

1 "Security aspects of nuclear facilities", *International Atomic Energy Association*. https://www.iaea.org/topics/security-aspects.

Phase II

Phase II of the exercise brought 11 of the experts who had completed the scanning form into four focus groups, who then participated in a 'scenario exercise' where they used drivers from the Kumu map to help them envisage four possible futures for nuclear security. In the appendix of this report, all of the drivers and their definitions are listed. The scenario exercise was an intensive 3-hour workshop that utilised three foresight tools and methodologies.

> All four focus groups created at least one fleshed-out scenario that showed how their drivers of nuclear security to lead to their prescribed level of change in 2075. Their scenarios are presented in this report.

PHASE I

The Emerging Voices Future of Nuclear Security Map

The creation of the Emerging Voices Future of Nuclear Security Map began with an extensive search for other early-career security expert networks across several domains. Rather than focusing exclusively on nuclear or military security experts, I sought to also identify networks in the domains of Governance & Politics, Environment, Finance & Economics, Health & Wellbeing, Infrastructure, Society & Culture, and Technology.

As mentioned, expanding the project to other security domains was inspired by the participation of experts from other security domains in the "Security & the Future" workshop hosted by Ploughshares and Horizon 2045 in Washington, DC. The decision to choose those specific security domains was inspired by the domains of the Horizon 2045 Foresight Radar, an interactive tool for exploring pivotal issues and drivers of change shaping human and planetary security.[2] Over 50 regional and international networks across these domains were contacted with an advert for the project, and with the link to the 'scanning form'.

2 Horizon 2045, "Horizon 2045 Foresight Radar", https://radar.horizon2045.org/?pg=home.

37 participants from across the seven security domains completed the scanning form. The scanning form was designed to ask the participants to identify firstly which drivers they believe will be the most important in shaping the future of nuclear security, and secondly to name which drivers they believed were the most connected. Across each of the security domains, participants were asked the following question: "In the security domain of [...], which key issues/drivers do you believe will be the most important in shaping the future of nuclear security? Please include no more than five." The form included space for the participants to add context to their answers, which most of them did with significant detail. Participants were also asked if there were any drivers they had thought of that they believed did not fit into any of the identified domains. This generated a substantial amount of data that required several distillations before it could be input into the programme Kumu to generate the systems map.

Systems mapping is the creation of visual depictions of a system, such as its relationships and feedback loops, actors and trends.[3] These distillations were firstly important because a systems map must be comprehensible to effectively visualise the drivers and connections to the audience. After the first distillation, I had roughly 250 drivers. This was far too many to effectively visualise these drivers, and adding the connections would have made the map an incomprehensible web. There were also many drivers that could be amalgamated as they were very similar, or could be combined with others into a larger driver. This process also involved converting the collected data into spreadsheets under the guidance of the project consultant, Chris Spedding. These spreadsheets were designed to allow the drivers and connections to be directly uploaded into Kumu, utilising the programme's ability to generate a systems map if the data is configured correctly. To reduce the number of drivers and connections sufficiently to ensure the map was comprehensible, the amalgamated and combined drivers and connections that appeared less than five times in respondents' answers were cut from the data. This left a total of 47 drivers and 103 connections, which were used to create the final map. These drivers and connections included short descriptions based on the context added by the participants' answers. The drivers were also weighted based on how many times they had been named by participants.

> The size of the drivers is proportional to the number of times they were mentioned, with some appearing in over 25 of the 37 survey responses.

The Final Map

The final map visualises all of the drivers and connections included in the final data distillation. As mentioned, the more frequently a driver was mentioned by participants, the larger it appears on the map. The positioning of the drivers was shaped by their connections, with the programme using these connections to place the more connected drivers at the centre, with the least connected being positioned at the periphery. The connections are also arrows of causality, with some drivers being connected in both directions. On the map, the number of connections a driver has outwardly towards others is listed as the 'indegree', and inwardly from others is listed as the 'outdegree'. The drivers are colour-coded based on the security domain in which the driver was primarily identified. Buttons are included in the map that only show drivers from specific domains to help compare different security domains.

The map shows just how interconnected these individual drivers and security domains are in nuclear security. As for the most connected drivers, nodes from the 'Politics & Governance' domain dominate the centre of the map. The driver with the most connections is 'Arms Control', with 13 in total, followed by the 'Non-Proliferation Treaty' with 12, 'Trust in Institutions' with 11, and 'Nuclear Weapons Use' and 'Nuclear Disarmament' with 10. The decisions made by state leaders and policymakers are deemed to be central to the future of nuclear security. It also appears that the participants felt that the successes and failures in creating new and sustaining existing arms control and international treaties were vital for shaping this future.

Only one driver is not connected to any others, which was the only driver to receive multiple mentions that respondents did not put into one of the identified domains. This driver is the 'Weaponisation of Space'. Space systems have multiple civilian and military purposes, including missions related to nuclear deterrence.

3 Erin Gray and Charlie Bloch, "INSIDER: Systems Mapping — A Vital Ingredient for Successful Partnerships", *World Resources Institute*, (17th August 2020) https://www.wri.org/technical-perspectives/insider-systems-mapping-vital-ingredient-successful-partnerships.

Consequently, real and perceived military operations targeting space systems could create pathways to nuclear escalation.[4] The lack of named connections is striking, yet this could be due to the formatting of the form. Not believing it belongs in any of the named security domains, participants may have put it out of mind when thinking about connections. As demonstrated, Nuclear Deterrence alone could be connected to the Weaponisation of Space, as well as Geopolitical Tensions and Emerging Technologies.

> Generally speaking, we see a correlation between the size of drivers and how well-connected they are.

Only one of the top five most connected drivers has a weighting of less than three, which is 'Nuclear Disarmament'. However, there are some significant outliers to this trend. 'Nuclear Education', for example, has 7 connections, yet only between 5 and 10 participants named this driver, but those who did believed it was heavily linked to other drivers. Another interesting finding was that despite having over 15 mentions, 'Climate Change' was only connected to two drivers. This is particularly surprising after reading the future scenarios participants envisioned during the scenario exercise later in this report. This may show how experts may not immediately consider how the issues they focus on are connected to other issues outside of their security domains.

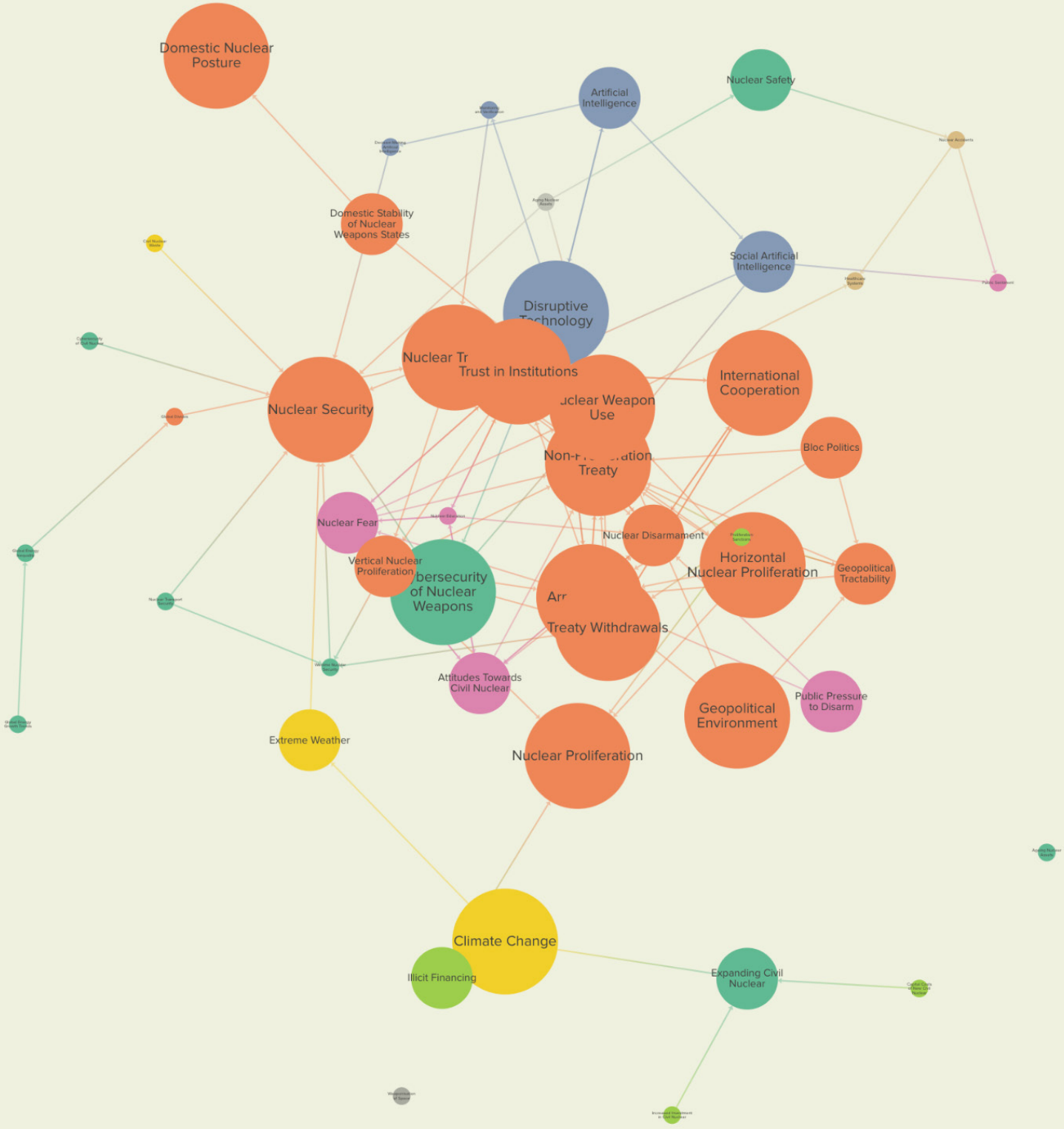
This does not mean the participants do not believe these issues are connected. Rather, the threshold for inclusion in the map saw many connections cut. What the map shows is which drivers were most connected, rather than all connections.

This Kumu map will go on the BASIC website and, like this report, will be a free-to-access resource. The map is not a definitive map of all of the drivers that will shape the future of nuclear security. It is an exercise to map out what the next generation believes will be the most important, and which of these drivers are most connected. The purpose of this map was to bring these experts together to see what their combined expertise would reveal. It was also designed to be a free resource for everyone to see and take as they please. People could use it to inspire their next research project. They might be struck more by what is not on the map than what is. They might find drivers and connections they were unaware of. I had a fascinating time distilling the data and learning to use Kumu, and I hope people find this map interesting and useful.

4 Nivedita Raju and Dr Tytti Erästö, "The Role of Space Systems in Nuclear Deterrence", *SIPRI*, (2023) https://www.sipri.org/publications/2023/sipri-background-papers/role-space-systems-nuclear-deterrence#:~:text=Space%20systems%20are%20used%20for,create%20pathways%20to%20nuclear%20escalation.

The Emerging Voices Future of Nuclear Security Map

Click here to view the interactive map



PHASE II

The Emerging Voices Future of Nuclear Security Scenario Exercise

As part of the scanning survey form, participants were asked if they were interested in participating in a scenario exercise using the map as inspiration. After the Kumu map was completed, 11 of the participants took part in this exercise in an intensive 3-hour workshop. They were split into four groups, where they used multiple foresight tools to imagine potential futures for nuclear security over the next 50 years. Utilising the issues and drivers identified in the map, they worked on four different visions of the future.

Utilising a 'Change Progression Scenario' methodology, one group was tasked with envisioning a future with little to no change. In this future, the status quo and the systems of international nuclear security remain the same, meaning that key issues are not addressed. A second group worked on a future where there is marginal change. In this future, there are some changes to the system; however, on the whole, it remains largely the same. These changes may address some key issues, but may not solve the underlying causes. A third group imagined a future where there had been adaptive change. In this, future changes are made to the system to adapt to new conditions. This could involve modifying existing structures or introducing new elements into the system. The fourth and final group envisaged a future of radical change. This future would see changes that would fundamentally alter the system and create a new paradigm. These changes involve radically changing and transforming the existing system into a new one.

> The exercises were designed with a 'Change Progression Scenario' methodology in mind to consider the pull of the future, the push of the present, and the weight of history in their scenarios.[5]

They started the exercises by selecting the drivers from the final map that they felt were either the most important or the most relevant to their interests and expertise. These drivers were then used to kick-start their scenarios. Whether their assigned future was one of significant change or not, they were tasked with exploring how their chosen drivers could lead us there.

The groups then utilised the foresight tool 'Scenario Development' to begin thinking about what impact their chosen drivers would have on their scenarios, and how these drivers may interact with each other. Inspired by their drivers, participants identified the critical uncertainties that could shape their futures and how these uncertainties can shape alternative scenarios.

This was followed by an exercise using another foresight tool, 'Visioning', to look back on the scenario they had developed and think about which key decision-tree moments, ideas, and emotions had led to their envisaged scenario pathways. Visioning is typically used to imagine a preferred future and create a pathway to it.[6]

They then used their findings to complete a text template that encouraged them to think about the chronological order of their pathways by discussing which main drivers will shape the events of each decade of the next 50 years, culminating in a final scenario for the future of nuclear security in 2078.

5 Ivana Milojevic, *Educational Futures: Dominant and Contesting Visions*, (2006, Oxford: Routledge).

6 José Manuel Roche, "The Future Is Ours: Strategic Foresight toolkit – making better decisions", *Save the Children UK*, (2019) https://resourcecentre.savethechildren.net/pdf/strategic_foresight_toolkit_online.pdf.

FOCUS GROUP ONE

No Change Scenario

A 2075 Defined by Power Hierarchies, Mutually Assured Destruction, and Alliance Structures

GROUP MEMBERS:

Amanda Narhan Pereira
Alex Parton
Palwasha Khan

The first focus group was instructed to complete the foresight exercises by imagining a future where there was no change to the system or the primary issues we face. In this scenario, the key drivers of the future of nuclear security reinforced the existing system, structures, and hierarchies that form the global nuclear order.

They decided to focus on the following drivers to construct their scenario for 2078: Bloc Politics, Trust in Institutions, Nuclear Weapon Use, International Cooperation, Climate Change, Treaty Withdrawal, Horizontal Proliferation, and the Geopolitical Environment. The resulting scenario saw the conflicts and tensions of today continue to remain unresolved and yet central to the state of the world in 2075. The current political blocs and alliances remain, and while nuclear weapons have not been used, these divisions mean that it has been impossible to rectify the issues humanity faces through international cooperation.

Beginning in 2025, the first decade of this scenario is primarily driven by increased geopolitical competition and a lack of trust in International Organisations. Areas of cooperation become areas of contestation as states focus on competing under realist power politics. For example, the Ukraine War is never resolved. While nuclear weapons are never used, it falls into a stalemate, and Russia continues to occupy at least some Ukrainian territory. A general apathy towards change and hope for a better world grows as the institutions designed to address international issues, such as the United Nations (UN) and the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), fail to bring agreements and solutions. This leads to shock withdrawals from the NPT and horizontal proliferation of nuclear weapons. These issues are further exacerbated by the Trump administration's cuts to the US foreign aid budget.[7] Many states fear that these cuts mean they will not receive US support during a crisis, leading states to think and behave less cooperatively..

As we move into the 2035s, the dynamics of bloc politics and fear of expansionist nuclear states drive many less wealthy states that did not proliferate to seek the protection of nuclear umbrellas. This is driven not only by Russia's invasion of Ukraine but also by China's ambitions over Taiwan and the US's ambitions to control Canada and Greenland. Many states conclude that they must be part of a Great Power bloc to secure themselves, entrenching the reliance on nuclear deterrence and Mutually Assured Destruction (MAD) to avoid direct conflicts.

7 Oxfam America, "What USAID does, its impact and what Trump's cuts mean", (2nd April 2025) https://www.oxfamamerica.org/explore/issues/making-foreign-aid-work/what-do-trumps-proposed-foreign-aid-cuts-mean/.

These tensions and fears continue to strengthen and reinforce the rise of nationalism across states as states continue to prioritise themselves over using empathy and international cooperation.

By 2045, global peace and security will be fragmenting under a multipolar system with a paralysed UN Security Council. The divisions between Great Power blocs continued to deepen, rendering international institutions powerless to reduce the tensions between adversaries. Even issues that have previously been able to bring states together to attempt to address them, such as climate change, have fallen further down in the hierarchy of state priorities. Even as the impacts of climate change escalate, states remain too focused on these rivalries and too distrustful to try to address the issue. As another decade passes, these systems and issues continue to be entrenched. By 2065, the continued role of nationalism will see states finally drop their expensive and domestically unpopular green commitments. Existing climate treaties collapse due to mass withdrawals, and they are not replaced due to a lack of cooperation and political will. This also means that domestic commitments and legislation to protect the environment are removed, enabling capitalist and military industries to harm the environment and the ecosystem further.

At the end of the scenario in 2075, nuclear and global security was defined by Great Power blocs, competition for resources, and realpolitik. The world relies on nuclear deterrence and MAD to avoid conflicts between nuclear adversaries. International institutions are unable to reduce these tensions and encourage diplomacy. We sit one escalation, miscalculation, or misunderstanding away from nuclear war. Furthermore, we have failed to effectively address the existential threat of climate change. This further strengthens the disparity between states as climate change disproportionately harms the global south and exacerbates resource scarcity.[8] Despite states attempting to act rationally based on the circumstances around them, the lack of assistance from international institutions contributed to these decisions, leading to a worse future. States decided it was rational to focus on their national interests, but interpreted this narrowly and focused on the short-term, as managing climate change is in all states national interest. The system and primary issues may be the same, but the world is perilously close to nuclear war, and it is likely far too late to address the other existential threat of climate change.

This scenario showed us how the primary issues of today and possible issues in the future could reinforce and sustain the current system of nuclear security that has failed to resolve our problems. Nuclear deterrence may have continued to have some credibility as nuclear weapons had not been used, however, adversaries have remained incapable of reconciling. Furthermore, international cooperation has collapsed and has allowed climate change to go past the point of no return. This 2075 is a world that is burning. The world knows this is the case, but actors cannot move beyond their own selfish short-term interests and mistrust to save the planet together. No nuclear weapons have been, or may ever be, used in this future. However, nuclear weapons are not the only existential threat we face and life as we know it could be crumbling away forever soon after 2075. How much longer can the system survive under these conditions?

8 Erika Strazzante, Stéphanie Rycken, Vanessa Winkler, "Global North and Global South: How Climate Change Uncovers Global Inequalities", *Generation Climate Europe*, (27th October 2021) https://gceurope.org/global-north-and-global-south-how-climate-change-uncovers-global-inequalities/.

FOCUS GROUP TWO

Marginal Change Scenario

A Partially Reformed Arms Control Regime

GROUP MEMBERS:

Evance Owuor Ouma
Geraldine Nneka Okoye
Johannes Nordin

The second group imagined a future of nuclear security where the system marginally changes, remaining largely the same.

Focus Group Two selected the following drivers to shape their future scenarios: Geopolitical Environment, International Cooperation, Disruptive Technologies, Public Sentiment, Nuclear Fear, Nonproliferation Treaty, Cybersecurity of Nuclear Weapons, Treaty Withdrawals, and Artificial Intelligence.

This scenario sees disruptive technologies and geopolitical tensions disrupt and weaken norms and international treaties such as the NPT, before somewhat recovering in 2075 due to reforms and renewed efforts to start rebuilding nuclear arms control. Yet, before 2075, much instability has to be navigated, and ultimately, the current international security system and the issues we face remain.

In the first decade of this scenario, breakthroughs in disruptive technologies and increasing geopolitical tensions further destabilise global nuclear politics, the complex interactions, strategies, and policies related to nuclear weapons and nuclear energy. This is accompanied by rising public distrust in institutions as the world becomes more unsafe and unstable. This results in a wave of withdrawals from arms control and nuclear treaties, including from the NPT. The world was shocked by this, and many policymakers and experts did not foresee just how quickly nuclear restraint and transparency norms were eroded. This damaged the nuclear policy field and created a far worse environment for revitalising multilateral arms control agreements. The rising distrust between adversaries led states to neglect diplomacy in favour of nuclear threats and coercion. This further normalised the use of nuclear threats, increasing public fear of nuclear war.

As we reach the second decade in 2035, rising fears and tensions drive the public to demand more restraint and transparency in international nuclear politics. The nuclear security environment continued to worsen, exacerbated by the further development and implementation of disruptive technologies. Due to a lack of legal oversight and international agreements, minimal restraint was shown in developing dual-use technologies, which refers to military use of civil nuclear power technology.[9] Also, states were advancing the implementation of AI in their nuclear and conventional military systems. It was clear that several states planned to further expand their nuclear arsenals. United by fear and a recognition that these tensions and distrust were increasing the risk of nuclear war, the public ramped up efforts to encourage diplomacy, trust-building, and new arms agreements between the nuclear states. This included efforts to modernise and reform the increasingly precarious NPT regime.

9 Reid B C Pauly, "Deniability in the Nuclear Nonproliferation Regime: The Upside of the Dual-Use Dilemma", *International Studies Quarterly*, 66(1), (2022) pp. 1-13. https://academic.oup.com/isq/article/66/1/sqab036/6278489?login=true.

As the geopolitical environment continued to worsen after 2045, further efforts were made by some to rebuild diplomacy and arms control. Unfortunately, this was undermined by states continuing to favour deterrence and distrust. By 2055, it became clear that these efforts had largely failed, and the NPT regime continued to falter. The failures to modernise the NPT and maintain the non-proliferation regime damaged the NPT's legitimacy in the eyes of states. As a result, even more states have begun to strongly and publicly consider acquiring nuclear weapons. Here, we find the NPT and non-proliferation on the brink of collapse, and there is little sign that it can be saved as it fails to deal with an increasingly divided world. One factor that has driven distrust is the fear of emerging technologies in the military. New and potentially destabilising technologies have further increased anxiety of nuclear war, and these new capabilities are undermining nuclear deterrence.

So far, this scenario has seen technological advancements further increase fear and division in the future. However, as we reach 2065, those seeking to improve global peace and security and save the NPT from collapse were able to take advantage of timely innovations in nuclear verification technologies. Just as the NPT looked to be all but dead, these new technologies made it far easier for the International Atomic Energy Agency (IAEA) to verify non-proliferation and other organisations to verify nuclear capabilities. This made it much easier to detect early efforts to develop nuclear weapons and understand the capabilities and stockpile size of signatories. Even today, we see advancements in verification technologies, such as open source information, aiding Non-Governmental Organisations (NGOs) and the public to verify non-proliferation and disarmament.[10] Better verification methods can increase the credibility of institutions such as the IAEA, and strengthen trust between nuclear adversaries that they understand each other's stockpile size. For the first time in decades, there is the possibility of increased transparency and an increase in the legitimacy of the NPT and its ability to verify and govern non-proliferation. This is joined simultaneously by a renewed wave of nuclear disarmament activism. Instead of accepting the collapse of non-proliferation and arms control, civil society groups rally to try to prevent a huge wave of nuclear proliferation and the further entrenchment of nuclear deterrence.

By 2075, these positive developments culminate in a partially reformed arms control and non-proliferation regime. New verification technology helps the NPT to start positive reforms, and some faith returns to its role at the centre of the non-proliferation regime. Furthermore, the wave of civil society calls for reform inspires nuclear and conventional arms control reforms. Activist campaigners were finally able to positively utilise the fear of nuclear war to successfully argue that the path we had taken had pushed the world closer to nuclear war. State leaders and policymakers realised that they stood at a vital crossroads and, crucially, it was not too late. As a result, a wave of new and reformed arms control agreements was created. This finally leaves us with a 2075 that has finally taken steps to shore up the systems of global nuclear security.

This vision of the future demonstrates the dangers of a future driven by a lack of transparency, fear, and distrust. Over these decades, nuclear security has become increasingly fragmented and unstable. Arms control and the non-proliferation regime struggle to contend with the further increase of tensions and the introduction of disruptive technologies in nuclear arsenals. These fears further drove instability and undermined efforts to stabilise global security. It took forty years and several long-overdue advancements in verification technologies to show the world how close it was to nuclear war. Eventually, the fear that had made the world more insecure and dangerous was utilised to start reforms in arms control agreements and the non-proliferation regime. While we eventually see minor changes in the system, this vision of 2075 remains very close to the state of nuclear security as we know it today.

10 Ferenc Dalnoki-Veress, Catherine Dill, Melissa Hanham, Bryan Lee, Jeffrey Lewis, Tamara Patton, "New Nonproliferation & Disarmament Verification Technology", *James Martin Center for Nonproliferation Studies*, (6th November 2013) https://nonproliferation.org/new-technology-in-treaty-verification/#:~:text=Such%20tools%20extend%20the%20ability,ground%20in%20societal%20verification%20research; Massimo Aparo, "Verifying States' non-proliferation obligations — past, present and into the future", *IAEA Bulletin*, 64(2) (2021) https://www.iaea.org/bulletin/verifying-states-non-proliferation-obligations-past-present-and-into-the-future; Sara Al Sayed, "Revisiting Societal Verification for Nuclear Non-proliferation and Arms Control: The Search for Transparency", *Journal for Peace and Nuclear Disarmament*, 5(2), (2022), pp. 496-506 https://www.tandfonline.com/doi/full/10.1080/25751654.2022.2133336.

FOCUS GROUP THREE

Adaptive Change Scenario

Meaningful Steps Towards Stability, Arms Control, and Disarmament

GROUP MEMBERS:

Ching Wei Sooi
Sathchidha Pachiappan
Hazel Ropafadzo Ruzani

Focus group three was granted more leeway to envisage a future of nuclear security that saw the system adapt significantly from today, yet was not entirely and radically changed or remade. To drive their scenario, focus group three selected the following drivers from the map: Militarisation of Space, Arms Control, Nuclear Fear, Climate Change, Cybersecurity, Geopolitical Environment, Nuclear Disarmament, Artificial Intelligence, and Public Pressure to Disarm. Ultimately, they imagined that the primary driver of the adaptive changes by 2075 was an environment of fear. While nuclear tensions and anxieties were rising in the early decades of this scenario and driving short-term decisions, the fear of nuclear war and the impacts of climate change motivated more collaboration. This leads to a future system that is much more collective, stable, and is taking concrete steps towards nuclear disarmament.

Within the next decade, public fear of nuclear war will continue to escalate dramatically due to two primary drivers. The first is the rapid militarisation and weaponisation of space as states seek to gain advantages in this domain. More Rendezvous and Proximity Operations (RPO) Satellites were deployed in geostationary orbit for maintenance so military spacecraft can manoeuvre to dock with or operate nearby them for repairs, resupply, and refuelling. The Aerospace Corporation defines RPO as at least two satellites in space matching their plane, altitude and phasing, which then perform manoeuvres which affect their relative states or positions (e.g., docking).[11] This is coupled with more military Command and Control satellites (C2), which militaries rely on to maintain situational awareness and interconnect data processing and distillation systems, including for nuclear command and control.[12] Not only does this increase the chances of conflict in space, but it is also exacerbated by the emerging and disruptive technologies interlinked with these satellites. These factors, combined with geopolitical tensions, drive public fear of nuclear war and put state and military leaders on edge. This results in a significant nuclear accident, miscommunication, or near miss, made far more likely due to these heightened risks. This shocks the world and drives system changes over the following decades.

By the end of the first decade, a powerful public pressure to disarm had grown. People were sick of living in fear of nuclear war, and the unspecified nuclear incident showed everyone how close to nuclear war we were. The public now paid far more attention to nuclear matters and was far better informed, enabling them to better scrutinise their governments. In particular, the public began to demand more transparency regarding nuclear

11 Anuradha Damale-Day, "Rendezvous Proximity Operations: Not operating in isolation", *European Leadership Network*, (12th August 2020) https://europeanleadershipnetwork.org/commentary/rendezvous-proximity-operations-not-operating-in-isolation/.

12 LTC James T. Edwards Jr, Lt Col Jeffrey A. Katzman, and MAJ Robert P. Farrell, "The Critical Role Space Plays in Enabling C2 (The Ultimate High Ground)", *ALSSA Center*, (14th March 2022) https://www.alssa.mil/News/Article/2966222/the-critical-role-space-plays-in-enabling-c2-the-ultimate-high-ground/.

arsenals and infrastructure. This would be a significant change from today, for example, in the UK, the government is becoming more secretive regarding the nuclear weapons programme while it faces mounting problems.[13] Those working towards global peace and security were able to take advantage of this public pressure to revive nuclear arms control. The bottom-up pressure on governments and demands for increased transparency helped drive states back towards transparency, diplomacy, and arms control.

By 2045, the devastating impacts of climate change began to be felt, which further harmed progress towards global peace and security. By 2055, climate change had drastically reduced states' capacity to secure themselves and provide services. Over the decades, the capitalist system has failed to combat climate change due to the greed and short-sightedness of corporations that opted to 'greenwash' instead of taking meaningful environmental measures.[14] One dangerous result of reducing state capacities was a rise in transnational terrorism and non-state actor interference. It became clear quickly that existing climate agreements and legislation had failed, and the world was again becoming more unstable. However, by 2065, disarmament and arms control proponents were again able to seize the moment and push for progress towards peace and security to mitigate these increased risks. Furthermore, they used the struggle against climate change to convince states that they needed to cooperate to survive. Individualistic and capitalist approaches to climate change and security were not working, and thankfully, the world realised and became more open to change.

By the end of this scenario in 2075, we see concrete changes to the current international order and nuclear security. Concrete steps towards nuclear disarmament are now being taken, thanks to the power of public pressure and learning that existential threats like climate change cannot be tackled alone. For example, many nuclear umbrella states have become constructive observers of the TPNW. In nuclear doctrines, the emphasis on nuclear primacy had been reduced, with states realising that attempting to undermine adversaries' secondary strike capabilities, and therefore MAD, was incredibly escalatory. Furthermore, the more collaborative environment in global nuclear politics made it far easier for states to reach consensus at the NPT Preparatory Meetings and Review Conferences. Lastly, states learnt from the dangerous implementations of emerging technologies into their nuclear arsenals in previous decades and restricted further instability through creating international agreements to govern these technologies.

This scenario has several similarities to the previous one, where fear and individualistic thinking create instability and distrust, leaving humanity less capable of collectively addressing the existential threat of climate change. In this scenario, however, the public is much more proactive and pressures their governments to begin to change their approach much sooner. While there are steps forward and backwards as the decades progress, this scenario ends with global nuclear security in a better place than we find it today. States have realised that distrust, rivalries, and relying on deterrence have harmed them in the long term. By the end of the 50-year scenario, we see states taking concrete steps away from their reliance on nuclear deterrence and making better use of international treaties and agreements. We see the system changing for the better, but it remains recognisable to today as nuclear weapons remain, and the threat of climate change has yet to be fully addressed.

13 Dave Cullen, "Secrecy ramping up as problems mount in the UK nuclear programme", *Nuclear Information Service*, (12th November 2024) https://www.nuclearinfo.org/comment/2024/11/secrecy-ramping-up-as-problems-mount-in-the-uk-nuclear-programme/

14 For a summary of what Greenwashing is, read: Sebastião Vieira de Freitas Netto, Marcos Felipe Falcão Sobral, Ana Regina Bezerra Ribeiro & Gleibson Robert da Luz Soares, "Concepts and forms of greenwashing: a systematic review", *Environmental Sciences Europe*, 32(19), (2020), https://enveurope.springeropen.com/articles/10.1186/s12302-020-0300-3.

FOCUS GROUP FOUR

Radical Change Scenario(s)

A Negative and a Positive Vision for the Future

GROUP MEMBERS:

Nivedita S
Christelle Barakat

Focus group four was granted the most freedom in their scenario, with no limits to the level of change to international relations and nuclear security. They were even instructed that the structures that uphold the system could be heavily disrupted or replaced over the next 50 years. Presented with so many possibilities, they decided to envisage not one, but two scenarios. Both were driven by the same drivers, which were: Nuclear Treaties, Nuclear Weapon Use, Disruptive Technology, Climate Change, Nuclear Fear, and International Cooperation. We are left with two vastly differing visions of nuclear security in 2075. In one, efforts towards global peace and security were almost non-existent as the world fell into nuclear war. In the other scenario, we see an almost utopian world where nuclear deterrence has been discarded in favour of disarmament, diplomacy, and combating climate change.

In the negative radical scenario, the harms of climate change quickly begin to take effect. Furthermore, the increase in nuclear threats that we see today continues to escalate. These threats became much more normalised and appeared regularly between international and regional adversaries. Within the first decade, a serious escalation in research and implementation of emerging and disruptive technologies led to a drastic increase in nuclear fear amongst the public and further drove geopolitical tensions. By 2035, we see a complete breakdown of international climate, disarmament and non-proliferation negotiations and agreements. The situation only gets worse by 2045 due to the intensification of climate change and an explosion of tensions in key nuclear hotspots across the world. Many nuclear adversaries escalate to the point of clear nuclear threats, making it almost impossible to reconcile these divisions and coordinate collaborations and diplomacy.

By 2055, global nuclear arms treaties and agreements begin to rapidly collapse due to a wave of withdrawals from member states. As tensions rose and states became more fearful of nuclear war over the decades, they stopped listening to expert advice and found institutions such as the IAEA and UN to be at best pointless, and at worst, a nuisance. The NPT and even the TPNW suffer significant withdrawals, reducing their legitimacy and ability to contribute to non-proliferation and disarmament. This leaves many non-nuclear weapon states to conclude that they should consider gaining nuclear weapons, and the rest fearful of a dangerous and rapid expansion of vertical and horizontal proliferation.[15] Between rivals, distrust and extreme suspicion only grow under these circumstances. Those favouring non-proliferation and disarmament are left furious at the states that withdrew from these vital treaties, leaving many state relationships in tatters. With international organisations and forums such as the UN rendered obsolete, lines of communication are left in tatters, and any hope of encouraging states to cooperate seems to be lost.

15 See here for definition of and background of vertical and horizontal proliferation: Victor W. Sidel, Barry S. Levy, "Proliferation of Nuclear Weapons: Opportunities for Control and Abolition", *American Journal of Public Health*, (2007), 97(9), pp. 1589-1594.

Fears that nuclear deterrence would fail intensified further as we reached 2065. The international system we know today it collapsed. The world is left in chaos, and many fear it is only a matter of time before a nuclear war erupts. These fears are finally realised in 2075. It is unclear if this was triggered by the failure of deterrence, an accidental detonation/ first-use, or a breakdown in communication and Confidence Building Measures (CBMs). Global peace and security are lost as the world descends into nuclear war. Reliance on nuclear deterrence and mistrust has contributed to nuclear war, and life as we know it ceases to exist, along with the lives of millions, if not billions.

However, focus group four also imagined a utopian vision of radical change. This is primarily driven by a common concern regarding the planet's future, yet again in response to the impacts of climate change taking effect. This scenario starts like their first one, with climate change escalating in 2025. Fears of nuclear war are also increasing due to the rapid and escalatory implementation of disruptive technologies in nuclear arsenals. The fear of the urgent existential threats of climate change and nuclear war increases the political will to cooperate amongst the people and the states. States quickly begin interacting with multilateral forums such as the UN and NPT in realising that they must act now, and together, to address these threats. While initially this did not lead to radical changes in the system, cooperation to mitigate the threat of disruptive technologies began, and more progress was made to share peaceful uses of nuclear technology.

By 2035, further advances in agreements on disruptive technologies and peaceful uses showed that collaboration was possible. At the same time, new and more ambitious environmental commitments and Sustainable Development Goals (SDGs) were made as states realised that despite how challenging these goals were, they had no choice but to aspire to them. This change in approach lowered tensions significantly and further entrenched this new global approach to security amongst states. 2045 saw existing nuclear treaties such as the NPT and TPNW flourish, and a wave of new treaty negotiations begin, and the Comprehensive Test Ban Treaty (CTBT) finally come into force.[16] Not only do the IAEA receive a significant boost in funding, but increased trust and transparency mean member states grant them more On-Site Inspection (OSI) access. 2055 continues these trends as several new substantive nuclear and arms control treaties emerge. Further advancements in peaceful uses are made and shared globally to contribute to the efforts against climate change. With this radical shift towards cooperation and transparency bearing excellent results, further funding was granted to international organisations, and treaty adherence reached new heights.

In 2065, disarmament discussions amongst nuclear states moved from track 2 to track 1.5, and even to track 1 as nuclear state leaders came together to discuss eliminating nuclear weapons. They created new hotlines to ensure frequent communication, and they unanimously agreed to adhere to nuclear treaties and IAEA inspections fully. By 2075, the nuclear states had agreed to total nuclear disarmament, and the process began to dismantle and decommission their nuclear arsenals, overseen thoroughly by the IAEA for verification and to ensure irreversibility. While the effects of climate change had been felt, immense progress over the decades had averted a global catastrophe and climate treaties had also reached near universality amongst states. The reliance on deterrence has been significantly reduced because the world finally realised it could not secure itself, or the planet, alone or divided. Faced with two existential threats, they realised they had no choice but to collaborate and interact with international forums. Despite geopolitical tensions, this radical change to global nuclear security quickly proved that we could overcome both threats and create a more stable and peaceful world. In the first scenario, fear of other states and selfishness see global cooperation collapse and eventually drive us to a climate change-induced nuclear war. The second sees fear instead directed towards these collective existential threats, using it as motivation to move past their differences for survival and peace. As we can see, these visions of radical change present us with two almost opposite futures. Yet, in the current geopolitical environment, both are possible, and we may soon have to choose between these pathways to the future of nuclear security.

16 For information on the CTBTO: Daryl Kimball, "Comprehensive Test Ban Treaty at a Glance", *Arms Control Association*, (2024) https://www.armscontrol.org/factsheets/comprehensive-test-ban-treaty-glance.

Conclusion

Across these visions of the future, we see several key trends that the emerging security experts believe will dictate the future of nuclear security. Levels of cooperation and mistrust are central to these visions of the future.

The worst developments are often driven by fear and mistrust of adversaries, making decisions that prioritise short-term deterrence and security over long-term stability. The better changes and advances come when states push past their differences and mistrust to cooperate on arms control, peaceful uses, and climate change. The impacts of climate change are also essential drivers of these scenarios. The more states cooperate in these scenarios, generally, the more they do to mitigate the impacts of climate change. Yet, climate change is also seen to exacerbate nuclear security issues and geopolitical tensions by straining resources and restricting state capacities. Across these scenarios, we see how the existential threats of nuclear weapons and climate change are inextricably linked. Cooperation is essential to reduce nuclear and environmental threats. In most scenarios, the world is either struggling or failing to mitigate climate change. In many the world as we know it could just as easily be ended as we know it by climate change as well as nuclear war.

So, how do the participants envisage we cooperate towards a better and more stable future of nuclear security? How do we encourage states to work on their differences and begin to trust each other to collaborate meaningfully? In several of the scenarios, the answer to this is significant public pressure. In several scenarios, an active public and civil society can show the world how close it is to disaster and push states to collaborate on climate change, arms control, and nuclear disarmament. An informed, united, and passionate public appears to be key to these futures. Without an involved and proactive public and civil society, it appears that states operate more distrustfully and focus on short-term interests. This point should be a key lesson from this exercise. Post-Cold War, public and media interest in the prospect of nuclear war has been significantly lower. Even amongst recent rises in geopolitical tensions and nuclear threats, we have not seen the same levels of disarmament activism from the wider public. If we wish to secure a favourable future of nuclear security, we need an informed and motivated public that will hold governments accountable and exert pressure when we find ourselves close to the precipice. As a field, we should do our best to keep the public informed and engaged in nuclear issues through accessible information and research. If these visions of the future are accurate, they will be essential in the struggle for a stable and peaceful future of nuclear security.

APPENDIX ONE

Driver descriptions

The following drivers and brief descriptions are those that appear in the final Kumu Map for this project, and therefore, the definitions that the scenario exercise participants were using in their scenarios.

Ageing Nuclear Assets	Some nuclear assets, including warheads and reactors, continue to be used far past their original intended lifespan.
Arms Control	International restrictions on the development, production, stockpiling, proliferation, and use of weapons, aiming to reduce the likelihood of conflict and manage the global arms trade.
Artificial Intelligence	Artificial intelligence (AI) is a set of technologies that enable computers to perform a variety of advanced functions, including the ability to see, understand and translate spoken and written language, analyse data, make recommendations, and play an increasing role in nuclear command and control.
Attitudes Towards Civil Nuclear	Public and political attitudes to peaceful nuclear uses, including nuclear energy and medicine.
Bloc Politics	Groups or factions of states working and voting together, often specifically against adversaries.
Capital Costs of New Civil Nuclear	New civil nuclear developments, particularly new nuclear reactors, are very expensive, which can harm efforts to invest in them.
Civil Nuclear Waste	Nuclear energy waste, a byproduct of nuclear power generation and other uses of radioactive materials, is categorised as low, intermediate, or high-level based on radioactivity and hazard duration, requiring careful management and disposal.
Climate Change	Long-term shifts in temperatures and weather patterns can occur naturally; however, since the 1880s, this has been attributed to human activities such as the burning of fossil fuels.

Cybersecurity of Civil Nuclear	Cyber systems are critical to the management of civil nuclear facilities, making cybersecurity an essential component of nuclear security.
Cybersecurity of Nuclear Weapons	Cyber systems are used for the command and control of nuclear weapons; a hacking of a nuclear weapons system could disarm a state's ability to use them or even allow the hacker to use them.
Decision Making Artificial Intelligence	As AI becomes used more and more to aid decision making, it may also be used in the future to make decisions which has significant ramifications for nuclear security and accountability.
Disruptive Technology	Disruptive technologies in security and defence are rapidly changing the landscape, offering both opportunities and challenges, with examples including AI, quantum computing, and cybersecurity advancements, requiring a proactive and adaptive approach to security measures.
Domestic Nuclear Posture	A "domestic nuclear posture" refers to a nation's internal policies and strategies regarding its nuclear weapons, including their role in national security, development, and potential use, as well as arms control and non-proliferation efforts.
Domestic Stability of Nuclear Weapons States	The domestic political and societal stability of nuclear weapon states.
Expanding Civil Nuclear	The increase in peaceful uses of nuclear technology, such as building more nuclear energy reactors.
Extreme Weather	Extreme weather events, like heat waves, cold waves, heavy precipitation, droughts, and tropical cyclones, are becoming more frequent and intense due to climate change, posing significant risks to nature, buildings, infrastructure, and human health.
Geopolitical Environment	The geopolitical environment, such as the relations between states, has a critical impact on international politics.
Geopolitical Tractability	Refers to the ease or feasibility with which geopolitical issues, conflicts, or situations can be managed, navigated, or resolved.
Global Divides	Significant global divides, such as between rivalling blocs or between levels of wealth, can have negative impacts on potential collaboration on nuclear matters.
Global Energy Growth Trends	Refers to the patterns and shifts in the worldwide demand, production, and consumption of energy resources, including fossil fuels, renewable energy, and emerging technologies, over time.

Global Energy Inequality	The unequal distribution of energy access, resources, and infrastructure between different regions, countries, or populations, often leading to disparities in economic development, quality of life, and environmental impact.
Healthcare Systems	The standard of state healthcare systems would play a critical role in responding to a nuclear incident.
Horizontal Nuclear Proliferation	The spread of nuclear weapons technology and capabilities specifically to countries or non-state actors that previously did not possess them.
Illicit Financing	Illicit financing could be used to fund nuclear proliferation.
Increased Investment in Civil Nuclear	More money invested in peaceful nuclear uses would include more nuclear reactors and the development of nuclear medicine technology.
International Cooperation	International cooperation will be vital for addressing the many global and domestic nuclear challenges the world faces.
Monitoring and Verification	Monitoring and verifying non-proliferation is already a vital part of the NPT and could play a crucial role in nuclear disarmament efforts in the future, using new technologies.
Non-Proliferation Treaty	An international agreement aimed at preventing the spread of nuclear weapons, promoting the peaceful use of nuclear energy, and fostering disarmament, with the goal of ultimately eliminating nuclear weapons worldwide.
Nuclear Accidents	Unplanned and undesirable events involving the release of radioactive materials or the failure of nuclear facilities, leading to potential harm to human health, the environment, or both.
Nuclear Disarmament	The disarmament of nuclear weapons, globally or in just one state, would have a huge impact on the future of nuclear security.
Nuclear Education	The education of the general public on nuclear issues through state education, the media, and in pop culture.
Nuclear Fear	The fear of nuclear technology, such as nuclear war or nuclear reactor accidents.
Nuclear Proliferation	The spread of nuclear weapons technology and capabilities to states or non-state actors that previously did not possess them.
Nuclear Safety	Reducing the risk of nuclear accidents that could lead to radioactive contamination.
Nuclear Security	Measures taken to improve nuclear safety to minimise the chances of nuclear accidents, misuse, and attacks on facilities.

Nuclear Treaties	International agreements to regulate nuclear technologies, such as the NPT and TPNW.
Nuclear Weapon Use	The deployment or detonation of nuclear weapons in a conflict or military action, causing massive destruction and potentially catastrophic consequences for human life, the environment, and global security.
Nuclear Transport Security	Measures and protocols implemented to safeguard the safe and secure movement of nuclear materials, including preventing theft, sabotage, or accidents during transportation.
Proliferation Sanctions	Punitive measures imposed by countries or international organisations to deter or penalise states or entities that develop, acquire, or spread nuclear weapons in violation of international agreements like the Nuclear Non-Proliferation Treaty (NPT).
Public Pressure to Disarm	The pressure from citizens imposed on their governments to dismantle their nuclear arsenals.
Public Sentiment	Public attitudes to all nuclear technologies and nuclear politics, including peaceful and military uses.
Social Artificial Intelligence	AI systems designed to interact with humans in a socially intelligent manner, understanding and responding to emotions, behaviours, and social contexts to facilitate communication, relationships, or problem-solving.
Treaty Withdrawals	The withdrawal of states from international treaties and agreements, such as North Korea withdrawing from the NPT in 2003 before developing nuclear weapons.
Trust in Institutions	The level of credibility an institution has to function and deliver desired results, such as the UN's ability to reduce tensions and facilitate the development of international treaties.
Vertical Nuclear Proliferation	The expansion of a country's existing nuclear weapons capabilities, such as increasing the number, sophistication, or effectiveness of its nuclear arsenal.
Wartime Nuclear Security	The protection and safeguarding of nuclear weapons, materials, and facilities during armed conflict to prevent theft, misuse, or accidental detonation that could escalate the war or cause catastrophic consequences.
Weaponisation of Space	The weaponisation of space could have serious ramifications for nuclear security, such as attacks on nuclear command and control satellites, nuclear reactors in space, and even nuclear weapons on satellites.

APPENDIX TWO

List of Acronyms

CBM	Confidence Building Measures
CTBT	Comprehensive Test Ban Treaty
EVN	Emerging Voices Network
IAEA	International Atomic Energy Agency
INF	Intermediate-Range Nuclear Forces Treaty
MAD	Mutually Assured Destruction
NGO	Non-Governmental Organisation
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
OSI	On-Site Inspection
RPO	Rendezvous and Proximity Operations
SDG	Sustainable Development Goals
UN	United Nations

BASIC promotes meaningful dialogue amongst governments and experts in order to **build international trust, reduce nuclear risks**, and advance disarmament.

The British American Security Information Council (BASIC)
Work + Play
111 Seven Sisters Rd
Finsbury Park
London N7 7FN